



# **Project Manual**

Specifications and Other Documents  
for

## **Early Release Package - NC State Fairgrounds Midway Event Center**

NC Department of Agriculture & Consumer Services

4285 Trinity Road, Raleigh, NC 27607

SCO ID # 22-25408-02B, 22-25408-02C, 22-25408-02D

**Issued for Bid  
January 8, 2025**

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HH # 23-013



# NC State Fairgrounds Midway Event Center

## North Carolina Department Agriculture & Consumer Services

HH # 23-013

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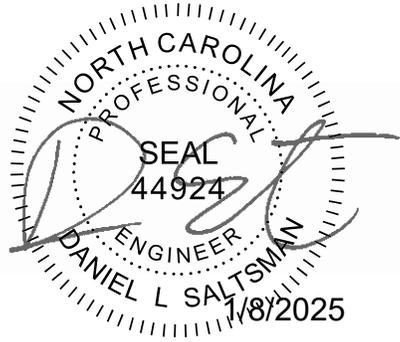
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NC State Fairgrounds  
4285 Trinity Rd, Raleigh, NC 27607

SCO ID # 22-25408-02  
HH # 23-013

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Final Geotechnical Exploration Report  
Midway Event Center  
Raleigh, North Carolina  
S&ME Project No. 23050451

PREPARED FOR:

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**March 27, 2024**



March 27, 2024

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Attention: Mr. Jacob Hilton, PE, PMP, LEED AP  
Department Manager, Federal Market

Reference: **Final Geotechnical Exploration Report**  
Midway Event Center  
State Fairgrounds  
Raleigh, North Carolina  
S&ME Project No. 23050541

Dear Jacob:

S&ME, Inc. (S&ME) is pleased to submit this geotechnical exploration report for the referenced project. Our services were performed in general accordance with our change order number 23050451 CO-1 Rev 1, dated September 29, 2023. The purpose of our geotechnical study was to explore and evaluate subsurface conditions as they relate to site development. This geotechnical report presents a brief summary of our understanding of the project, descriptions of our field exploration and laboratory testing, a discussion of encountered subsurface conditions, and recommendations related to earthwork and foundation design.

We appreciate the opportunity to work with you on this project. Please contact us with any questions, or if you need additional information.

Sincerely, S&ME, Inc.

A handwritten signature in black ink, appearing to read 'Will Harrison'.

Will Harrison  
Associate Project Manager

A handwritten signature in blue ink, appearing to read 'Wes Lowder', next to a circular professional seal. The seal contains the text: 'NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 18819 WESLEY M. LOWDER'.

Wes Lowder, P.E.  
Vice President  
N.C. License No. 18819



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## 1.0 Executive Summary

A brief summary of our preliminary and final explorations is presented below. This brief summary should not be used for design or construction without reviewing the more detailed information presented in this report.

- The design of the Midway Event Center has not been finalized. The building will be one or two-stories, with corresponding assumed maximum column loads of 150 kips and 250 kips, respectively.
- The preliminary finish floor elevation is 493 feet; however, this elevation is subject to change.
- The explorations were performed in two phases: a preliminary exploration performed prior to demolition of the Lunch Stand building, and a final exploration performed after demolition.
- All borings encountered existing fill soils to depths of approximately 5 to 12 feet. Fill was erratically, and in many cases, poorly compacted. Existing fill is not suitable for foundation or floor slab support.
- We recommend that all fill be removed from the building area and replaced with well compacted structural fill. We considered alternative foundation support through ground improvement techniques. However, because of the potential for aggregate piers to bulge due to very soft fill, and the fact that ground improvement would also be needed for slabs, it is our opinion that undercut and replacement is a preferred method for building support.
- Some of the undercut fill could be re-used as structural fill; however, this would require segregation of deleterious materials and drying of soils. Given the limited space available for construction, it is our opinion that re-use of these materials will not be practical.
- Materials found in the off-site stockpile are not suitable for re-use as structural fill.
- After fill has been removed and replaced with well compacted structural fill, building foundations can be designed as shallow spread footings using a bearing pressure of 3,000 pounds per square foot.
- Floor slabs can be soil supported on properly prepared and compacted subgrades.

## 2.0 Project Information

S&ME was provided the *NC State Fairgrounds – Midway Event Center* conceptual site plan, which was prepared by HH Architecture, dated January 8, 2023. We understand the new building will occupy a plan area of about 20,000 square feet. We anticipate the building will be a one or two-story, steel-framed structure with a soil supported slab-on-grade. Structural loads were not available at the time this report was prepared. Based on experience with similar projects, we expect that maximum wall and column loads will be 5 kips per linear foot and 150 kips for a one-story building, and column loads 250 kips for a two-story building. Floor slab loads are expected to be 150 pounds per square foot or less. Concrete

pavements will wrap around the building perimeter with a concrete entranceway/stairway proposed just north of the building.

The finish floor elevation has been tentatively set at 493 feet, which is near existing grade. Shallow cut and fill depths, on the order of 5 feet or less, are anticipated.

### 3.0 Site Description

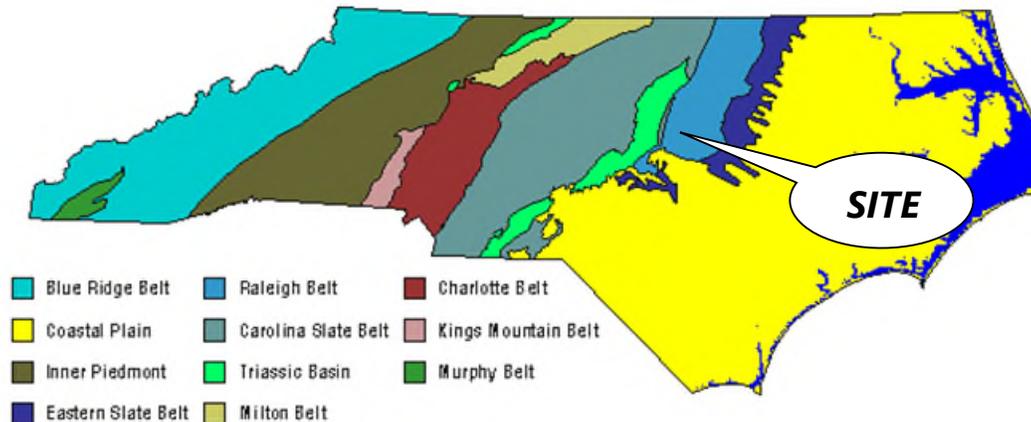
The existing Lunch Stand building was present when our preliminary borings were performed (S&ME report dated September 12, 2023). At the time of this final exploration, the Lunch Stand building had been demolished and the area stabilized as shown in photos below.

The surrounding area is highly developed, consisting of paved parking areas surrounding the demolished building and numerous underground utilities located nearby.



## 4.0 Regional Geology

**Figure 3.1 - Physiography**



The site is located within the Raleigh Belt region of the Piedmont Physiographic Province in North Carolina. The parent rock materials in the area primarily consist of gneiss and schist rock. Within the upland areas, soils within the Piedmont Province are the residual product of in-place chemical and physical weathering of parent rock materials. The typical residual profile consists of finer grain silts and clays near the ground surface which gradually transition to coarser and denser material with depth. In many locations, the transition zone between soil and rock is not well defined. Locally, the transition zone is termed partially weathered rock (PWR). For engineering purposes, partially weathered rock is defined as residual material in which standard penetration test values exceed 100 blows per foot.

## 5.0 Exploration Program

The preliminary subsurface exploration for this project included a visual site reconnaissance and the performance of four soil test borings (B-1 through B-4) to depths of 25 to 50 feet below the ground surface. Boring locations were established in the field by S&ME using a hand-held GPS. Approximate boring locations are shown on Figure 1 in Appendix I. The borings were performed outside of the Lunch Stand building which had not yet been demolished.

The final subsurface exploration consisted of a visual site reconnaissance and the performance of an additional five soil test borings (B-5 through B-9) to depths of 25 feet below the existing ground surface. Boring locations were established in the field by S&ME using a hand-held GPS. Approximate boring locations are shown on Figure 1 in Appendix I.

Soil test borings were advanced using 3¼-inch hollow-stem-auger hollow stem auger drilling procedures with a D-50 drill rig. The borings were sampled at 2.5-foot intervals in the upper 10 feet, and at 5-foot intervals below 10 feet to their boring termination depths. Standard penetration testing was performed

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with an automatic hammer in conjunction with split-spoon sampling in general accordance with ASTM D 1586.

Groundwater measurements were attempted immediately after drilling was completed. Boreholes were then backfilled with auger cuttings nearly to the existing ground surface.

Soil Test Boring Logs (Appendix II) and Generalized Subsurface Profiles (Figures 2.1 and 2.2, Appendix I) showing specific subsurface information from each boring (preliminary and final exploration borings), are included in the Appendix. Ground surface elevations were estimated from the provided conceptual site plan and should be considered approximate. Stratification lines shown on Test Boring Records and Subsurface Profile are intended to represent approximate depths of changes in soil types. Naturally, transitional changes in soil types are often gradual and cannot be defined at a particular depth.

Representative split-spoon samples were brought back to our laboratory for visual classification and testing. Soils were classified in general accordance with Unified Soil Classification System (USCS) guidelines. Testing included natural moisture content, Atterberg limits and grain size testing. Laboratory testing was performed in general accordance with applicable ASTM standards.

### 5.1 Proposed Borrow Area

A stockpile located west of the project area was evaluated for use as structural fill. We planned on performing a soil test boring in this area to evaluate these materials. However, given the configuration of the stockpile, we could not safely move the drill rig to the top of the stockpile. These materials were instead sampled by hand by excavating into the sides of the stockpile in numerous locations and collecting composite samples. Samples were subjected to standard Proctor compaction testing.

## 6.0 Surface and Subsurface Conditions

A general description of surface and subsurface conditions encountered during our field exploration for this site is provided below. More detailed information on subsurface conditions is presented on the Test Boring Logs in Appendix II.

### 6.1.1 Surficial Materials

Surficial asphalt thicknesses ranging from 4 to 5 inches in thickness were encountered in each boring during our preliminary exploration. A surficial layer of topsoil approximately 2 to 6 inches in depth was encountered in each boring during our final exploration. Topsoil is typically a dark-colored soil material containing roots, fibrous matter, and/or other organic components, and is unsuitable for engineering purposes. The topsoil depths provided in this report are based on measurements made during drilling and should be considered approximate. The transition from topsoil to underlying natural soils may be gradual.

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### 6.1.2 *Fill Soils*

Fill soils were encountered at each boring to approximate depths of 5 ½ to 12 feet below ground surface. Fill soils consists of elastic silt (USCS group symbol ML and MH), sandy lean and fat clays (CL and CH), and silty and clayey sands (SC and SM). Fill soils contained some debris, including gravel, rootlets, rock fragments and asphalt pieces.

Standard penetration test values ranged from weight of hammer (WOH) to 23 blows per foot (bpf). Weight of hammer indicates the split-spoon sampler was able to penetrate the last 12 inches of sampling interval under its own weight without any blows from the hammer. These values indicate an erratic, and in many cases, poor degree of compaction.

### 6.1.3 *Residual Soils*

Each boring encountered residual soils underlying fill materials at depths ranging from 5 ½ to 12 feet below existing ground surface. Residual soils consisted of low plasticity silt (ML) with varying sand content. SPT N-values ranged from 6 to 70 bpf indicating firm to hard consistencies with more typical residual soils having SPT N-values between 10 and 20 bpf. The residual soils were visually observed to be moist to wet.

### 6.1.4 *Groundwater*

Groundwater measurements and cave depths were attempted after completion of drilling. Groundwater was encountered in boring B-3 at a depth of 26 feet below existing ground surface. Borings B-1, B-2, and B-4 through B-9 were found to be dry above their cave-in depths.

Groundwater levels should be expected to fluctuate with seasonal changes and with rainfall and evaporation rates at other times of the year.

## 7.0 Laboratory Test Results

Representative soil samples were returned to our laboratory for testing and visual classification in general accordance with Unified Soil Classification System Guidelines. Laboratory testing included natural moisture content, grain size analyses, and Atterberg limits for general classification purposes as well as California Bearing Ratio (CBR) and standard Proctor testing for the bulk sample from the stockpile.

The stockpiled offsite borrow material (adjacent to the fairgrounds) was tested for standard Proctor, Atterberg limits, grain size analyses and organic content. Maximum dry density, optimum moisture content, and organic content for the stockpiled material was 79.8 pounds per cubic foot (pcf), 32.0% and 14.7%, respectively.

Individual laboratory test results are included in Appendix III and a summary of the laboratory test results is presented in the table below.

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**Table 1 - Summary of Laboratory Test Results**

Boring ID	Sample Depth (ft)	Natural Moisture Content (%)	Atterberg Limits (%)		Standard Proctor		CBR <sup>1</sup> (%)	Swell (%)	USCS
			Liquid Limit	Plasticity Index	Opt. Moisture Content (%)	Max. Dry Unit Weight (pcf)			
B-3	1 – 5*	12.4	48	13	20.0	103.8	6.5	0.6	ML
B-1	3.5 – 5	30.6	66	26	--	--	--	--	MH
B-2	8.5 – 10	21.7	--	--	--	--	--	--	ML
B-2	13.5 – 15	26.3	--	--	--	--	--	--	ML**
Composite (Stockpile)	0 – 5	--	--	--	32.0	79.8	--	--	SM

<sup>1</sup> Corrected CBR value at 0.1 inches of penetration. The sample was compacted to approximately 98% of its standard Proctor maximum dry density, near its optimum moisture content. The sample was soaked for approximately 96 hours under a surcharge of approximately 100pounds per square foot.

\* Bulk Sample

\*\* Visually Classified

## 8.0 Conclusions and Recommendations

The following sections provide our geotechnical conclusions and recommendations regarding site development. These recommendations are based upon review of our test boring data, our understanding of proposed site development, engineering analyses, and experience with similar projects and subsurface conditions.

### 8.1 Earthwork

#### 8.1.1 Removal of Existing Fill

All fill should be undercut from the building area, including nearby structural areas such as retaining walls. The area undercut should extend at least 20 feet horizontally beyond the actual building/structural limits. The complete removal of all existing fill is a critical part of site development. The contractor should be able to confirm that he/she has met the above requirement prior to backfilling.

After undercutting, the exposed subgrade should be evaluated by the geotechnical engineer or his representative. This evaluation should include proofrolling with heavily loaded rubber-tired equipment, performance of shallow hand auger borings, test pits, or some combination of these. If unstable soil conditions are present once fill has been removed, stabilization of the excavation bottom could be

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required. This is especially true if site grading occurs during winter months or during a period of wet weather. Stabilization measures could require additional undercutting, compaction of the subgrade surface, placement of a geotextile fabric, placement of crushed stone, or some combination of these. Because the need for stabilization will be partially weather dependent, actual repair measures can only be determined in the field.

### *8.1.2 Site Preparation – General*

Site grading will be difficult due to the fine-grained nature of the near-surface soils encountered. This will be especially true if site grading occurs during periods of extended rainfall that generally occur during the winter and early spring months. Near-surface soils are moisture sensitive, and when wet, will tend to rut and pump under rubber-tired traffic and provide poor subgrade support for structures and pavements. To reduce potential earthwork problems, site preparation and grading should be scheduled during the typically drier months of May through November, if possible.

### *8.1.3 Reuse of On-Site Soils as Structural Fill*

A portion of the existing fill soils could be suitable for re-use as structural fill; however, this would require that deleterious materials be segregated and that soils be dried to a suitable moisture content. Given the relatively limited area of construction, it is our opinion that re-use of existing fill will not be practical. We recommend that existing fill which is undercut be wasted.

### *8.1.4 Off-Site Stockpile*

Off-site stockpiled materials consisted of red highly plastic clays with various amounts of debris and sandier soils which contain significant organics. Neither are suitable for re-use as structural fill.

## **8.2 Excavations**

Excavations to remove existing fill will extend through low to medium-consistency soils. Outside of undercut areas, we expect that only shallow excavations will be needed. These soils can typically be excavated using backhoes, dozers, and other types of typical earthmoving equipment. In this geologic province, there is always a potential to encounter rock at erratic depths and locations. However, this appears unlikely at this site.

Groundwater was encountered at depths of about 26 feet below the existing ground surface in the performed soil test borings. Based on our understanding of proposed grades, water is not expected during mass grading or utility installation. Shallow water or perched water conditions may be encountered during wet periods of the year or after heavy rainfall. The contractor should be prepared to control groundwater during construction.

Excavations should be sloped or shored in accordance with local, state and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is responsible for site safety. This information is provided only as a service and under no circumstances should we be assumed responsible for construction site safety.

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### 8.2.1 *Structural Fill Requirements*

After proper site preparation (including the removal of poorly compacted fill materials and other deleterious materials), areas requiring fill may be raised to their design subgrade levels using approved borrow materials. Borrow material should meet the following requirements:

- ◆ USCS classification of ML, CL, SP, SM, SC or some combination of these.
- ◆ Low plasticity soil (with a plasticity index less than 25%).
- ◆ A standard Proctor maximum dry density of at least 95 pounds per cubic foot.
- ◆ Maximum particle size of 3 inches in any dimension.
- ◆ Less than 3% organic content.
- ◆ Free of deleterious materials.

Once a borrow area has been identified, samples should be provided to us for laboratory testing.

### 8.2.2 *Structural Fill Placement*

Structural fill should be placed in uniform lifts of 8 to 10 inches and compacted to at least 95 percent of its standard Proctor maximum dry density at a moisture content within 2 percent of optimum moisture. The upper 12 inches below buildings and pavements should be compacted to at least 98 percent.

Fill placement and compaction operations should be observed and tested by a qualified soil technician working under the supervision of the geotechnical engineer. Fill should not be placed in areas where free water is standing, on frozen subsoil, or on surfaces which have not been approved by the soil technician. An appropriate number of soil density tests should be conducted to confirm that adequate fill compaction is achieved.

### 8.2.3 *Subgrade Repair and Improvement Methods*

The exposed subgrade can deteriorate and lose support when exposed to construction traffic and adverse weather conditions. Deterioration can occur in the form of rutting, pumping, freezing, or erosion. We recommend that during construction, exposed subgrade surfaces be sealed at the end of each day or when wet weather is forecast. Water should not be allowed to pond on exposed subgrades. Heavy rubber-tired construction equipment should not be allowed to operate on exposed subgrades during wet conditions.

Immediately prior to floor slab or pavement construction, exposed subgrade soils should be evaluated by proof-rolling to determine their stability. Soils which rut, pump, or deflect under proof-rolling should be repaired prior to ABC stone placement. Repair measures may include scarifying/drying/recompacting, undercutting, placement of geotextiles, use of chemical additives, or some combination of these. Actual repair measures will be influenced by project schedule and weather conditions and can only be determined in the field by the geotechnical engineer.

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### 8.3 Foundation and Floor Slab Support

Assuming that the site is prepared as recommended, the proposed structure can be supported on a shallow spread foundation system. A net allowable bearing pressure of 3,000 pounds per square foot (psf) may be used for design.

Footings should bear at least 18 inches below exterior grade to avoid frost penetration and develop the design bearing capacity. All footings should be a minimum of 18 inches wide for wall footings and 24 inches wide for column footings. This recommendation is made to help prevent a localized or shear failure condition. Footing excavation and concrete placement should occur on the same day if practical. Footing excavations should be evaluated by the geotechnical engineer or his representative as described below.

The bottom of footing excavations should be evaluated by the project geotechnical engineer (or a soils technician working under their direction) using hand auger borings and dynamic cone penetrometer (DCP) to gauge the consistency of subgrade soils and determine that subsurface conditions beneath footings are consistent with those encountered in the soil borings. Foundation subgrades that are unstable should be over-excavated and replaced with washed (NCDOT #57) stone. The acceptability of #57 stone for use as over-excavation backfill must be evaluated on a case-by-case basis during construction considering the potential for undermining due to future adjoining excavations, underground repair work, interference with subdrains, etc.

Assuming that site preparation recommendations are followed, we estimate total settlement beneath building loads will be 1 inch or less. We expect that differential settlement will be about one-half of expected total settlement.

#### 8.3.1 Floor Slabs

A properly prepared subgrade should be suitable for slab-on-grade support. We recommend a 6-inch thickness of compacted dense graded aggregate (NCDOT ABC gradation) beneath the slab to enhance uniform slab support. A vapor retarder should be included in the slab design if vapor penetration is an unacceptable condition.

The slab subgrade should be evaluated by proofrolling with overlapping passes of a loaded tandem-axle dump truck or similar pneumatic tire vehicle immediately prior to placement of concrete. Provided subgrade materials are stable under proofrolling, a modulus of subgrade reaction value (k-value) of 100 psi/inch may be used for slab-on-grade design. This value is predicated on anticipated results of a 30-inch diameter plate load test and is applicable for relatively light loads (i.e. 150 psf or less).

The k-value described above is not applicable to heavier slab loads, especially those created by stored materials or heavy rack loads. If building tenants store materials which create slab loads greater than those described above, a risk of slab cracking exists.

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### 8.4 Seismic Site Classification

The proposed structure should be designed to resist possible earthquake effects as determined in accordance with Section 1613 of the 2018 North Carolina Building Code. Based on our test borings and experience in the project area, we recommend a Seismic Site Class D be used.

### 8.5 Retaining Walls

We are not aware of planned retaining walls on this development. However, based on grades in the northern portion of the site near the planned walkway area, existing site grades from 480 to 487 are present and may require retaining walls for soil retention. Also, loading dock walls may be needed.

General recommendations with respect to retaining wall design and construction are provided below along with specific recommendations for cast-in-place and MSE walls. Once additional information is available, we should be contacted for any additions or revisions to the recommendations that may be appropriate.

#### 8.5.1 Retaining Walls – General

Retaining walls must be designed to resist lateral earth pressures from the backfill. In addition to the lateral stresses from backfill, the walls may be subjected to surcharge loading from adjacent traffic, stockpiled materials, or stresses from nearby footings or floor slabs. If present, these surcharge stresses should be resolved into appropriate lateral stress distributions and added to the earth pressures outlined below. Walls should have adequate factors of safety against overturning, sliding, and global failure.

We recommend placing a drainage medium, such as clean stone (NCDOT No. 57) wrapped in geotextile fabric or a prefabricated geocomposite drain, behind the wall. The drainage medium should be connected to a footing drain or weep holes to reduce potential buildup of hydrostatic pressure due to surface water, perched water, or utility leaks.

Backfill soils placed behind retaining walls should be of low plasticity and compacted to at least 95 percent of the soil's standard Proctor maximum dry density (ASTM D 698) and within 2 percent of optimum moisture. Operating heavy compaction equipment within 5 feet behind the retaining structures can create lateral earth pressures in excess of those recommended for design. As such, we recommend that hand-operated equipment be used within 5 feet of the walls.

#### 8.5.2 Cast-In-Place Concrete Walls

Recommended backfill parameters for on-site soils are summarized in the table below. The lateral earth pressure coefficients presented below assume no wall friction between the wall and soil backfill ( $\delta = 0$  degrees) and are based on placement of properly compacted backfill and a level backfill surface.

## Geotechnical Exploration Report

Midway Event Center

NC Fairgrounds

S&ME Project No. 23050541



**Table 7-1 – Recommended Parameters for Retained Soils behind Concrete Walls**

Parameter	On-Site Soils
Friction Angle, $\phi$ (degrees)	26
At-Rest Earth Pressure Coefficient ( $K_o$ )	0.56
At-Rest Equivalent Earth Pressure (psf/ft)	73
Active Coefficient Earth Pressure ( $K_a$ )	0.4
Active Equivalent Earth Pressure (psf/ft)	51
Passive Earth Pressure Coefficient ( $K_p$ )	2.56
Passive Equivalent Earth Pressure (psf/ft)	333
Moist Unit Weight of Backfill (pcf)	130
Ultimate Friction Coefficient Between Wall Foundations and Bearing Soils	0.33

### 8.5.3 Mechanically Stabilized Earth (MSE) Walls

On-site soils should not be used as backfill within the reinforced zone. Off-site soils such as clean sands, stone screenings, ABC stone, or washed stone, are recommended for use as reinforced backfill (backfill containing mechanical reinforcement or geogrid) behind MSE walls. Depending on several factors (i.e., geogrid length, compaction conditions of backfill, and others), use of silts or clays as backfill could cause wall instability. It is our opinion that silt and clay backfill cause more long-term lateral deflection of the backfill mass (and wall face) when compared to granular soil backfill. Excessive lateral deflection could cause leaning of the wall face and development of cracks behind the wall (e.g., cracking of ground surface or asphalt behind the wall). Cracks behind the wall can create a path for surface water infiltration into the backfill. Water infiltration into the backfill can create loss of backfill strength (i.e. soil strength lower than the design strength) and lead to wall instability (i.e. possible wall failure).

Once a backfill material is selected, sufficient laboratory testing (i.e., grain size analysis, standard Proctor and triaxial testing) of the backfill should be performed prior to construction, or empirical judgments made, to verify design soil parameters for reinforced fill.

The parameters in the table below are applicable for retained soils (i.e. soils behind the reinforced zone). The parameters assume that retained soils are properly compacted in accordance with recommendations presented previously.

## Geotechnical Exploration Report

Midway Event Center

NC Fairgrounds

S&ME Project No. 23050541



**Table 7-3 – Recommended Parameters for Retained Soil behind MSE Walls**

Parameter	Value
Friction Angle, $\phi$ (degrees)	26
Cohesion, $c$ (psf)	0
Active Coefficient Earth Pressure ( $K_a$ )	0.4
Moist Unit Weight (pcf)	130

## 9.0 Qualifications of Report

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

Our field exploration program did not include an assessment of regulatory compliance, environmental conditions or pollutants or presence of any biological materials (mold, fungi, bacteria). The environmental assessment of this site is being handled by a separate consultant.

S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

## **Appendices**

## **Appendix I – Figures**



REFERENCE:  
 IMAGERY RETRIEVED FROM HH ARCHITECTURE'S  
 CONCEPTUAL SITE PLAN DATED JANUARY 8, 2023  
 AND MODIFIED BY S&ME.



**LEGEND**

- APPROXIMATE BORING LOCATION (August 2023 Exploration)
- APPROXIMATE BORING LOCATION (March 2024 Exploration)

**BORING LOCATION PLAN**

**STATE FAIRGROUNDS LUNCH STAND**  
 RALEIGH, NORTH CAROLINA

SCALE:  
 NOT TO SCALE

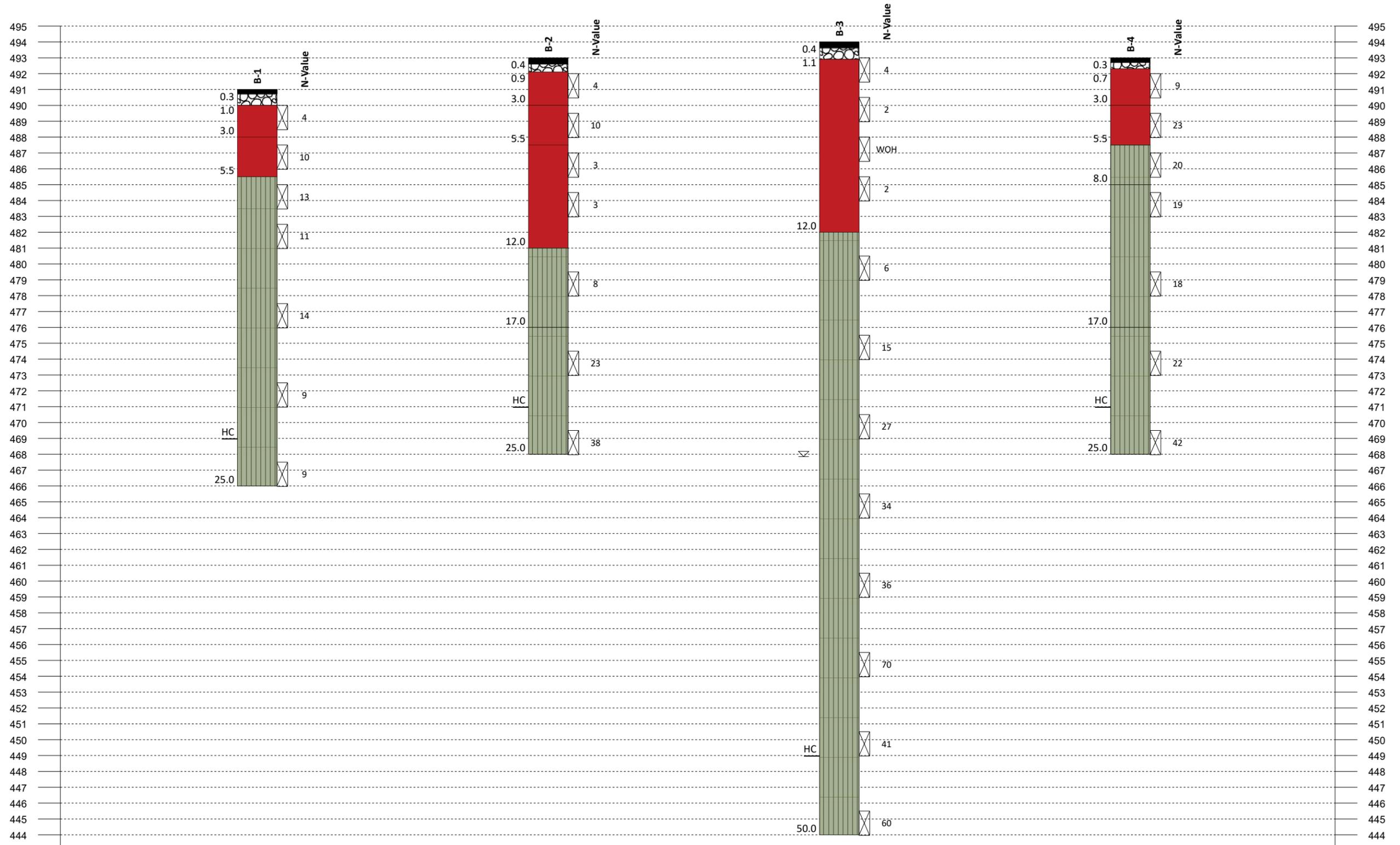
DATE:  
 3-19-2024

PROJECT NUMBER:  
 23050451

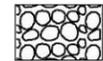
FIGURE NO.

1





**Legend Key**

-  Asphalt
-  ABC
-  ML
-  MH

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface conditions will vary between boring locations.

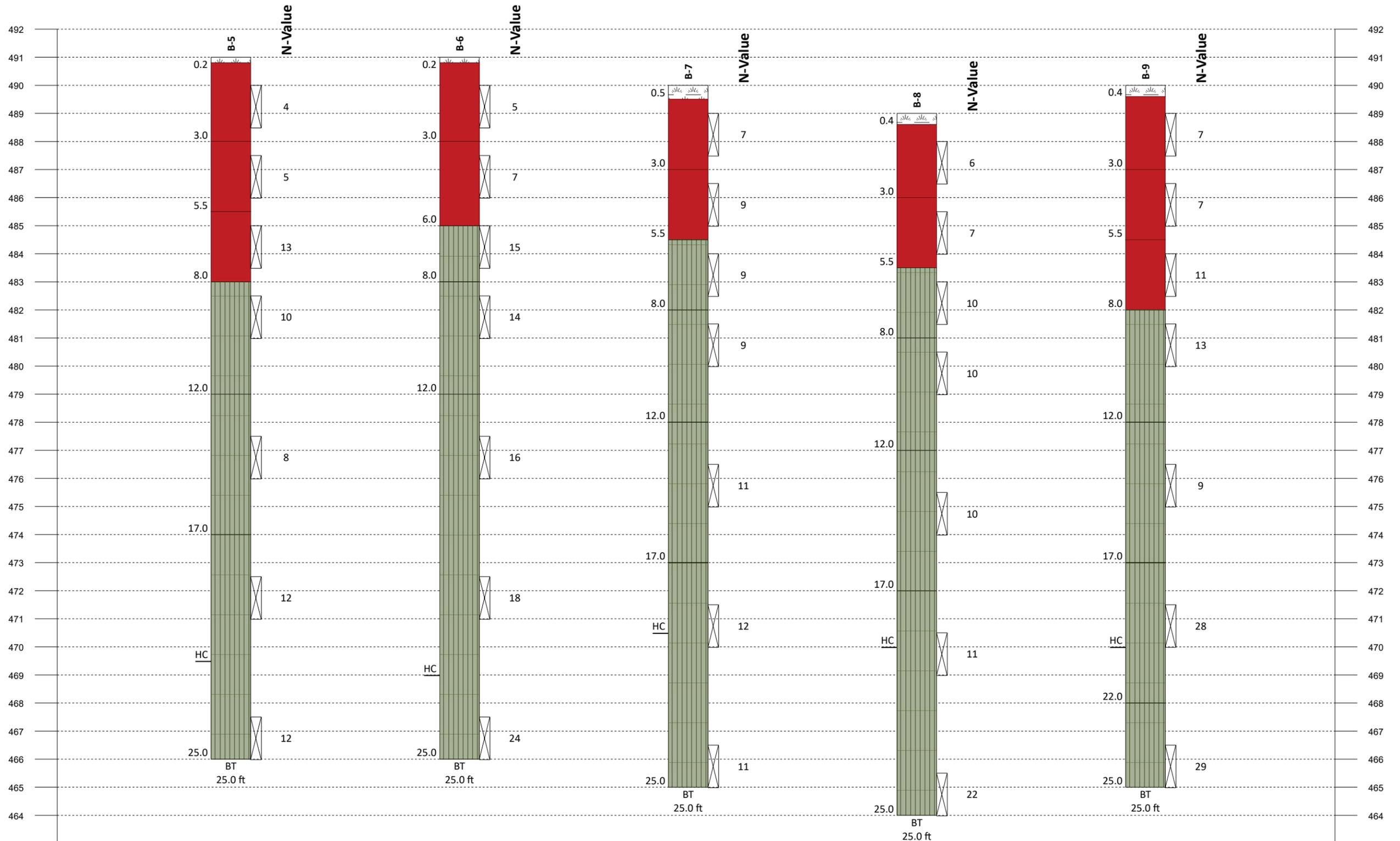
	AT TIME OF DRILLING
	END OF DRILLING
	AFTER DRILLING



Generalized Subsurface Profile  
 NC Fairgrounds Lunch Stand Replacement  
 Raleigh, North Carolina

SCALE:	Not to scale
DATE:	Aug 28, 2023
PROJECT NUMBER:	23050451

FIGURE NO.  
 2.1



**Legend Key**

- Topsoil
- MH
- CH
- CL
- ML
- SM
- SC

The depicted stratigraphy is shown for illustrative purposes only and is not warranted. Separations between different strata may be gradual and likely vary considerably from those shown. Profiles between nearby borings have been estimated using reasonable engineering care and judgement. The actual subsurface conditions will vary between boring locations.

"AR" = Auger Refusal, "BT" = Boring Termination

	AT TIME OF DRILLING
	END OF DRILLING
	AFTER DRILLING



Generalized Subsurface Conditions

NC Fairgrounds Lunch Stand Replacement  
Raleigh, North Carolina

SCALE:	Not to scale
DATE:	Mar 19, 2024
PROJECT NUMBER:	23050451

FIGURE NO.

2.2

## **Appendix II – Field Exploration Data**

## ◆ Summary of Exploration Procedures

The American Society for Testing and Materials (ASTM) publishes standard methods to explore soil, rock and ground water conditions in Practice D-420-18, "*Standard Guide for Site Characterization for Engineering Design and Construction Purposes.*" The boring and sampling plan must consider the geologic or topographic setting. It must consider the proposed construction. It must also allow for the background, training, and experience of the geotechnical engineer. While the scope and extent of the exploration may vary with the objectives of the client, each exploration includes the following key tasks:

- Reconnaissance of the Project Area
- Preparation of Exploration Plan
- Layout and Access to Field Sampling Locations
- Field Sampling and Testing of Earth Materials
- Laboratory Evaluation of Recovered Field Samples
- Evaluation of Subsurface Conditions

The standard methods do not apply to all conditions or to every site. Nor do they replace education and experience, which together make up engineering judgment. Finally, ASTM D 420 does not apply to environmental investigations.

## ◆ Reconnaissance of the Project Area

We walked over the site to note land use, topography, ground cover, and surface drainage. We observed general access to proposed sampling points and noted any existing structures.

Checks for Hazardous Conditions - State law requires that we notify the North Carolina (NC 811) before we drill or excavate at any site. NC 811 is operated by the major water, sewer, electrical, telephone, CATV, and natural gas suppliers of North Carolina. NC 811 forwarded our location request to the participating utilities. Location crews then marked buried lines with colored flags within 72 hours. They did not mark utility lines beyond junction boxes or meters. We checked proposed sampling points for conflicts with marked utilities, overhead power lines, tree limbs, or man-made structures during the site walkover.

## **Boring and Sampling**

### **Soil Test Boring with Hollow Stem Auger Drilling**

Soil sampling and penetration testing were performed in general accordance with ASTM D 1586, "Standard Test Method for Penetration Test and Split Barrel Sampling of Soils". Rotary drilling processes were used to advance the boreholes. At regular intervals, the drilling tools were removed and soil samples were obtained with a standard 1.4 inch I. D., two-inch O. D., split barrel sampler. The sampler was first seated six inches to penetrate any loose cuttings, then driven an additional 18 inches with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler through the two intermediate six inch increments was recorded as the penetration resistance (SPT N) value. The N-value, when properly interpreted by qualified professional staff, is an index of the soil strength and foundation support capability. The bottom 6 inches of each sample recovered in the split barrel sampler was placed in a glass jar, closed with a screw top lid, and labeled.

### **Water Level Measurement**

Subsurface water levels in the boreholes were measured during the onsite exploration by measuring depths from the existing grade to the current water level using a tape.

### **Backfilling of Borings**

Once subsurface water levels were obtained, boring spoils were backfilled into the open bore holes. Bore holes were backfilled to the existing ground surface.

# LEGEND TO SOIL CLASSIFICATION AND SYMBOLS

## SOIL TYPES

(Shown in Graphic Log)

	Fill
	Asphalt
	Concrete
	Topsoil
	Gravel
	Sand
	Silt
	Clay
	Organic
	Silty Sand
	Clayey Sand
	Sandy Silt
	Clayey Silt
	Sandy Clay
	Silty Clay
	Partially Weathered Rock
	Cored Rock

## WATER LEVELS

(Shown in Water Level Column)

-  = Water Level At Termination of Boring
-  = Water Level Taken After 24 Hours
-  = Loss of Drilling Water
- HC = Hole Cave

## CONSISTENCY OF COHESIVE SOILS

### CONSISTENCY

Very Soft	STD. PENETRATION RESISTANCE BLOWS/FOOT
Soft	0 to 2
Firm	3 to 4
Stiff	5 to 8
Very Stiff	9 to 15
Hard	16 to 30
Very Hard	31 to 50
	Over 50

## RELATIVE DENSITY OF COHESIONLESS SOILS

### RELATIVE DENSITY

Very Loose	STD. PENETRATION RESISTANCE BLOWS/FOOT
Loose	0 to 4
Medium Dense	5 to 10
Dense	11 to 30
Very Dense	31 to 50
	Over 50

## SAMPLER TYPES

(Shown in Samples Column)

-  Shelby Tube
-  Split Spoon
-  Rock Core
-  No Recovery

## TERMS

**Standard Penetration Resistance** - The Number of Blows of 140 lb. Hammer Falling 30 in. Required to Drive 1.4 in. I.D. Split Spoon Sampler 1 Foot. As Specified in ASTM D-1586.

**REC** - Total Length of Rock Recovered in the Core Barrel Divided by the Total Length of the Core Run Times 100%.

**RQD** - Total Length of Sound Rock Segments Recovered that are Longer Than or Equal to 4" (mechanical breaks excluded) Divided by the Total Length of the Core Run Times 100%.



<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-1</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 08/23/2023	<b>ELEVATION:</b> 491 ft	<b>NOTES:</b> Location and elevation are approximate	
<b>DRILL RIG:</b> CME 750	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> D. Garrow	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings and Asphalt Patch		
<b>DRILLING METHOD:</b> 3-1/4" HSA	<b>LOGGED BY:</b> Matthew Millette		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>		

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
0					ASPHALT, 4"							491
0.3					AGGREGATE BASE, 8"	1-2-2						
1.0		Fill		SS-1 (18 in)	SILT WITH SAND (ML), few gravel, soft, red brown and tan, moist	N = 4	●					
3.0				SS-2 (18 in)	ELASTIC SILT WITH SAND (MH), stiff, red brown, moist	3-5-5 N = 10	●					
5.5		Residuum		SS-3 (18 in)	SILT (ML), trace mica, stiff, red orange brown, moist	3-5-8 N = 13	●					
				SS-4 (18 in)	<i>Purple red and orange tan.</i>	3-4-7 N = 11	●					
				SS-5 (18 in)	<i>Gray purple.</i>	5-5-9 N = 14	●					
				SS-6 (18 in)		3-4-5 N = 9	●					
				SS-7 (18 in)	<i>Trace gravel, purple red brown.</i>	3-4-5 N = 9	●					
25.0	Hole Cave at 22.0 feet				Borehole terminated at 25.0 feet							466
30												461

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	08/23/2023		Not encountered
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-2</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 08/23/2023	<b>ELEVATION:</b> 493 ft	<b>NOTES:</b> Location and elevation are approximate	
<b>DRILL RIG:</b> CME 750	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> D. Garrow	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings and Asphalt Patch		
<b>DRILLING METHOD:</b> 3-1/4" HSA	<b>LOGGED BY:</b> Matthew Millette		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>		

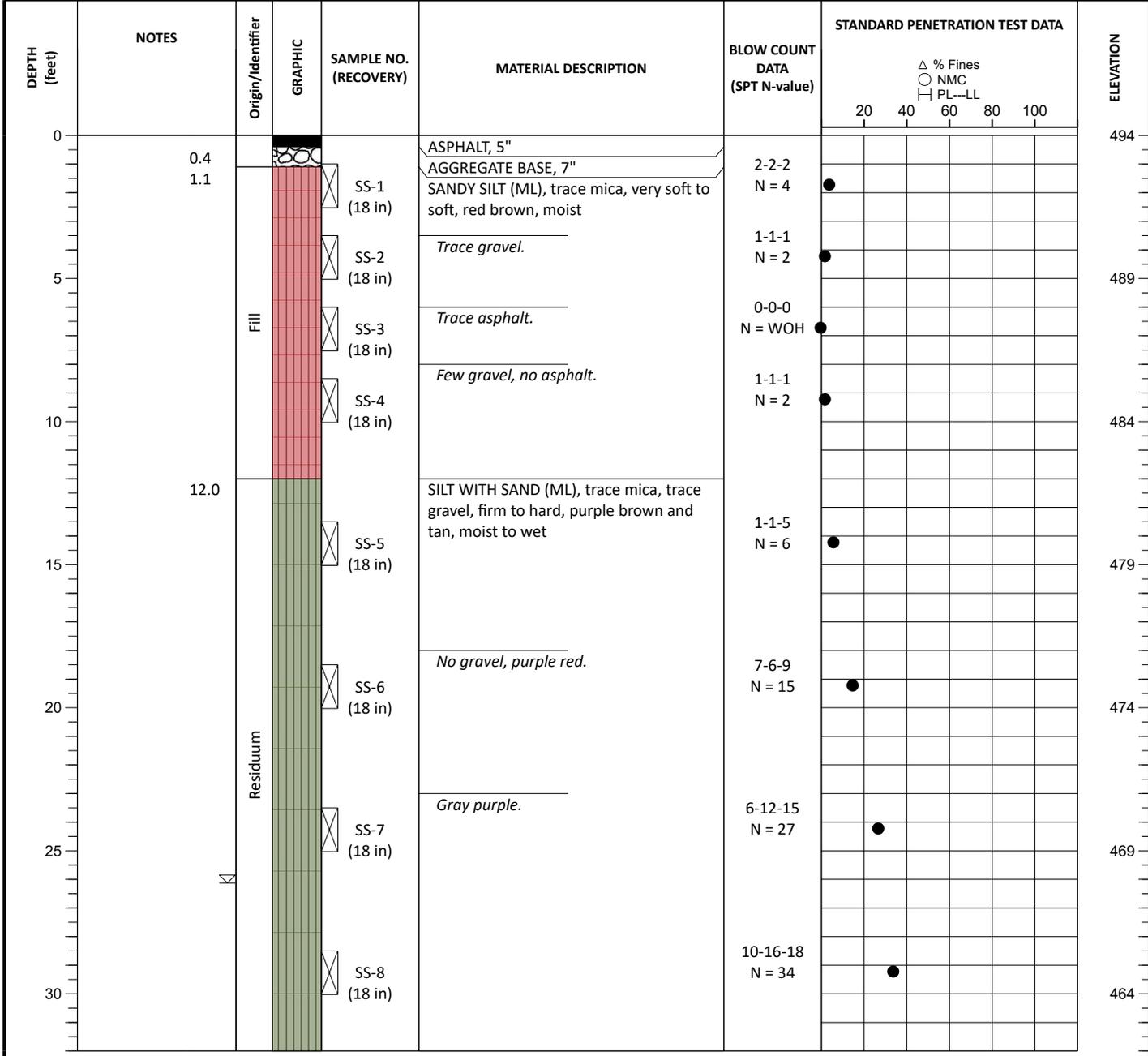
DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
0					ASPHALT, 5"							493
0.4					AGGREGATE BASE, 6"	1-2-2						
0.9				SS-1 (18 in)	SILT WITH SAND (ML), trace gravel, soft, red brown, moist	N = 4	●					
3.0				SS-2 (18 in)	SILT (ML), stiff, red brown, moist	2-2-8	●					
5						N = 10						488
5.5		Fill		SS-3 (18 in)	SILT WITH SAND (ML), trace gravel, trace mica, soft, orange red	1-1-2	●					
				SS-4 (18 in)	Trace gravel, red brown.	0-1-2	●					
10						N = 3						483
12.0				SS-5 (18 in)	SILT WITH SAND (ML), trace mica, firm, red brown and gray, moist	4-3-5	●					
15						N = 8						478
17.0		Residuum		SS-6 (18 in)	SILT (ML), trace mica, very stiff to hard, orange brown, moist	4-6-17	●					
20						N = 23						473
	Hole Cave at 22.0 feet			SS-7 (18 in)	Purple red and orange brown.	5-10-28	●					
25					Borehole terminated at 25.0 feet	N = 38						468
30												463

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	08/23/2023		Not encountered
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-3</b> Sheet 1 of 2	
<b>DATE DRILLED:</b> 08/23/2023	<b>ELEVATION:</b> 494 ft	<b>NOTES:</b> Location and elevation are approximate	
<b>DRILL RIG:</b> CME 750	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> D. Garrow	<b>BORING DEPTH:</b> 50.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings and Asphalt Patch		
<b>DRILLING METHOD:</b> 3-1/4" HSA	<b>LOGGED BY:</b> Matthew Millette	<b>LATITUDE:</b> 35.795003	<b>LONGITUDE:</b> -78.709967
<b>SAMPLING METHOD:</b> SS		<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>	



GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	08/23/2023	26.0	
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-3</b> Sheet 2 of 2	
<b>DATE DRILLED:</b> 08/23/2023		<b>ELEVATION:</b> 494 ft	
<b>DRILL RIG:</b> CME 750		<b>DATUM:</b> NAVD88	
<b>DRILLER:</b> D. Garrow		<b>BORING DEPTH:</b> 50.0 ft	
<b>HAMMER TYPE:</b> Automatic hammer		<b>CLOSURE:</b> Cuttings and Asphalt Patch	
<b>DRILLING METHOD:</b> 3-1/4" HSA		<b>LOGGED BY:</b> Matthew Millette	
<b>SAMPLING METHOD:</b> SS		<b>LATITUDE:</b> 35.795003 <b>LONGITUDE:</b> -78.709967	
<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>			

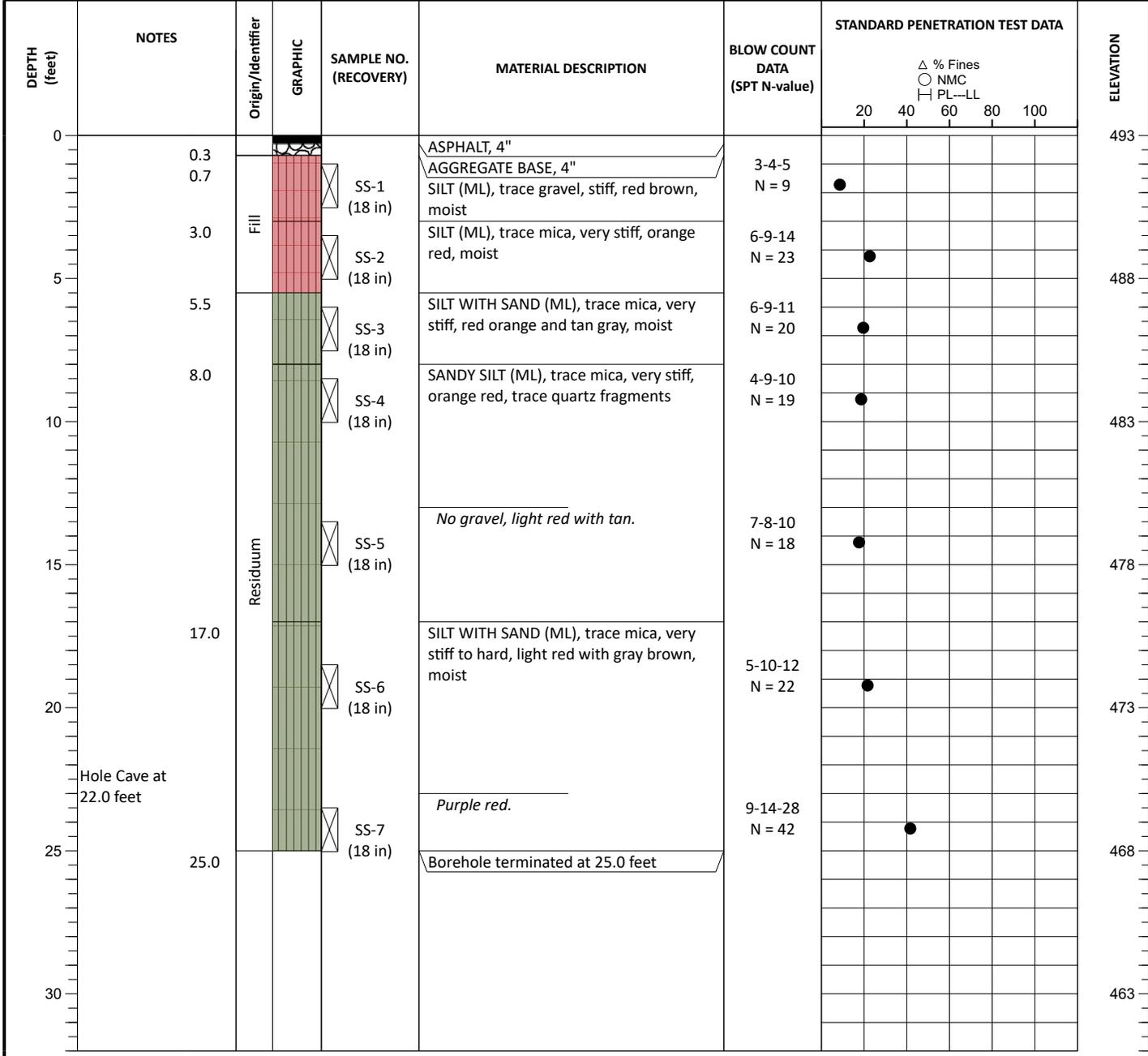
DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION		
							20	40	60	80	100			
35		Residuum		SS-9 (18 in)	SILT WITH SAND (ML), trace mica, trace gravel, firm to hard, purple brown and tan, moist to wet	10-16-20 N = 36		●					459	
40				SS-10 (18 in)			20-30-40 N = 70			●				454
45	Hole Cave at 45.0 feet			SS-11 (18 in)		Light red with gray tan.	13-16-25 N = 41		●					449
50				SS-12 (18 in)		Purple red with gray tan.	22-30-30 N = 60			●				444
50.0				Borehole terminated at 50.0 feet										

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	08/23/2023	26.0	
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-4</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 08/23/2023	<b>ELEVATION:</b> 493 ft	<b>NOTES:</b> Location and elevation are approximate	
<b>DRILL RIG:</b> CME 750	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> D. Garrow	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 3-1/4" HSA	<b>LOGGED BY:</b> Matthew Millette		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>		



GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	08/23/2023		Not encountered
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-5</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 03/11/2024		<b>ELEVATION:</b> 491 ft	
<b>DRILL RIG:</b> D-50		<b>DATUM:</b> NAVD88	
<b>DRILLER:</b> TJ Williams		<b>BORING DEPTH:</b> 25.0 ft	
<b>HAMMER TYPE:</b> Automatic hammer		<b>CLOSURE:</b> Cuttings with Hole Closure Device	
<b>DRILLING METHOD:</b> 3-1/4" HSA		<b>LOGGED BY:</b> William Harrison	
<b>SAMPLING METHOD:</b> SS		<b>PROJECT COORDINATE SYSTEM -</b> NAD 1983 StatePlane North Carolina FIPS 3200 Feet	
<b>NOTES:</b> Boring location and elevation are approximate.			
		<b>LATITUDE:</b> 35.795068 <b>LONGITUDE:</b> -78.710158	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
0					TOPSOIL, 2"							491
0.2				SS-1 (18 in)	SANDY ELASTIC SILT (MH), trace mica, trace fine gravel, soft, brown with red orange, moist	2-2-2 N = 4	●					
3.0		Fill		SS-2 (18 in)	FAT CLAY (CH), firm, brown red, moist	2-3-2 N = 5	●					
5.5				SS-3 (18 in)	LEAN CLAY WITH SAND (CL), trace fine gravel, trace, stiff, tan red and orange, moist, quartz	5-6-7 N = 13	●					
8.0				SS-4 (18 in)	SILT WITH SAND (ML), trace mica, stiff, purple red and orange, moist	4-5-5 N = 10	●					481
12.0		Residuum		SS-5 (18 in)	SANDY SILT (ML), trace mica, firm, purple gray and tan, moist	3-4-4 N = 8	●					476
17.0				SS-6 (18 in)	SILT WITH SAND (ML), little mica, stiff, red purple with gray, moist	4-6-6 N = 12	●					471
25.0	Hole Cave at 21.5 feet			SS-7 (18 in)	Borehole terminated at 25.0 feet	6-5-7 N = 12	●					466
30												461

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	03/11/2024		Caved dry at 21.5'
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal, IGM = Intermediate Geomaterial

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-6</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 03/11/2024		<b>ELEVATION:</b> 491 ft	
<b>DRILL RIG:</b> D-50		<b>DATUM:</b> NAVD88	
<b>DRILLER:</b> TJ Williams		<b>BORING DEPTH:</b> 25.0 ft	
<b>HAMMER TYPE:</b> Automatic hammer		<b>CLOSURE:</b> Cuttings with Hole Closure Device	
<b>DRILLING METHOD:</b> 3-1/4" HSA		<b>LOGGED BY:</b> William Harrison	
<b>SAMPLING METHOD:</b> SS		<b>PROJECT COORDINATE SYSTEM -</b> NAD 1983 StatePlane North Carolina FIPS 3200 Feet	
<b>NOTES:</b> Boring location and elevation are approximate.			
		<b>LATITUDE:</b> 35.795165 <b>LONGITUDE:</b> -78.709865	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION		
							20	40	60	80	100			
0					TOPSOIL, 2"							491		
0.2		Fill		SS-1 (18 in)	FAT CLAY (CH), with silt, trace fine to medium gravel, trace mica, firm, brown and red, moist	3-2-3 N = 5	●							
3.0				SS-2 (18 in)	FAT CLAY WITH SAND (CH), with, trace mica, firm, brown red and yellow, moist, rootlets	3-3-4 N = 7	●							
6.0				Residuum		SS-3 (18 in)	SANDY SILT (ML), trace mica, stiff, orange red, moist	4-7-8 N = 15	●					
8.0		SS-4 (18 in)	SANDY SILT (ML), with, little mica, stiff, tan red and gray, moist, quartz			5-5-9 N = 14	●							
12.0		SS-5 (18 in)	SANDY SILT (ML), little mica, very stiff, red purple, moist			7-7-9 N = 16	●							
20.0		SS-6 (18 in)				6-8-10 N = 18	●							
25.0		SS-7 (18 in)				9-10-14 N = 24	●							
25.0	Hole Cave at 22.0 feet				Borehole terminated at 25.0 feet									

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	03/11/2024		Caved dry at 22'
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal, IGM = Intermediate Geomaterial

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-7</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 03/11/2024	<b>ELEVATION:</b> 490 ft	<b>NOTES:</b> Boring location and elevation are approximate.	
<b>DRILL RIG:</b> D-50	<b>DATUM:</b> NAVD88		
<b>DRILLER:</b> TJ Williams	<b>BORING DEPTH:</b> 25.0 ft		
<b>HAMMER TYPE:</b> Automatic hammer	<b>CLOSURE:</b> Cuttings with Hole Closure Device		
<b>DRILLING METHOD:</b> 3-1/4" HSA	<b>LOGGED BY:</b> William Harrison		
<b>SAMPLING METHOD:</b> SS	<b>PROJECT COORDINATE SYSTEM - NAD 1983 StatePlane North Carolina FIPS 3200 Feet</b>		

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION		
							20	40	60	80	100			
0					TOPSOIL, 6"							490		
0.5		Fill		SS-1 (18 in)	SANDY SILT (ML), with clay, trace mica, trace fine gravel, firm, brown red, moist	3-4-3 N = 7	●							
3.0				SS-2 (18 in)	SILT WITH SAND (ML), trace fine gravel, stiff, orange and tan, moist	3-4-5 N = 9	●							
5.5				Residuum		SS-3 (18 in)	SILT (ML), little mica, stiff, red purple and orange, moist	3-4-5 N = 9	●					
8.0		SS-4 (18 in)	SANDY SILT (ML), little mica, stiff, tan brown, moist			3-3-6 N = 9	●							
12.0		SS-4 (18 in)	SANDY SILT (ML), little mica, stiff, purple tan, moist			3-4-7 N = 11	●							
17.0		SS-6 (18 in)	SANDY SILT (ML), little mica, stiff, purple red and tan, moist			3-5-7 N = 12	●							
25.0	Hole Cave at 19.5 feet	SS-7 (18 in)				5-5-6 N = 11	●							
						Borehole terminated at 25.0 feet								
30														

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	03/11/2024		Caved dry at 19.5'
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal, IGM = Intermediate Geomaterial

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-8</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 03/11/2024		<b>ELEVATION:</b> 489 ft	
<b>DRILL RIG:</b> D-50		<b>DATUM:</b> NAVD88	
<b>DRILLER:</b> TJ Williams		<b>BORING DEPTH:</b> 25.0 ft	
<b>HAMMER TYPE:</b> Automatic hammer		<b>CLOSURE:</b> Cuttings with Hole Closure Device	
<b>DRILLING METHOD:</b> 3-1/4" HSA		<b>LOGGED BY:</b> William Harrison	
<b>SAMPLING METHOD:</b> SS		<b>PROJECT COORDINATE SYSTEM -</b> NAD 1983 StatePlane North Carolina FIPS 3200 Feet	
<b>NOTES:</b> Boring location and elevation are approximate.			
		<b>LATITUDE:</b> 35.795241 <b>LONGITUDE:</b> -78.710088	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION		
							20	40	60	80	100			
0					TOPSOIL, 5"							489		
0.4		Fill		SS-1 (18 in)	SANDY LEAN CLAY (CL), trace fine gravel, trace, firm, orange red, moist, rootlets	3-3-3 N = 6	●							
3.0				SS-2 (18 in)	SILTY SAND (SM), trace fine gravel, loose, tan yellow, fine grained, moist	6-4-3 N = 7	●							
5.5		Residuum		SS-3 (18 in)	SILT (ML), stiff, tan orange, moist	4-4-6 N = 10	●						484	
8.0				SS-4 (18 in)	SANDY SILT (ML), little mica, stiff, red purple and orange, moist	4-4-6 N = 10	●							479
12.0				SS-5 (18 in)	SANDY SILT (ML), little mica, stiff, brown purple and red, moist	4-4-6 N = 10	●							474
17.0	Hole Cave at 19.0 feet			SS-6 (18 in)	SANDY SILT (ML), trace mica, stiff to very stiff, tan and red, moist	4-6-5 N = 11	●							469
25.0				SS-7 (18 in)	Borehole terminated at 25.0 feet	6-10-12 N = 22	●							464
30												459		

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	03/11/2024		Caved dry at 19'
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal, IGM = Intermediate Geomaterial

<b>PROJECT:</b> NC Fairgrounds Lunch Stand Replacement Raleigh, North Carolina S&ME Project No. 23050451		<b>BORING LOG: B-9</b> Sheet 1 of 1	
<b>DATE DRILLED:</b> 03/11/2024		<b>ELEVATION:</b> 490 ft	
<b>DRILL RIG:</b> D-50		<b>DATUM:</b> NAVD88	
<b>DRILLER:</b> TJ Williams		<b>BORING DEPTH:</b> 25.0 ft	
<b>HAMMER TYPE:</b> Automatic hammer		<b>CLOSURE:</b> Cuttings with Hole Closure Device	
<b>DRILLING METHOD:</b> 3-1/4" HSA		<b>LOGGED BY:</b> William Harrison	
<b>SAMPLING METHOD:</b> SS		<b>PROJECT COORDINATE SYSTEM -</b> NAD 1983 StatePlane North Carolina FIPS 3200 Feet	
<b>LATITUDE:</b> 35.795325		<b>LONGITUDE:</b> -78.709799	

DEPTH (feet)	NOTES	Origin/Identifier	GRAPHIC	SAMPLE NO. (RECOVERY)	MATERIAL DESCRIPTION	BLOW COUNT DATA (SPT N-value)	STANDARD PENETRATION TEST DATA					ELEVATION
							20	40	60	80	100	
0					TOPSOIL, 5"							490
0.4				SS-1 (18 in)	SANDY LEAN CLAY (CL), with fine to medium gravel, firm, tan brown and red, moist	4-3-4 N = 7	●					
3.0		Fill		SS-2 (18 in)	SANDY SILT (ML), trace mica, trace fine gravel, firm, purple red and tan, moist	3-4-3 N = 7	●					
5.5				SS-3 (18 in)	CLAYEY SAND (SC), trace rock fragments, medium dense, tan brown and red, fine to medium grained, moist	3-5-6 N = 11	●					
8.0				SS-4 (18 in)	SANDY SILT (ML), with, stiff, orange red, moist, quartz	8-9-4 N = 13	●					
12.0		Residuum		SS-5 (18 in)	SANDY SILT (ML), little mica, stiff, purple tan and orange, moist	4-4-5 N = 9	●					
17.0				SS-6 (18 in)	SANDY SILT (ML), little mica, very stiff, light red purple, moist	13-13-15 N = 28	●					
22.0				SS-7 (18 in)	SANDY SILT (ML), trace mica, with, very stiff, tan red, moist, quartz	10-18-11 N = 29	●					
25.0	Hole Cave at 20.0 feet				Borehole terminated at 25.0 feet							

GROUNDWATER	DATE	DEPTH (FT)	REMARKS
ATD	03/11/2024		Caved dry at 20'
END OF DRILLING			
AFTER DRILLING			
AFTER DRILLING			



GROUNDWATER DEPTHS ARE NOT EXACT AND MAY VARY SUBSTANTIALLY FROM THOSE INDICATED. ATD = AT TIME OF DRILLING  
 LL=Liquid Limit, PL = Plastic Limit, NMC = Natural Moisture Content, PPV = Pocket Penetrometer (tsf), PTV = Pocket Torvane (tsf),  
 AR = Auger Refusal, IGM = Intermediate Geomaterial

## **Appendix III – Laboratory Test Data**



# Moisture, Ash, and Organic Matter



## ASTM D-2974

S&ME, Inc. Raleigh, 3201 Spring Forest Road, Raleigh, North Carolina 27616

Project #:	23050451	Report Date:	3/21/2024
Project Name:	NC Fairgrounds Lunch Building	Test Date(s):	3/19 - 3/21/23
Client Name:	Dewberry		
Client Address:			
Boring #:	N/A	Sample No.	S-1
		Sample Date:	3/4/2024
Location:	On Site Stockpile	Offset:	N/A
		Depth (ft):	0-5 ft.

Sample Description: Gray Silty SAND with Organics

<b>Equipment:</b>	Balance: 0.01 g. Readability, 500g. Minimum Capacity		
Balance:	S&ME ID #:	<b>20977</b>	Cal. Date: <b>3/2/23</b> Due: <b>3/2/24</b>

### Method A: Moisture Content Determination

Required Oven Temperature: 105 ± 5°C

Oven Temperature: 105 °C		Tare #	10
t	Tare Weight (Dish plus Aluminum Foil Cover)	grams	49.23
a	Mass of <b>As-Received</b> Specimen + Tare Wt.	grams	149.19
b	Mass of Oven Dry Specimen + Tare Wt.	grams	122.45
w	Water Weight	(a-b)	26.74
A	Mass of As-Received Specimen	(a-t)	99.96
B	Mass of Oven Dry Specimen	(b-t)	73.22
<b>% Moisture Content as a % of As Received or Total Mass</b>		(w/A)*100	<b>26.8%</b>
<b>% Moisture Content as a % of Oven-dried Mass</b>		(w/B)*100	<b>36.5%</b>

Oven	S&ME ID #:	1454	Cal. Date:	8/30/23	Due:	8/30/24
------	------------	------	------------	---------	------	---------

### Method C (440°C) or D (750°C): Ash Content and Organic Matter Determination

Muffle Furnace: 440 °C		Tare #	10
t	Tare Weight (Dish plus Aluminum Foil Cover)	grams	49.23
b	Mass of Oven Dry Specimen + Tare Wt.	grams	122.45
c	Ash Weight + Tare Wt.	grams	111.67
C	Ash Weight	c-t	62.44
B	Mass of Oven Dry Specimen	(b-t)	73.22
D	<b>% Ash Content</b>	(C/B)*100	<b>85.3%</b>
	<b>% Organic Matter</b>	100-D	<b>14.7%</b>

Muffle Furnace:	S&ME ID #:	00261
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Notes / Deviations / References:

ASTM D2974: Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

Mal Krajan, ET  
 Technical Responsibility

  
 Signature

Laboratory Manager  
 Position

3/21/2024  
 Date

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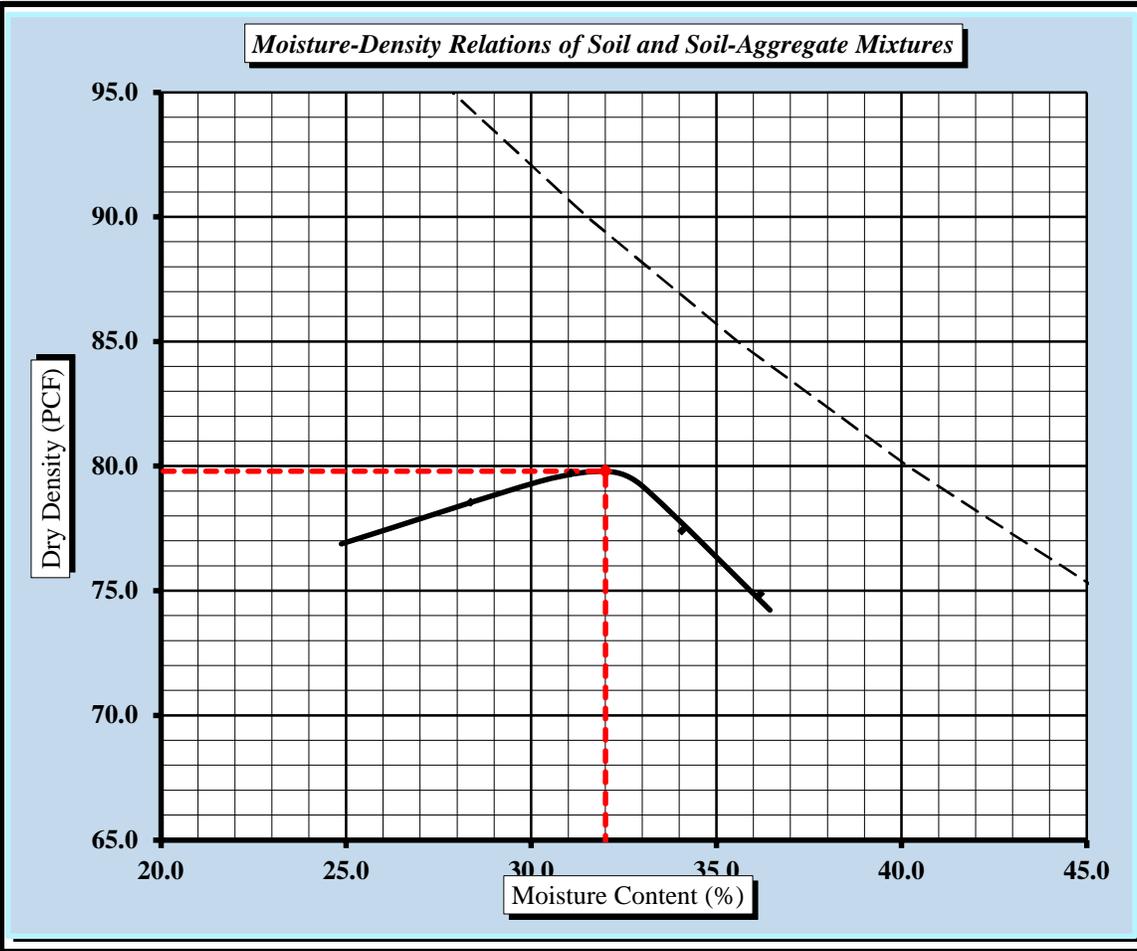
# MOISTURE - DENSITY REPORT



Quality Assurance

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616			
S&ME Project #:	23050451	Report Date:	3/12/24
Project Name:	NC Fairgrounds lunch Building	Test Date(s):	3/8 - 3/12/24
Client Name:			
Client Address:			
Boring #:	N/A	Sample #:	S-1
Location:	On Site	Offset:	N/A
Sample Description:	Gray Silty SAND with Organics		

Maximum Dry Density	79.8	PCF.	Optimum Moisture Content	32.0%
<b>ASTM D 698 - - Method A</b>				



Soil Properties	
Natural Moisture Content	ND
Assumed Specific Gravity	2.650
Liquid Limit	ND
Plastic Limit	ND
Plastic Index	ND
% Passing	
3/4"	100.0%
3/8"	100.0%
#4	
#200	
Oversize Fraction	
Bulk Gravity	
% Moisture	
% Oversize	
MDD	
Opt. MC	

Moisture-Density Curve Displayed: Fine Fraction  Corrected for Oversize Fraction (ASTM D 4718)   
 Sieve Size used to separate the Oversize Fraction: #4 Sieve  3/8 inch Sieve  3/4 inch Sieve   
 Mechanical Rammer  Manual Rammer  Moist Preparation  Dry Preparation

References / Comments / Deviations: ND=Not Determined.  
 ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass  
 ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

**Mal Krajan**  
 Technical Responsibility

Signature

**Laboratory Manager**  
 Position

**3/12/2024**  
 Date

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# MOISTURE - DENSITY REPORT

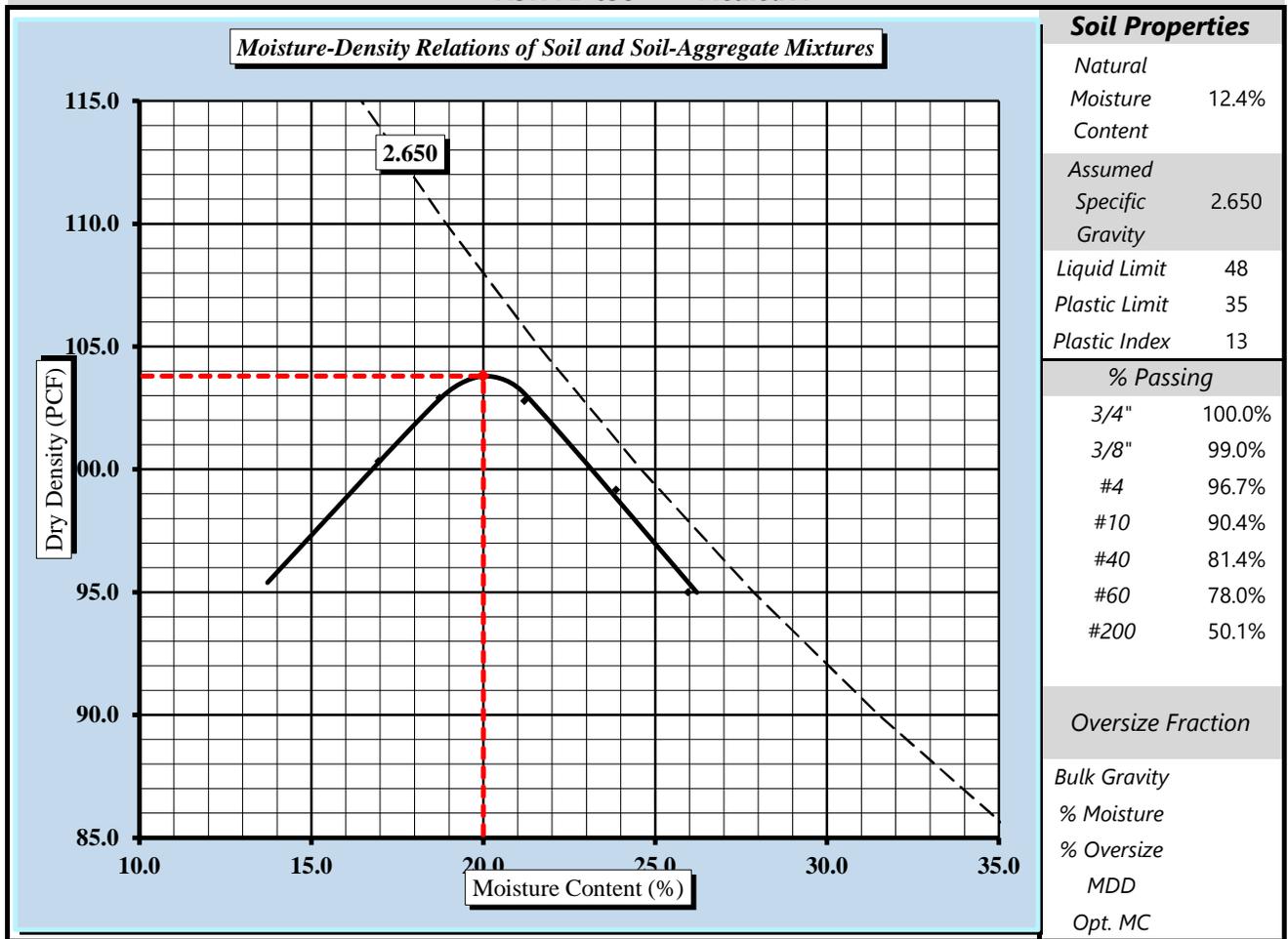


Quality Assurance

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616			
S&ME Project #:	23050451	Report Date:	9/1/2023
Project Name:	NC Fairgrounds Lunch Stand Replacement	Test Date(s):	8/30-9/1/2023
Client Name:	Dewberry		
Client Address:			
Boring #:	B-3	Sample #:	Bulk
		Sample Date:	8/23/2023
Location:	Boreholes	Offset:	N/A
		Depth (ft):	1-5
Sample Description:	Brown Sandy SILT (ML)		

Maximum Dry Density 103.8 PCF. Optimum Moisture Content 20.0%

**ASTM D 698 -- Method A**



Moisture-Density Curve Displayed: Fine Fraction  Corrected for Oversize Fraction (ASTM D 4718)   
 Sieve Size used to separate the Oversize Fraction: #4 Sieve  3/8 inch Sieve  3/4 inch Sieve   
 Mechanical Rammer  Manual Rammer  Moist Preparation  Dry Preparation

References / Comments / Deviations:

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass  
 ASTM D 698: Laboratory Compaction Characteristics of Soil Using Standard Effort

Mal Krajan, ET  
 Technical Responsibility

Signature

Laboratory Manager  
 Position

9/1/2023  
 Date

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## CBR (CALIFORNIA BEARING RATIO) OF LABORATORY COMPACTED SOIL



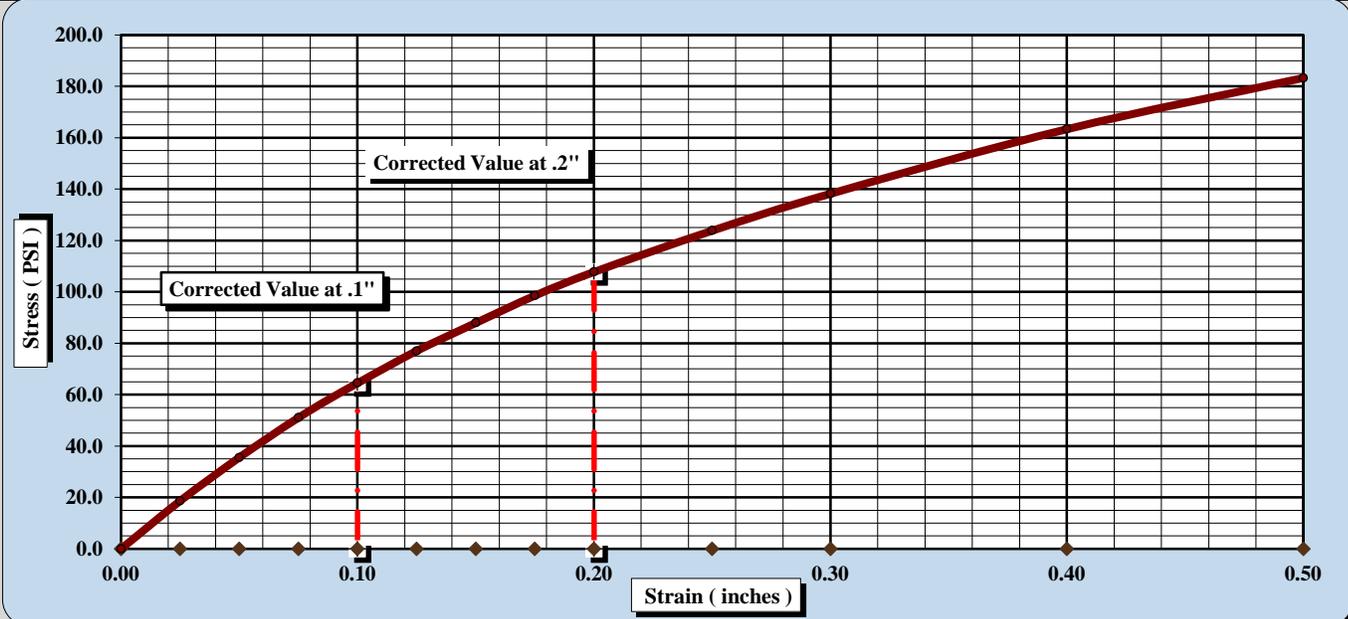
ASTM D 1883

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	23050451	Report Date:	9/6/2023
Project Name:	NC Fairgrounds Lunch Stand Replacement	Test Date(s)	9/4 - 9/6/23
Client Name:	Dewberry		
Client Address:			
Boring #:	B-3	Sample #:	Bulk
		Sample Date:	8/23/23
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	1-5
Sample Description:	Brown Sandy SILT (ML)		

ASTM D 698 Method A      Maximum Dry Density: 103.8 PCF      Optimum Moisture Content: 20.0%  
 Compaction Test performed on grading complying with CBR spec.      % Retained on the 3/4" sieve: 0.0%

Uncorrected CBR Values		Corrected CBR Values	
CBR at 0.1 in.	6.5	CBR at 0.1 in.	6.5
CBR at 0.2 in.	7.2	CBR at 0.2 in.	7.2



CBR Sample Preparation:

*The entire gradation was used and compacted in a 6" CBR mold in accordance with ASTM D1883, Section 6.1.1*

Before Soaking		After Soaking	
Compactive Effort (Blows per Layer)	42	Final Dry Density (PCF)	101.4
Initial Dry Density (PCF)	101.8	Average Final Moisture Content	23.0%
Moisture Content of the Compacted Specimen	19.9%	Moisture Content (top 1" after soaking)	23.7%
Percent Compaction	98.1%	Percent Swell	0.6%

Soak Time:	96 hrs.	Surcharge Weight	20.0	Surcharge Wt. per sq. Ft.	101.9
Liquid Limit	48	Plastic Index	13		

Notes/Deviations/References:

Test specimen compacted to 98% at optimum moisture.

Mal Krajan, ET  
 Technical Responsibility

Signature

Laboratory Manager  
 Position

9/13/2023  
 Date

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Single sieve set

ASTM D6913

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #: 23050451 Record Date: 8/29/2003

Project Name: NC Fairgrounds Lunch Stand Replacement Lab Report #: 1

Client Name: Dewberry Date Received: 8/29/2023

Client Address:

Received By: Lab Tech Sampled by: S&ME, Inc. Date Sampled: 8/23/2023

Location: Site-Borehole Boring #: B-2 Sample #: SS-4

Log/Sample Id. 289 Type: SS-4 Elev/Depth (ft): 8.5-10

Sample Description: Brown Sandy SILT (ML)





Single sieve set

ASTM D6913

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	23050451	Record Date:	3/5/2024
Project Name:	NC Fairgrounds Lunch Building	Lab Report #:	1
Client Name:	Dewberry	Date Received:	3/5/2024
Client Address:			
Received By:	Lab Tech	Sampled by:	S&ME, Inc.
		Date Sampled:	3/4/2024
Location:	Site-Borehole	Boring #:	Bulk
		Sample #:	S-1
Log/Sample Id.	48	Type:	Bulk
		Elev/Depth (ft):	0-5 ft.

Sample Description: Gray Silty SAND with Organic (SM)



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Method:	B	Procedure for obtaining Specimen:	Moist		
Maximum Particle Size	3/8"	Coarse Sand	20.0%	Fine Sand	20.5%
Gravel	0.8%	Medium Sand	37.0%	Silt & Clay	21.7%
Liquid Limit	*ND	Plastic Limit	N.P.	Plastic Index	N.P.
Maximum Dry Density	N/A	Bulk Gravity (C127)	N/A	% Absorption	N/A
Optimum Moisture	N/A	Natural Moisture	33.5%		

Notes / Deviations / References: \*ND=The Liquid Limit Could Not be Determined.

<u>Mal Krajan</u>		<u>Laboratory Manager</u>	<u>3/21/2024</u>
Technical Responsibility	Signature	Position	Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



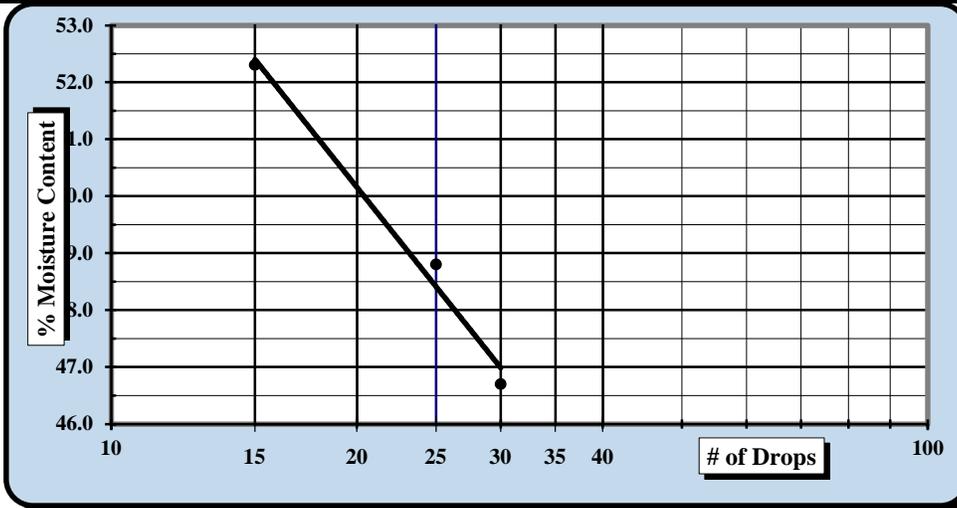
ASTM D 4318  AASHTO T 89  AASHTO T 90

S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	23050451	Report Date:	9/13/23
Project Name:	NC Fairgrounds Lunch Stand Replacement	Test Date(s)	9/6 - 9/13/23
Client Name:	Dewberry		
Client Address:			
Boring #:	B-3	Sample #:	Bulk
		Sample Date:	8/23/23
Location:	Site-Borehole	Offset:	N/A
		Depth (ft):	1-5

Sample Description: Brown Sandy SILT					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	20977	3/2/2023	Grooving tool	1801	3/2/2023
LL Apparatus	34656	3/20/2023			
Oven	13289	8/30/2023			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
A	Tare Weight	12.34	12.25	13.92			13.96	12.32	
B	Wet Soil Weight + A	23.62	23.25	24.67			24.05	21.74	
C	Dry Soil Weight + A	20.03	19.64	20.98			21.43	19.30	
D	Water Weight (B-C)	3.59	3.61	3.69			2.62	2.44	
E	Dry Soil Weight (C-A)	7.69	7.39	7.06			7.47	6.98	
F	% Moisture (D/E)*100	46.7%	48.8%	52.3%			35.1%	35.0%	
N	# OF DROPS	30	25	15			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						<b>35.1%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>48</b>
Plastic Limit	<b>35</b>
Plastic Index	<b>13</b>
Group Symbol	<b>ML</b>

Multipoint Method	<input checked="" type="checkbox"/>
One-point Method	<input type="checkbox"/>

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 5.5%

Notes / Deviations / References:

---

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET  
 Technical Responsibility

Signature

Laboratory Manager  
 Position

9/13/2023  
 Date

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## LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318  AASHTO T 89  AASHTO T 90

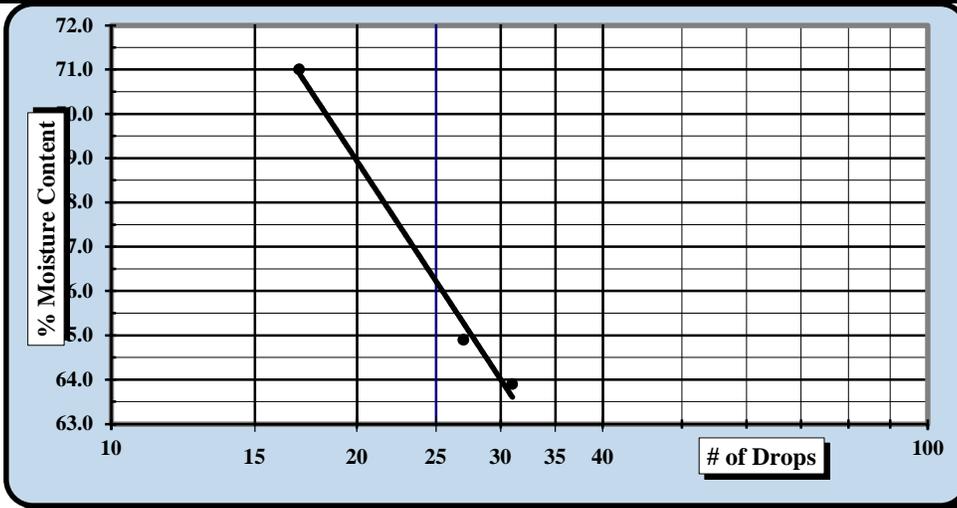
S&ME, Inc. Raleigh: 3201 Spring Forest Road, Raleigh, NC 27616

Project #:	23050451	Report Date:	9/13/23
Project Name:	NC Fairgrounds Lunch Stand Replacement	Test Date(s)	9/6 - 9/13/23
Client Name:	Dewberry		
Client Address:			

Boring #:	B-1	Sample #:	SS-2	Sample Date:	8/23/23
Location:	Site-Borehole	Offset:	N/A	Depth (ft):	3.5-5

Sample Description: Red SILT with Sand					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	20977	3/2/2023	Grooving tool	1801	3/2/2023
LL Apparatus	34656	3/20/2023			
Oven	13289	8/30/2023			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
A	Tare Weight	12.21	12.34	12.20			12.19	12.35	
B	Wet Soil Weight + A	21.19	21.08	22.12			22.96	24.31	
C	Dry Soil Weight + A	17.69	17.64	18.00			19.90	20.88	
D	Water Weight (B-C)	3.50	3.44	4.12			3.06	3.43	
E	Dry Soil Weight (C-A)	5.48	5.30	5.80			7.71	8.53	
F	% Moisture (D/E)*100	63.9%	64.9%	71.0%			39.7%	40.2%	
N	# OF DROPS	31	27	17			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						<b>40.0%</b>		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	<b>66</b>
Plastic Limit	<b>40</b>
Plastic Index	<b>26</b>
Group Symbol	<b>MH</b>

Multipoint Method   
 One-point Method

Wet Preparation  Dry Preparation  Air Dried  Estimate the % Retained on the #40 Sieve: 5.5%

Notes / Deviations / References:

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ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Mal Krajan, ET  
 Technical Responsibility

Signature

Laboratory Manager  
 Position

9/13/2023  
 Date

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**BUILT FOR  
VERSATILITY**

# Important Information About Your Geotechnical Engineering Report

*Variations in subsurface conditions can be a principal cause of construction delays, cost overruns and claims. The following information is provided to assist you in understanding and managing the risk of these variations.*

## **Geotechnical Findings Are Professional Opinions**

Geotechnical engineers cannot specify material properties as other design engineers do. Geotechnical material properties have a far broader range on a given site than any manufactured construction material, and some geotechnical material properties may change over time because of exposure to air and water, or human activity.

Site exploration identifies subsurface conditions at the time of exploration and only at the points where subsurface tests are performed or samples obtained. Geotechnical engineers review field and laboratory data and then apply their judgment to render professional opinions about site subsurface conditions. Their recommendations rely upon these professional opinions. Variations in the vertical and lateral extent of subsurface materials may be encountered during construction that significantly impact construction schedules, methods and material volumes. While higher levels of subsurface exploration can mitigate the risk of encountering unanticipated subsurface conditions, no level of subsurface exploration can eliminate this risk.

## **Scope of Geotechnical Services**

Professional geotechnical engineering judgment is required to develop a geotechnical exploration scope to obtain information necessary to support design and construction. A number of unique project factors are considered in developing the scope of geotechnical services, such as the exploration objective; the location, type, size and weight of the proposed structure; proposed site grades and improvements; the construction schedule and sequence; and the site geology.

Geotechnical engineers apply their experience with construction methods, subsurface conditions and exploration methods to develop the exploration scope. The scope of each exploration is unique based on available project and site information. Incomplete project information or constraints on the scope of exploration increases the risk of variations in subsurface conditions not being identified and addressed in the geotechnical report.

## **Services Are Performed for Specific Projects**

Because the scope of each geotechnical exploration is unique, each geotechnical report is unique. Subsurface conditions are explored and recommendations are made for a specific project. Subsurface information and recommendations may not be adequate for other uses. Changes in a proposed structure location, foundation loads, grades, schedule, etc. may require additional geotechnical exploration, analyses, and consultation. The geotechnical engineer should be consulted to determine if additional services are required in response to changes in proposed construction, location, loads, grades, schedule, etc.

## **Geo-Environmental Issues**

The equipment, techniques, and personnel used to perform a geo-environmental study differ significantly from those used for a geotechnical exploration. Indications of environmental contamination may be encountered incidental to performance of a geotechnical exploration but go unrecognized. Determination of the presence, type or extent of environmental contamination is beyond the scope of a geotechnical exploration.

## **Geotechnical Recommendations Are Not Final**

Recommendations are developed based on the geotechnical engineer's understanding of the proposed construction and professional opinion of site subsurface conditions. Observations and tests must be performed during construction to confirm subsurface conditions exposed by construction excavations are consistent with those assumed in development of recommendations. It is advisable to retain the geotechnical engineer that performed the exploration and developed the geotechnical recommendations to conduct tests and observations during construction. This may reduce the risk that variations in subsurface conditions will not be addressed as recommended in the geotechnical report.

**GENERAL CONDITIONS OF THE CONTRACT**

**STANDARD FORM FOR CONSTRUCTION MANAGER-AT-RISK PROJECTS**

**NORTH CAROLINA**

**DEPARTMENT OF ADMINISTRATION**

**STATE CONSTRUCTION OFFICE**

**Form OC-15CM**

**This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of “Supplementary General Conditions” is strongly discouraged. State agencies and institutions may include special requirements in “Division 1 – General Requirements” of the specifications, where they do not conflict with the General Conditions.**

**Second Edition January 2013**

**Revision 1 – May 2024: Article 23.b**

## GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

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## ARTICLE 1 - DEFINITIONS

- a. The **contract documents** consist of the Request for Proposal (RFP); Construction Manager's formal response to the RFP; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.
- b. The **Owner** is the State of North Carolina by and through the agency or institution named in the contract..
- c. The **designer** or **project designer** means the firm or firms of architects or engineers or both (and their consultants) which have undertaken to design the project pursuant to a contract with the Owner, (hereinafter, the "design contract").
- d. The **Construction Manager-at-Risk (CM)** accepts a relationship of trust and confidence between himself and the Owner and undertakes to act as the Owner's fiduciary in the handling and opening of bids in accordance with the provisions of North Carolina General Statute (N.C.G.S.) 143-128.1. The CM agrees to furnish his best skills and his best judgment to cooperate with the Owner and Designer for undertaking all necessary action contemplated under the contract documents to (a) establish during the design phase a Guaranteed Maximum Price (GMP) to construct the project and (b) ensure timely and quality completion of the project at a cost within the GMP. Construction Manager or CM as used in the contract documents means Construction Manager-at-Risk (CM at Risk).
- e. A **subcontractor**, as the term is used herein, shall be in the case of a principal trade contractor, a general, mechanical, electrical or plumbing contractor or in the case of a specialty contractor, a trade contractor who is not a principal trade contractor, who has entered into a direct contract with a CM, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.
- f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.
- g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor as supervised by the CM.
- h. The **project** is the total construction work to be performed under the contract documents.
- i. **Construction Management Fee** shall be an all inclusive lump sum management fee which will include all Construction Manager-at-Risk home office, project site and project related costs including all Construction Manager-at-Risk overhead costs and profit.
- j. **Change order**, as used herein, shall mean a written order to the CM subsequent to the signing of the contract authorizing a change in the GMP contract. The change order shall be signed by the CM, designer and the Owner, and approved by the State Construction Office, in that order (Article 19).

- k. **Field Order**, as used herein, shall mean a written approval for the CM to proceed with the work requested by Owner prior to issuance of a formal Change Order. The field order shall be signed by the CM, designer, Owner, and State Construction Office (SCO).
- l. **Field Change**, as used herein shall mean a written approval from the Owner for the CM to proceed with work requested by the Owner to be paid for from the CM Contingency or Owner's Project Reserve within the GMP.
- m. **Time of Completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).
- n. **Liquidated damages**, as stated in the contract documents, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the CM to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the CM, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused solely by the CM (e.g., if a multi-phased project-subsequent phases, delays in start of other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).
- o. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the CM, and which engages to be responsible for the CM and his acceptable performance of the work.
- p. **Routine written communications between the Designer and the Construction Manager** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications cannot be identified as "request for information".
- q. **Clarification or Request for information (RFI)** is a request from the CM seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the CM's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.
- r. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work.
- s. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.
- t. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of the designer and owner.

- u. **“Substitution” or “substitute”** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the designer and owner.
- v. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.
- w. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.
- x. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.
- y. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner’s project requirements and the project design documents.
- z. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.
- aa. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.
- bb. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.
- cc. **Final Acceptance** is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

## ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

- a. The drawings and specifications are complementary, one to the other. That which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.
- b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.

- c. The CM shall execute each copy of the response to RFP, contract, performance bond and payment bond as follows:
  1. If the documents are executed by a sole Owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
  2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
  3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
  4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole Owner, partnership or corporation, whichever form is applicable to each particular member.
  5. All signatures shall be properly witnessed.
  6. If the construction manager's license is held by a person other than an Owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.
  7. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.
  8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.
  9. The seal of the bonding company shall be impressed on each signature page of the bonds.
  10. The CM's signature on the performance bond and the payment bond shall correspond with that on the contract.

### **ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS**

- a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.
- b. The CM and the Designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The Designer shall furnish drawings or clarifications in accordance with that schedule. The CM shall not proceed with the work without such detail drawings and/or written clarifications.

### **ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS**

The Designer or owner shall furnish free of charge to the CM electronic copies of plans and specifications. If requested by the CM, up to 30 paper copies of plans and specifications will be

provide free of charge,, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the CM shall clearly and legibly record all work-in-place that is at variance with the contract documents. Additional sets shall be furnished at cost, including mailing, to the CM at the request of the CM.

#### **ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA**

- a. Within fifteen (15) consecutive calendar days of the notice to proceed, a schedule for anticipated submission of all shop drawings, product data, samples, and similar submittals shall be prepared by the CM and provided to the designer. This schedule shall indicate the items, relevant specification sections, other related submittal data, and the date when these items will be furnished to the designer.
- b. The CM shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the CM's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the CM. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner.
- c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the CM not later than twenty (20) days from the date of receipt by the Designer, for the CM's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals.
- d. Approval of shop drawings by the designer shall not be construed as relieving the CM from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such error has been called to the attention of the designer in writing by the CM.

#### **ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE**

- a. The CM shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the Designer or his authorized representative, owner or State Construction Office.
- b. The CM shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the CM and submitted to the designer upon project completion and no later than thirty (30) days after acceptance of the project.
- c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

## **ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS**

All drawings and specifications are instruments of service and remain the property of the Owner. The use of these instruments on work other than this contract without permission of the Owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the Owner upon request after completion of the work.

## **ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES**

- a. The CM shall, unless otherwise specified, supply & pay for all lighting, power, heat, sanitary facilities & water and shall require the Principal Trade and Specialty Contractors to, supply and pay for all labor, transportation, materials, tools, apparatus, scaffolding and incidentals necessary for the completion of his work, and to install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same. The CM shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied there from, all in accordance with the contract documents.
- b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.
- c. Upon notice, the CM shall furnish evidence from the the Principal Trade and Specialty Contractors as to quality of materials.
- d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the CM through the Principal Trade or Specialty Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the CM through the Principal Trade or Specialty Contractor has the option of using any product and manufacturer combination listed. However, the CM through the Principal Trade or Specialty Contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. The CM shall be responsible for reviewing all substitution requests from Principal Trade or Specialty Contractors prior to submission to the Project Designer and Owner and shall track & monitor all such requests. Requests for substitution of materials, items, or equipment shall be submitted to the Project Designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and the owner approves.
- e. The CM shall obtain written approval from the designer for the use of products, materials, equipment, assemblies or installation methods claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered.

- f. The Designer is the judge of equality for proposed substitution of products, materials or equipment.
- g. If at any time during the construction and completion of the work covered by these contract documents, the conduct of any workman of the various crafts be adjudged a nuisance to the Owner or Designer, or if any workman be considered detrimental to the work, the CM shall order such parties removed immediately from grounds.

## **ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS**

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The CM shall protect and save harmless the Owner against suit on account of alleged or actual infringement. The CM shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

## **ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS**

- a. The CM shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the CM observes that the drawings and specifications are at variance therewith, he shall promptly notify the Designer in writing. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the CM performs any work or authorizes any work to be performed knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising there from. Additional requirements implemented after bidding will be subject to equitable negotiations.
- b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the CM unless otherwise specified.
- c. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The CM shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.
- d. Projects involving local funding (Community Colleges) are also subject to county and municipal building codes and inspection by local authorities. The CM shall pay the cost of these permits and inspections unless otherwise specified.

## **ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC**

- a. The CM shall be responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the Owner or designer, and by laws or ordinances governing such conditions. The CM shall be responsible for any damage to the Owner's property or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. The CM shall be responsible for and pay for any damages caused to the Owner. The CM shall have access to the project at all times.

- b. The CM shall be responsible to cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the Owner.
- c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the Designer.
- d. The CM shall ensure that all trees and shrubs designated to remain in the vicinity of the construction operations are protected in accordance with the requirements of the plans and specifications. All walks, roads, etc., shall be barricaded as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.
- e. The CM shall develop and implement a project safety plan that provides all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. The CM shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. The CM shall insure that protection is provided against damage or injury resulting from falling materials and that all protective devices and signs be maintained throughout the progress of the work.
- f. The CM shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by N.C.G.S. 95-126 through 155.
- g. The CM shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract. The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.
- h. In the event of an emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the CM is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage. Any compensation claimed by the CM on account of such action shall be determined as provided for under Article 19(b).
- i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

## **ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

- a. Any land-disturbing activity performed by the CM or any Principal Trade or Specialty Contractor in connection with the project shall comply with all erosion control measures set

forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).

- b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the CM shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said act are promptly taken.
- c. The CM shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.
- d. To the fullest extent permitted by law, the CM shall indemnify and hold harmless the Owner, the designer and the agents, consultants and employees of the Owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

#### **ARTICLE 13 - INSPECTION OF THE WORK**

- a. It is a condition of this contract that the work shall be subject to inspection during normal working hours by the designer, designated official representatives of the Owner, State Construction Office and those persons required by state law to test special work for official approval. The CM shall therefore provide safe access to the work at all times for such inspections.
- b. All instructions to the CM will be made only by or through the designer or his designated project representative. Observations made by official representatives of the Owner shall be conveyed to the designer for review and coordination prior to issuance to the CM.
- c. The CM shall perform quality control inspections on the work of Principal Trade and Specialty Contractors to guard the Owner against defects and deficiencies in the work and shall coordinate this activity with the on-site duties of the Project Designer. The CM shall advise the Project Designer of any apparent variation and/or deviation from the intent of the Contract Documents and shall take the necessary action to correct such variations and deviations.
- d. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. The CM shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first re-inspection all costs associated with additional re-inspections shall be borne by the CM.
- e. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the CM shall give adequate notice to the Project Designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the Project Designer. Such special tests or inspections will be made in the presence of the Project Designer, or his authorized representative, and it shall be the CM's responsibility to serve ample notice of such tests.

- f. All laboratory tests shall be paid by the Owner unless provided otherwise in the contract documents except the CM shall pay for laboratory tests to establish design mix for concrete and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.
- g. Should any work be covered up or concealed prior to inspection and approval by the Project Designer and/or (SCO) such work shall be uncovered or exposed for inspection, if so requested by the Project Designer or SCO in writing. Inspection of the work will be made promptly upon notice from the CM. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the CM.

#### **ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE**

- a. On-site representatives of the CM shall manage the work of the Principal Trade and Specialty Contractors and coordinate the work with the activities of the Owner and Project Designer to complete the project with the Owner's objectives of cost, time and quality. Throughout the progress of the work, the CM shall maintain a competent and adequate full-time staff approved by the Owner and Project Designer. It is understood that the designated and approved on-site representative of the CM will remain on the job and in responsible charge as long as those persons remain employed by the CM unless otherwise requested or agreed to by the Owner. The CM shall establish an on-site organization with appropriate lines of authority to act on behalf of the CM. Instructions, directions or notices given to the designated on-site authority shall be as binding as if given to the CM. However, directions, instructions, and notices shall be confirmed in writing.
- b. The CM shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.
- c. The CM shall call and preside over monthly job site progress conferences. All Principal Trade and Specialty Contractors shall be represented at these job progress conferences by both home office and project personnel. The CM shall require attendance from other subcontractors and material suppliers who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. The CM shall be prepared to assess progress of the work and to recommend remedial measures for correction of progress as may be appropriate. The CM with assistance from the Designer shall be the coordinator of the conferences and shall preside as chairman. The CM shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.
- d. The CM shall employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark nearby in a location where same will not be disturbed and where direct instruments sights may be taken.

- e. Prior to bidding, it shall be the responsibility of the CM to prepare an electronic and paper copy of a preliminary critical path method (CPM) schedule and submit such schedule to the Project Designer for his review and comment in sufficient time to allow revisions prior to inserting said schedule into the Principal Trade and Specialty Contractors' bid packages. After contract award but prior to thirty (30) days from the date of the notice to proceed, the CM shall obtain from the Principal Trade and Specialty Contractors their respective work activities and integrate them into a project construction schedule in CPM form. The resulting CPM schedule shall show all salient features of the work required for construction of the project from start to finish within the time allotted by the contract. The time in days between the CM's early completion date and the contractual completion date is project float time and shall be used as such by the CM unless amended by change order. The CM shall submit to the Project Designer an electronic and paper copy of the final CPM schedule after contracts are executed but within fifteen (15) days prior to the written notice to proceed. The Project Designer after reviewing and commenting on the project CPM schedule shall submit it to the Owner for approval. No application for payment will be processed until the project CPM schedule is approved by the Owner. No monthly application for payment will be processed without the submission of an electronic and paper copy of the CPM schedule attached.
- f. The CPM schedule shall be a complete computer generated network analysis showing the complete sequence of construction activities, identifying the work of separate stages and other logically grouped activities, indicating early and late start and early and late finish dates, float duration and a complete logic. Monthly updates will show the estimated completion of each activity.
- g. The CM shall distribute to the principal trade and specialty contractors the approved project CPM schedule and shall display same at the job site.
- h. The CM shall maintain the project CPM schedule, making monthly adjustments, updates, corrections, etc., which are necessary to finish the project within the time allotted by the contract. In doing so, the CM shall keep the designer as well as all Principal Trade and Specialty Contractors fully informed as to all changes and updates to the schedule. The CM shall submit to the Project Designer a monthly report of the status of all work activities. The monthly status report shall show the actual work completed to date in comparison with the original amount of work scheduled. If the work is behind schedule, the CM must indicate in writing what measures are being taken to bring the work back on schedule and ensure that the contract completion date is not exceeded. If the work is greater than thirty (30) days behind schedule and no legitimate requests for time extensions are in process, then the CM shall prepare and submit to the Project Designer a recovery schedule for review and approval. Failure of the CM to abide by the directives in this paragraph will give the Owner cause to exercise the remedies set forth in Article 29 of the General Conditions and pursue any other legal remedies allowed it by law.

**ARTICLE 15 – {NOT USED}**

**ARTICLE 16 - PRINCIPAL TRADE AND SPECIALTY CONTRACTS AND CONTRACTORS**

- a. Principal Trade and Specialty Contractors shall be pre-qualified by the CM. The prequalification criteria shall be determined by the Owner and CM to address quality, performance, the time specified in the bids for performance of the contract, the cost of construction oversight, time for completion, capacity to perform, and any other factors deemed appropriate by the Owner and/or CM. Basic qualification information from Principal Trade and Specialty Contractors shall be requested on the standard State of North Carolina

Prequalification Form approved by the State Building Commission. Only pre-qualified contractors are allowed to bid to and contract with the CM on a project.

- b. All bids for Principal Trade and Specialty Contracts shall be publically advertised and shall be opened publically in a public venue, and once opened, shall be public records under N.C.G.S. 132. The CM shall award the contract to the lowest responsible, responsive bidder, taking into consideration quality, performance, the time specified in the bids for performance of the contract, the time for completion, compliance with N.C.G.S. 143-128.2, and other factors deemed appropriate by the Owner and advertised as part of the bid solicitation. When contracts are awarded pursuant to this section, the Owner shall provide for a dispute resolution procedure as provided by N.C.G.S. 143-128(f1). Once Principal Trade and Specialty Contractors are in place, the CM shall provide copies of the contracts to the Project Designer and also provide a list of equipment and material suppliers.
- c. A CM may perform a portion of the work only if (a) bidding produces no responsible, responsive bidder for that portion of the work, or (b) the lowest responsible, responsive bidder will not execute a contract for the bid portion of the work, or the Principal Trade or Specialty Contractor defaults and a prequalified replacement cannot be obtained in a timely manner, and (c) the Owner approves performance of the work by the CM.
- d. The Designer will furnish to any Principal Trade or Specialty Contractor, upon request, evidence regarding amounts of money paid to the CM on account of the work of the Principal Trade or Specialty Contractor.
- e. The CM is and remains fully responsible for his own acts or omissions as well as those of any Principal Trade or Specialty Contractor or of any employee of either. The CM agrees that no contractual relationship exists between the Principal Trade and Specialty Contractors and the Owner in regard to the contract, and that the Principal Trade and Specialty Contractors act on this work as an agent or employee of the CM.

## **ARTICLE 17 - CONSTRUCTION MANAGER AND SUBCONTRACTOR RELATIONSHIPS**

The CM agrees that the terms of these contract documents shall apply equally to each Principal Trade and Specialty Contractor as to the CM, and the CM agrees to take such action as may be necessary to bind each Principal Trade and Specialty Contractor to these terms. The CM further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to CM-subcontractor relationships, and that payments to Principal Trade and Specialty Contractors shall be made in accordance with the provisions of N.C.G.S. 143-134.1 titled "Interest on final payments due to prime contractors: payments to subcontractors".

- a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to N.C. G.S. 136-28.1, the balance due the CM shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the Owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the Owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the CM, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. Should final

payment to the CM beyond the date such contracts have been certified to be completed by the Project Designer, accepted by the Owner, or occupied by the Owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said CM shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due the CM during construction shall be paid in accordance with the payment provisions of the contract documents or said CM shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the Owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

- b. Within seven days of receipt by the CM of each periodic or final payment, the CM shall pay the Principal Trade and Specialty Contractors based on work completed or service provided under their contract with the CM. Should any periodic or final payment to a Principal Trade or Specialty Contractor be delayed by more than seven days after receipt of periodic or final payment by the CM, the CM shall pay the Principal Trade or Specialty Contractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.
- c. The percentage of retainage on payments made by the CM to the Principal Trade and Specialty Contractors shall not exceed the percentage of retainage on payments made by the Owner to the CM. Any percentage of retainage on payments made by the CM to the Principal Trade or Specialty Contractors that exceeds the percentage of retainage on payments made by the Owner to the CM shall be subject to interest to be paid by the CM to the Principal Trade or Specialty Contractor at the rate of one percent (1%) per month or fraction thereof.
- d. Nothing in this section shall prevent the CM at the time of application and certification to the Owner from withholding application and certification to the Owner for payment to a Principal Trade or Specialty Contractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of the Principal Trade or Specialty Contractor to make timely payments for labor, equipment and materials; damage to CM or another subcontractor; reasonable evidence that a Principal Trade or Specialty Contract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by Owner.

## **ARTICLE 18 - DESIGNER'S STATUS**

- a. The Project Designer shall provide liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the Owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to stop work or to order work removed, or to order corrections of faulty work where such action may be necessary to assure successful completion of the work.
- b. The Project Designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the Owner and the CM, taking sides with neither.

- c. Should the Project Designer cease to be employed on the work for any reason whatsoever, then the Owner shall employ a competent replacement who shall assume the status of the former Project Designer.
- d. The Project Designer will make periodic inspections of the project at intervals appropriate to the stage of construction. He will inspect the progress, the quality and the quantity of the work.
- e. The Project Designer and the Owner shall have access to the work whenever it is in preparation and progress during normal working hours. The CM shall provide facilities for such access so the Designer may perform his functions under the contract documents.
- f. Based on the Project Designer's inspections and evaluations of the project, the Project Designer shall issue interpretations, directives and decisions as may be necessary to assist the CM in the administration of the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract. The CM's decisions, however, relating to means and methods, and administration of the contracts the CM holds are final.

## **ARTICLE 19 - CHANGES IN THE WORK**

- a. The Owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the CM from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.
- b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved\_change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax or hand- delivered, may be used where the change involved impacts the critical path\_of the work. A formal change order shall be issued as expeditiously as possible.

The CM may be requested to make a change to the work by the Project Designer and Owner where such work is to be funded by the CM Contingency or Project Reserve that is part of the GMP contract. Such a change must be documented in the same manner as a Change Order and must be authorized in writing by the Project Designer and Owner by a Field Change document.

In the event of emergency endangering life or property, the CM may be directed to proceed on a time and material basis whereupon the CM shall proceed and keep accurately on such form as may be required, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

- c. In determining the values of changes, either additive or deductive, the CM and Principal Trade and Specialty Contractors are restricted to the use of the following methods:
  - 1. Where the extra work involved is covered by unit prices quoted in the proposal, the value of the change shall be computed by application of unit prices based on quantities,

estimated or actual as agreed of the items involved, except in such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.

2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.
- d. Under Paragraph "b" and Methods "c(2)" above, the allowances for overhead and profit combined for a Principal Trade or Specialty Contractor and all multi-tier subcontractors shall not exceed fifteen percent (15%) of **net cost** of the work. No allowance for overhead and profit will be allowed for the CM until the change orders aggregate to a sum in excess of five percent (5%) of the Cost of the Work portion of the GMP. Once this threshold is met the CM may add an overhead & profit allowance not to exceed four percent (4%) of the net cost of the change order. Change orders to the GMP which authorize additional phases of a project without a change in scope of the originally intended project will not be considered in establishing the threshold for additional CM overhead & profit. Under Method "c (1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.
- e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:
  1. The actual costs of materials and supplies incorporated or consumed as part of the project;
  2. The actual costs of labor expended on the project site;
  3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker's compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;
  4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the project;
  5. The actual costs of premiums for bonds, insurance, permit fees and sales or use taxes related to the project.

Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the Owner.

- f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods.

All change orders shall be supported by a breakdown showing method of arriving at net cost as defined above.

- g. In all change orders, the procedure will be for the Project Designer to request proposals for the change order work in writing. The CM will require the Principal Trade and Specialty Contractors to provide such proposals and supporting data in suitable format and will review and approve such change orders prior to submission to the designer. The Project Designer shall verify correctness. Within fourteen (14) days after receipt of the CM's proposal, the Project Designer shall prepare the change order and forward to the CM for his signature or otherwise respond, in writing, to the CM's proposal. Within seven (7) days after receipt of the change order executed by the CM, the Project Designer shall, certify the change order by his signature, and forward the change order and all supporting data to the Owner for the Owner's signature. The Owner shall execute the change order and forward to the State Construction Office for final approval, within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. Upon approval by the State Construction Office, one copy remains with the State Construction Office, and the remaining copies are sent to the Project Designer for distribution to the Owner(s), CM and the surety. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.
- h. At the time of signing a change order, the CM shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety."
- i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.
- j. If, during the progress of the work, the Owner requests a change order and the CM's terms are unacceptable, the Owner, with the approval of the State Construction Office, may require the CM to perform such work on a time and material basis in accordance with paragraph "b" above. Without prejudice, nothing in this paragraph shall preclude the Owner from performing or to have performed that portion of the work requested in the change order.

## **ARTICLE 20 - CLAIMS FOR EXTRA COST**

- a. Should the CM consider that as a result of any instructions given in any form by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The CM shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation will be considered unless the claim is so made. The Designer shall render a written decision within seven (7) days of receipt of claim.
- b. The CM shall not act on instructions received by him from persons other than the Project Designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The Project Designer will not be responsible for misunderstandings claimed by the CM of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the

contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.

- c. Should a claim for extra compensation that complies with the requirements of (a) above by the CM be denied by the Project Designer or Owner, and cannot be resolved by a representative of the State Construction Office, the CM may request a mediation in connection with N.C.G.S. 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the CM is unable to resolve its claims as a result of mediation, then the CM may pursue his claim in accordance with the provisions of N.C.G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner, and the following:
  1. A CM who has not completed a contract with a state agency or institution for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the CM claims is due. The Director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under N.C.G.S. Chapter 150B.
  2. (a) A CM who has completed a contract with a State agency or institution for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the Director of the State Construction Office of the Department of Administration for the amount the CM claims is due. The claim shall be submitted within sixty (60) days after the CM receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.
    - (b) The Director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the Director and the CM agree. The CM may appear before the Director, either in person or through counsel, to present facts and arguments in support of his claim. The Director may allow, deny or compromise the claim, in whole or in part. The Director shall give the CM a written statement of the Director's decision on the CM's claim.
    - (c) A CM who is dissatisfied with the Director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the Director's written statement of the decision.
    - (d) As to any portion of a claim that is denied by the Director, the CM may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the Director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

## **ARTICLE 21 - MINOR CHANGES IN THE WORK**

The Project Designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the Owner and the CM.

## **ARTICLE 22 - UNCORRECTED FAULTY WORK**

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the Owner and the Project Designer, the Owner shall be reimbursed by the CM. A change order will be issued to reflect a reduction in the contract sum.

## **ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME**

- a. The final completion date will be as determined by the Owner, Designer and CM during the pre-construction phase of the project and will be incorporated into the contract for construction services between the Owner and the CM.
- b. The CM shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the Project Designer and shall fully complete all work hereunder within the time of completion specified. For each day in excess of the above number of days, the CM shall pay the Owner the sum stated as liquidated damages reasonably estimated in advance to cover the loses to be incurred by the Owner by reason of failure of the CM to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof. Should the work be delayed by both the owner and contractor, liquidated damages shall be apportioned to reflect the delays of each party. In the case of concurrent delays, contractor caused delays shall be accounted for before owner and designer caused delays.
- c. If the CM is delayed at any time in the progress of his work by any act or negligence of the Owner or the Project Designer, or by any employee of either; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and Owner determine may justify the delay, then the contract time may be extended by change order for the time which the designer and Owner may determine is reasonable.

Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the CM reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

- d. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the CM shall notify the designer copies to the owner and SCO, of the delay within twenty (20) days of the beginning of the delay and only one claim is necessary.
- e. The CM shall notify his surety in writing of extension of time granted.
- f. No claim shall be allowed on account of failure of the Project Designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

#### **ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY**

- a. The Owner may desire to occupy or utilize all or a portion of the project when the work is substantially complete.
- b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office, in such areas the following will be established:
  - 1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.
  - 2. The owner assumes all responsibilities for utility costs for entire building.
  - 3. Contractor will obtain consent of surety.
  - 4. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.
- c. The Owner shall have the right to exclude the CM from any part of the project which the Project Designer has so certified to be substantially complete, but the Owner will allow the CM reasonable access to complete or correct work to bring it into compliance with the contract.
- d. Occupancy by the Owner under this article will in no way relieve the CM from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

#### **ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT**

- a. Upon notification from the CM that the project is complete and ready for inspection, the Project Designer shall make a designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the CM shall ensure that all items requiring corrective measures noted at the designer final inspection are complete.

The Project Designer shall schedule an SCO final inspection at a time and date acceptable to the Owner, the CM and the State Construction Office.

- b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make the following determinations:
  - 1. That the project is completed and accepted.
  - 2. That the project is accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the Owner may invoke Article 28, Owner's Right to Do Work.
  - 3. That the project is not complete and another date for a final inspection will be established.
- c. Within fourteen (14) days of acceptance per Paragraph c1 or within fourteen (14) days after completion of punch list per Paragraph c2 above, the Project Designer shall certify the work and issue applicable certificate(s) of compliance.
- d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs c1 or c2 above shall be handled in accordance with Article 42.
- e. The date of acceptance will establish the following:
  - 1. The beginning of guarantees and warranties period.
  - 2. The date on which the CM's insurance coverage for public liability, property damage and builder's risk may be terminated.
  - 3. That no liquidated damages (if applicable) shall be assessed after this date.
  - 4. The termination date of utility cost to the CM (if applicable).
- f. **Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of all equipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.**

#### **ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT**

- a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the CM, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the Owner. Work or property of the Owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the CM.
- b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the Project Designer, and shall make satisfactory progress until completed.

- c. Should the CM fail to proceed with the required corrections, then the Owner may complete the work in accordance with the provisions of Article 28.

#### **ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT**

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee. Neither the final certificate, final payment, occupancy of the premises by the Owner, nor any provision of the contract, nor any other act or instrument of the Owner, nor the Project Designer, shall relieve the CM from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. The CM shall correct or make good any defects due thereto and repair any damage resulting therefrom, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The Owner will report any defects as they may appear to the CM and establish a time limit for completion of corrections by the CM. The Owner will be the judge as to the responsibility for correction of defects.

#### **ARTICLE 28 - OWNER'S RIGHT TO DO WORK**

If, during the progress of the work or during the period of guarantee, the CM fails to prosecute the work properly or to perform any provision of the contract, the Owner, after seven (7) days written notice sent by certified mail, return receipt requested, to the CM from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the CM, such action and cost of same having been first approved by the Project Designer. Should the cost of such action of the Owner exceed the amount due or to become due the CM, then the CM or his surety, or both, shall be liable for and shall pay to the Owner the amount of said excess.

#### **ARTICLE 29 - ANNULMENT OF CONTRACT**

If the CM fails to begin the work under the contract within the time specified or fails to establish a GMP or obtain bids from or enter into contracts with qualified Principal Trade or Specialty Contractors within the GMP, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the CM shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the Owner may give notice in writing, sent by certified mail, return receipt requested, to the CM and his surety of such delay, neglect or default, specifying the same, and if the CM within a period of seven(7) days after such notice shall not proceed in accordance therewith, then the Owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven(7) days after being so notified and notify the Owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the Owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said CM, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the Owner, together with the costs of completing the

work under contract, shall be deducted from any monies due or which may become due said CM and surety. In case the expense so incurred by the Owner shall be less than the sum which would have been payable under the contract, if it had been completed by said CM, then the said CM and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the CM and the surety shall be liable and shall pay to the Owner the amount of said excess.

### **ARTICLE 30 – CONSTRUCTION MANAGER’S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT**

- a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the CM, or if the Owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the CM, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the Owner and the designer, may suspend operations on the work or terminate the contract.
- b. The Owner shall be liable to the CM for the cost of all materials delivered and work performed on this contract plus ten (10) percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

### **ARTICLE 31 - REQUEST FOR PAYMENT**

- a. Not later than the fifth day of the month, the CM shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the CM and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:
  1. Total of contract including change orders.
  2. Value of work completed to date.
  3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the CM's work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.
  4. Less previous payments.
  5. Current amount due.
- b. Prior to submitting the first payment request, the CM shall prepare a schedule showing a breakdown of the contract price into values of the various parts of the GMP contract. The Cost of the Work breakdown will be arranged so as to facilitate payments to the Principal Trade and Specialty Contractors in accordance with Article 17. The combined CM Construction Management Fee, Bonds & Insurance, CM Contingency, and Project Reserve (if any) will be shown on the Schedule of values as separate lines. The values for the CM Contingency and Project Reserve (if any) will move to appropriate lines within the Cost of the Work as those funds are committed and expended. This schedule of values will be submitted to & approved by the designer and Owner within 30 days of the Notice to Proceed.

The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the designer and Owner may require.

- c. Applications for payment shall be in a form agreed upon by the CM, designer and Owner and shall be prepared and supported by such data to substantiate the accuracy of the request as the designer may require.
- d. Subject to other provisions of the contract documents, the amount of each progress payment shall be computed as follows:
  1. Take that portion of the GMP properly allocable to completed work as determined by multiplying the percentage completion of each portion Cost of the Work by the share of the GMP allocated to that portion of the work in the schedule of values.
  2. Add that portion of the GMP properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the work or if approved in advance by the Owner, suitably stored off site at a location agreed upon in writing.
  3. Subtract the aggregate of previous payments made by the Owner.
  4. Subtract the amount, in any, by which the CM has been previously overpaid, as evidenced by the Owner's review of the CM's documentation.
  5. Subtract amounts, if any, for which the Project Designer has withheld or nullified a certificate of payment.
  6. Subtract retainage as per paragraph (h) below.
  7. Add the amount due for the CM Construction Management Fee calculated on the basis of the percentage completion of the project or on a schedule of payment negotiated with the Owner less fifteen percent (15%) and less previous payments for CM Construction Management Fee.
- e. Payment allocated to Principal Trade and Specialty Contractors shall be subject to five percent (5%) retainage, provided, however that after fifty percent (50%) of the Cost of the Work has been satisfactorily completed on schedule, with the approval of the Owner and the State Construction Office and with written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule. The balance of the CM Construction Management Fee shall be held by the Owner until satisfactory completion and close out of the project. Satisfactory completion and close out of the project means that the Owner and Project Designer are satisfied that the project has been completed in accordance with the plans and specifications and within the GMP, all general conditions of the contract pertaining to close out have been satisfied, and all Principal Trade and Specialty Contractors have satisfactorily completed their respective contracts. No retainage will be held for the cost of Bonds and Insurance
- f. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the CM regardless

of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the CM, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the CM desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the CM's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the CM. Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the CM.

- g. In the event of beneficial occupancy, retainage of funds due the CM may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the CM's bonding company.

## **ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT**

- a. Within five (5) days from receipt of request for payment from the CM, the designer shall issue and forward to the Owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the CM and the Owner his reasons for withholding payment.
- b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the Owner except:
  - 1. Claims arising from unsettled liens or claims against the CM.
  - 2. Faulty work or materials appearing after final payment.
  - 3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.
  - 4. As conditioned in the performance bond and payment bond.
- c. The making and acceptance of final payment shall constitute a waiver of all claims by the CM except those claims previously made and remaining unsettled (Article 20(c)).
- d. Prior to submitting request for final payment to the designer for approval, the CM shall fully comply with all requirements specified in the "project closeout" section of the specifications. These requirements include but not limited to the following:
  - 1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval

from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the Owner).

2. Transfer of required attic stock material and all keys in an organized manner.
  3. Record of Owner's training.
  4. Resolution of any final inspection discrepancies.
  5. Granting access to Contractor's records, if Owner's internal auditors have made a request for such access pursuant to Article 52.
- e. The CM shall forward to the designer, the final application for payment along with the following documents:
1. List of minority business subcontractors and material suppliers showing breakdown of contracts amounts and total actual payments to subcontractors and material suppliers.
  2. Affidavit of Release of Liens.
  3. Affidavit from CM of payment to material suppliers and subcontractors. (See Article 36).
  4. Consent of Surety to Final Payment.
  5. Certificates of state agencies required by state law.
- f. The designer will not authorize final payment until the work under contract has been certified by Project Designer, certificates of compliance issued, and the CM has complied with the closeout requirements. The designer shall forward the CM's final application for payment to the Owner along with respective certificate(s) of compliance required by law.

### **ARTICLE 33 - PAYMENTS WITHHELD**

- a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:
1. Faulty work not corrected.
  2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.
  3. To provide for sufficient contract balance to cover liquidated damages that will be assessed against the CM.
- b. The Secretary of the Department of Administration may authorize the withholding of payment for the following reasons:
1. Claims filed against the CM or evidence that a claim will be filed.
  2. Evidence that Principal Trade or Specialty Contractors have not been paid.

- c. The Owner may withhold all or a portion of CM's Project Management Fee costs set forth in the approved schedule of values, if CM has failed to comply with: (1) a request to access its records by Owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time.
- d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the CM without cause will make owner liable for payment of interest to the CM in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

**ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS**

The work under this contract shall not commence until the CM has verified to the Owner that all required insurance and verifying certificates of insurance have been obtained and approved in writing by the Owner. These certificates shall contain a provision that coverage's afforded under the policies will not be cancelled, reduced in amount or coverage's eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the Owner of such alteration or cancellation.

**a. Worker's Compensation and Employer's Liability**

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall provide and maintain, during the life of the contract, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of \$100,000.

**b. Public Liability and Property Damage**

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall provide and maintain, during the life of the contract, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury:	\$500,000 per occurrence
Property Damage:	\$100,000 per occurrence / \$300,000 aggregate

In lieu of limits listed above, a \$500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

**c. Property Insurance (Builder's Risk/Installation Floater)**

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall purchase and maintain property insurance during the life of this contract, upon the entire work at the

site to the full insurable value thereof. This insurance shall include the interests of the Owner, the CM, and subcontractors in the work and shall insure against the perils of fire, extended coverage, and vandalism and malicious mischief. If the Owner is damaged by failure of the CM to purchase or maintain such insurance, then the CM shall bear all reasonable costs properly attributable thereto; the CM shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

**d. Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the CM and/or the Principal Trade or Specialty Contractor as applicable.

**e. Other Insurance**

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall obtain such additional insurance as may be required by the Owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

**f. Proof of Carriage**

The CM shall ensure that it and all Principal Trade and Specialty Contractors shall furnish the Owner with satisfactory proof of carriage of the insurance required before written approval is granted by the Owner.

## **ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND**

- a. The CM shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount, which shall be in the amount of the GMP for the entire project. Bonds shall be executed in the form bound with the specifications
- b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

## **ARTICLE 36 - CONTRACTOR'S AFFIDAVIT**

The final payment of retained amount due the CM on account of the contract shall not become due until the CM has furnished to the Owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work to Principal Trade and Specialty Contractors in connection with his contract have been satisfied, and that no claims or liens exist against the CM in connection with this contract. In the event that the CM cannot obtain similar affidavits from the Principal Trade and Specialty Contractors to protect the CM and the Owner from possible liens or claims against the subcontractor, the CM shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the CM's) knowledge, and if any appear afterward, the CM shall save the Owner harmless.

## **ARTICLE 37 - ASSIGNMENTS**

The CM shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the CM under the contract may be assigned.

### **ARTICLE 38 - USE OF PREMISES**

- a. The CM shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and shall not exceed those established limits in his operations.
- b. The CM shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
- c. The CM shall enforce the designer's and owner's instructions regarding signs, advertisements, fires and smoking.
- d. No firearms, any type of alcoholic beverages or drugs (other than those prescribed by a physician) will be permitted at the job site.

### **ARTICLE 39 - CUTTING, PATCHING AND DIGGING**

- a. The CM shall ensure that all cutting, fitting or patching that may be required to make the work come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.
- b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.
- c. No Principal Trade or Specialty Contractor shall endanger any work of another such contractor by cutting, digging or other means, nor shall he cut or alter the work of any other such contractor without the consent of the designer and the affected contractor(s).

### **ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS**

- a. The CM shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer, and other utility services, which may be necessary and required for completion of the project. If the Owner specifies that the CM is to pay all utilities, any permanent meters installed shall be listed in the CM's name until his work is fully accepted by the Owner. As stipulated in the Supplementary General Conditions, the Owner may: (1) pay utilities cost directly, (2) require the CM to pay all utilities cost, (3) or reimburse the CM for the actual cost of utilities. The Owner or CM, as applicable, may recover actual costs of metered utilities from the responsible party should delays occur in project completion. Coordination of the work of the utility companies during construction is the sole responsibility of the CM.
- b. If applicable Meters shall be relisted in the Owner's name on the day following completion and acceptance of the CM's work, and the Owner shall pay for services used after that date.
- c. Prior to the operation of permanent systems, the CM will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.
- d. The CM shall ensure that the permanent building systems are in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows, doorways (exterior, mechanical, and

electrical equipment rooms), and hardware are installed; and other openings have protection, which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the CM and the designer. Use of the equipment in this manner shall in no way affect the warranty requirements of the CM.

- e. The CM shall coordinate the work so that the building's permanent power wiring distribution system shall be in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.
- f. The CM shall coordinate the work so that the building's permanent lighting system shall be ready at the time interior painting and finishing begins and shall provide adequate lighting in those areas where interior painting and finishing is being performed.
- g. The CM shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:
  - 1. Prior to acceptance of work by the State Construction Office, the CM shall coordinate the removal and replacement of any parts of the permanent building systems damaged through use during construction.
  - 2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the Owner's acceptance of the work.
  - 3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.
  - 4. It shall be understood that any warranty on equipment presented to the Owner shall extend from the day of final acceptance by the Owner. The cost of warranting the equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.
  - 5. The CM shall ensure that all lamps are in proper working condition at the time of final project acceptance.
- h. The CM shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.
- i. The CM shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.
- j. On multi-story construction projects, the CM shall either provide or ensure that temporary elevators, lifts, or other necessary special equipment is available for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall either be included in the CM Construction Management Fee or specified as part of the work of a Principal Trade or Specialty Contractor and paid for as a part of the Cost of the Work.

- k. The CM will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the CM's name, and the name of the designer and consultants. Directional signs may be erected on the Owner's property subject to approval of the Owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the Owner.

#### **ARTICLE 41 - CLEANING UP**

- a. The CM shall ensure that the building and surrounding area is reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer. The CM shall provide an on-site refuse container(s) for the use of all Principal Trade and Specialty Contractors. The CM shall ensure that each Principal Trade and Specialty Contractor removes their rubbish and debris from the building on a daily basis. The CM shall ensure that the building is broom cleaned as required to minimize dust and dirt accumulation.
- b. The CM shall provide and maintain suitable all-weather access to the building.
- c. Before final inspection and acceptance of the building, the CM shall ensure that all portions of the work are clean, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the Owner, with no cleaning required by the Owner.

#### **ARTICLE 42 - GUARANTEE**

- a. The CM shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the Owner.
- b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The CM shall replace such defective equipment or materials, without cost to the Owner, within the manufacturer's warranty period.
- c. Additionally, the Owner may bring an action for latent defects caused by the negligence of the CM, which is hidden or not readily apparent to the Owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.
- d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

#### **ARTICLE 43 - CODES AND STANDARDS**

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina State Building Codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

## ARTICLE 44 - INDEMNIFICATION

To the fullest extent permitted by law, the CM shall indemnify and hold harmless the Owner, the designer and the agents, consultants and employees of the Owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom, and (2) is caused in whole or in part by any negligent act or omission of the CM, the CM's subcontractor, or the agents of either the CM or the CM's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

## ARTICLE 45 - TAXES

- a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).
- b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).
- c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.
- d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal from Principal Trade and specialty Contractors and contract sum.
- e. Accounting Procedures for Refund of County Sales & Use Tax

Amount of county sales and use tax paid per CM's statements:

CM's performing contracts for state agencies shall ensure that the Principal Trade and Specialty Contractors provide information to allow the CM to give the state agency for whose project the materials, supplies, fixtures and/or equipment was purchased a signed statement containing the information listed in N.C.G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement from the contractors setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the CM.

Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

#### **ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE**

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the Secretary of Labor, are incorporated herein.

#### **ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES**

The CM agrees not to discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant is qualified. The CM agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices.

#### **ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)**

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard. Construction Managers are reminded of the requirements of instructions under General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

#### **ARTICLE 49 - MINORITY BUSINESS PARTICIPATION**

N.C.G.S. 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project and requires documentation of good faith efforts for meeting that goal. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix F are hereby incorporated into and made a part of this contract.

The CM shall identify and define contract packages (the value of which shall total to at least ten percent (10%) of the GMP) that remove barriers to participation commonly experienced by Historically Underutilized Businesses and Minority Business Enterprises as those terms are defined in North Carolina General Statute 143-128.2, hereinafter referred to as Reduced Barrier Packages (RBP). Such contract packages will be submitted to the Owner for review. As an example, RBP's may require no performance or payment bond, or may offer the participation of the CM as a guarantor or surety in the financing of material purchases by the Principal Trade and/or Specialty Contractors, provided that the CM may condition such financing participation upon the

issuance of joint checks or other similar arrangements to allow the CM to verify that timely payments are made to suppliers furnishing credit. The CM may propose other and/or additional provisions for reducing barriers to participation.

The Owner shall require the CM to submit a plan for compliance with N.C.G.S.143-128.2 by approval by the Owner prior to soliciting bids for the Principal Trade and Specialty Contracts. The CM and Principal Trade and Specialty Contractors shall make a good faith effort to recruit and select minority businesses for participation in contracts pursuant to N.C.G.S. 143-128.2.

## **ARTICLE 50 – CONTRACTOR EVALUATION**

The CM's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to compete for future capital improvement projects for institutions and agencies of the State of North Carolina. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Construction Manager Evaluation Procedures, is hereby incorporated and made a part of this contract. The Owner may request the CM's comments to evaluate the designer.

## **ARTICLE 51 – GIFTS**

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor ( i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

## **ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS**

In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost

escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

## **ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT**

The North Carolina False Claims Act (“NCFCA”), N.C Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment its submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA “is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim.” (Section 1-605(b).) A contractor’s liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for loss productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

- A “claim” is “[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that (i) is presented to an officer, employee, or agent of the State or (ii) is made to a contractor ... if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor ... for any portion of the money or property which is requested or demanded.” (Section 1-606(2).)
- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)
- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)
- Liability. – “Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] ... (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or

approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) ...” (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General’s Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General’s investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

#### **ARTICLE 54 – TERMINATION FOR CONVENIENCE**

- a. Owner may at any time and for any reason terminate CM’s services and work at Owner's convenience. Upon receipt of such notice, CM shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.
- b. Upon such termination, CM shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by CM as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to CM prior to the date of the termination of this Agreement. CM shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

## SECTION 010001

### SUPPLEMENTARY GENERAL CONDITIONS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Work Results:
- B. Principal Products:

##### 1.2 REQUIREMENTS

- A. The following items are intended to modify the Second Edition January 2013 of Form OC-15CM "STANDARD FORM FOR CONSTRUCTION MANAGER-AT-RISK PROJECTS".
- B. Where items of this section conflict with or are at variance with those of the General Conditions, they shall take precedence over the General Conditions and modify such requirements to the extent of such conflict or variation.

##### 1.3 SUMMARY

- A. These Supplementary General Conditions amend and supplement the Second Edition January 2013, of Form OC-15CM "STANDARD FORM FOR CONSTRUCTION MANAGER-AT-RISK PROJECTS" and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary General Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

##### 1.4 MODIFICATIONS TO GENERAL CONDITIONS

- A. Modifications to Article 1 - Definitions:
  - 1. Modify Paragraph b as follows: The Owner referred to is North Carolina Department of Agriculture and Consumer Services.
  - 2. Modify Paragraph c as follows: The Designer referred to is HH Architecture located in Raleigh, North Carolina. Where the terms Engineer, Architect, or Architect-Engineer are used in the technical specifications, they shall mean Designer.
- B. Modifications to Article 34 - Minimum Insurance Requirements:
  - 1. Revise the second sentence of Paragraph c to read as follows: "This insurance shall include the interests of the Owner, the CM, and subcontractors in the work and shall insure against the perils of fire, extended coverage, and vandalism and malicious mischief and shall insure against risk of direct physical loss - (all perils)".

- C. Modifications to Article 40 - Utilities, Structures, Signs:
  - 1. Paragraph a is clarified as follows: The CM shall pay all utilities up to the day following completion and acceptance of the CM's work. In the case of Beneficial Occupancy, the cost of utilities after the date of Beneficial Occupancy will be based on a mutually agreed upon percentage of the cost of utilities provided to the owner accepted areas.
  - 2. Add the following Paragraph l: The Contractor is responsible for all utility, structure, and sign requirements and costs as specified in section 015000 - Temporary Facilities and Controls.
  
- D. Modifications to Article 23 - Time of Completion, Delays, Extension of Time:
  - 1. Add the following sub-paragraph to paragraph b.:
    - a. The Contractor shall commence work to be performed under this agreement on a date to be specified in a written order form from the designer and shall fully complete all work within 418 consecutive calendar days from the building notice to proceed date. For each day in excess of the above number of days, the contractor(s) shall pay the Owner liquidated damages in the amount of twenty-five hundred dollars (\$2,500.00) per consecutive calendar day.
  
- E. Modifications to Article 42 - Guarantee.
  - 1. Add the following new paragraph e.:
  - 2. Where specifications reference commencement of guarantees and warranties at the "Substantial Completion" date, this shall begin instead at the "Final Acceptance" date in accordance with Article 25 of the General Conditions. In the event of partial utilization of the project by the Owner for Beneficial Occupancy, the commencement of guarantees and warranties for equipment under Article 24, paragraph b. 1 of the General Conditions shall begin at the date of acceptance for Beneficial Occupancy.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**

## SECTION 011000

### SUMMARY

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Access to site.
  - 4. Work restrictions.
  - 5. Specification and Drawing conventions.
- B. Related Requirements:
  - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

##### 1.3 PROJECT INFORMATION

- A. Project Identification: NC State Fairgrounds Midway Event Center.
  - 1. Project Location: 4285 TRINITY RD, RALEIGH, NC 27607.
- B. Owner: North Carolina Department of Agriculture and Consumer Services.
  - 1. Owner's Representative: Andrew Meier, (919) 707-3238, NC Department of Agriculture and Consumer Services, Property and Construction Division.
- C. Architect of Record: HH Architecture, 1100 Dresser Court, Raleigh, NC 27609, phone: 919-828-2301.
- D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
  - 1. Plumbing, Mechanical, and Electrical Engineer: Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605.
  - 2. Civil Engineer: Dewberry, 2610 Wycliff Road, Ste 410, Raleigh, NC 27607.
  - 3. Structural Engineer: Lynch Mykins, 301 N West St #105, Raleigh, NC 27603.

##### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. The Work of Project: New 30,000 SF building consisting of a multi-vendor food hall and multi-purpose assembly space to support year-round dining and events at the North Carolina State Fairgrounds. New building is a 2-story steel framed structure.
- B. Type of Contract:
  - 1. Project will be constructed under a single prime Construction Manager at Risk contract in accordance with the State of North Carolina's requirements.

#### 1.5 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operations to Area of Disturbance as defined on drawings.
  - 2. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.

#### 1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 6:00 p.m., Monday through Friday, unless otherwise indicated.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner (NC Department of Agriculture and Consumer Services) or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated: Coordinate disruption with owner.
  - 1. Coordinate disruptive actions with Owner.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy (NC Department of Agriculture and Consumer Services) with Owner.
  - 1. Coordinate disruptive actions with owner.
- E. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on

Project site. Require personnel to use identification tags at all times.

## 1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
  - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



## **SECTION 012100**

### **ALLOWANCES**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Work Results:
- B. Principal Products:
- C. Section includes administrative and procedural requirements governing allowances.
- D. Types of allowances include the following:
  - 1. Quantity allowances.
- E. Related Requirements:
  - 1. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

##### **1.2 ACTION SUBMITTALS**

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Field Orders.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Submit quantity verification and documentation from Testing Agency, invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

##### **1.4 COORDINATION**

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

##### **1.5 QUANTITY ALLOWANCES**

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Designer under allowance and shall include labor, material, taxes, freight, and delivery to Project site.

## 1.6 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Field Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. All unused allowances will be credited to the Owner at the end of the project.
  - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
  - 2. Submit substantiation of a change in scope of work, if any, claimed in Field Orders related to unit-cost allowances.
  - 3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
  
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
  - 1. Do not include Contractor's or subcontractor's indirect expense in the Field Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.
  - 3. No change in unit is permitted for over-run or under-run of allowance bid items.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Removal of unsuitable soils at building undercut, disposal offsite and replacement with satisfactory soil material.
  - 1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
  - 2. This allowance includes material cost receiving, handling, and installation and Contractor

- overhead and profit.
3. Changes to Contract Price shall be made per the Unit Prices contained in the Form of Proposal.
  4. Allowance Quantity: 100 cubic yards.

**END OF SECTION**



## **SECTION 012200**

### **UNIT PRICES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Work Results:
- B. Principal Products:
- C. Section includes administrative and procedural requirements for unit prices.
- D. RELATED REQUIREMENTS:
  - 1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
  - 2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
  - 3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

##### **1.3 DEFINITIONS**

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

##### **1.4 PROCEDURES**

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use

of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 SCHEDULE OF UNIT PRICES

- A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material at building undercut. As referenced in Section 012100 "Allowances", Part 3.3.
1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, in accordance with Section 312000 "Earth Moving."
  2. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
  3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

## END OF SECTION

## SECTION 012500

### SUBSTITUTION PROCEDURES

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

##### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

##### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use standard CSI substitution request form.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section.

Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor through Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## 1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



## SECTION 012600

### CONTRACT MODIFICATION PROCEDURES

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

##### 1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue through Construction Manager supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

##### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Construction Manager will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Construction Manager are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish

- times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- e. Quotation Form: Use forms provided by Owner.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Construction Manager.
- 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  - 7. Proposal Request Form: Use form provided by Owner.

#### 1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

#### 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, Architect will upload onto the State Construction "Interscope" system for approval by Contractor, Owner and State Construction Office.

#### 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Construction Manager may issue a Construction Change Directive on form included in Project Manual. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



# State Construction Office

Field Order # \_\_\_\_\_

Project: \_\_\_\_\_ Location: \_\_\_\_\_ Project ID: \_\_\_\_\_

Description of Change: \_\_\_\_\_

Justification of Change: \_\_\_\_\_

**CONTRACTOR:**

A total cost change not to exceed a lump sum cost is \$ \_\_\_\_\_ or a unit cost of \_\_\_\_\_ extended using estimated quantities to not exceed is \$ \_\_\_\_\_. The contractor will need a maximum number of \_\_\_\_\_ days time extension to the contract. The actual cost, not to exceed stated cost, shall be based on a realistic estimate based on current acceptable market values submitted with change order for approval by designer, owner, and State Construction Office.

**DESIGNER:**

The quoted price and need for the change are in the best interests of the owner to have the work accomplished. A formal change order will be prepared for contractor's signature within seven (7) days.

**OWNING AGENCY:**

The owning agency agrees to the change as being in the owner's best interest. Adequate funds are available to pay the cost for the change.

**STATE CONSTRUCTION OFFICE:**

The State Construction Office approves the request for the change.

**SIGNATURES:**

\_\_\_\_\_  
Contractor:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Designer:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
Owning Agency:

\_\_\_\_\_  
Date:

\_\_\_\_\_  
State Construction Office:

\_\_\_\_\_  
Date:





HH ARCHITECTURE

## Request for Proposal

Project: **NCDA&CS NC State Fairgrounds Midway Event Center** Proposal Request #:  
HH # 23-013  
SCO # 22-25408-02

Owner: N.C. Department of Agriculture & Consumer Services Date of Issuance:

To:

Contract For:

Contract Dated:

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Submit proposal within 7 days or notify the Architect in writing of the date on which you anticipate submitting your proposal.

**THIS IS NOT A CHANGE ORDER, CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.**

**Description:**

**All changes in specified items must be submitted to the designer for review and approval.**

Attachments:

Requested By:





HH ARCHITECTURE

## Construction Change Directive

Project: **NC State Fairgrounds Midway Event Center**  
Owner: N.C. Department of Agriculture & Consumer Services

HH # 23-013

Date of Issuance:

SCO # 22-25408-02

To:

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Submit a change order request upon completion of the work indicating actual cost of the work described in the directive.

**Description:**

Provide

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**Attachments:**

None

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Requested By:



## **SECTION 012900**

### **PAYMENT PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

##### **1.3 DEFINITIONS**

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

##### **1.4 SCHEDULE OF VALUES**

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect through Construction Manager at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.
  - 4. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
  - 5. Subschedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment

requests, provide subschedules showing values coordinated with the scope of each design services contract, as described in Section 011000 "Summary."

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  2. Arrange schedule of values consistent with format of AIA Document G703.
  3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that affect value.
    - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
      - 1) Labor.
      - 2) Materials.
      - 3) Equipment.
  4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site.
  6. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  7. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
  8. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
  9. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
  10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
  11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G732 and AIA Document G703 as form for Applications for Payment.
  - 1. Other Application for Payment forms proposed by the Contractor shall be acceptable to Construction Manager and Owner. Submit forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  - 3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
  4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  5. Products list (preliminary if not final).
  6. Sustainable design action plans, including preliminary project materials cost data.
  7. Schedule of unit prices.
  8. Submittal schedule (preliminary if not final).
  9. List of Contractor's staff assignments.
  10. List of Contractor's principal consultants.
  11. Copies of building permits.
  12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  13. Initial progress report.
  14. Report of preconstruction conference.
  15. Certificates of insurance and insurance policies.
  16. Performance and payment bonds.
  17. Data needed to acquire Owner's insurance.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706.
  5. AIA Document G706A.
  6. AIA Document G707.
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Final Acceptance or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



## SECTION 013100

### PROJECT MANAGEMENT AND COORDINATION

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 5. Web-based Project management software package.
  - 6. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

##### 1.3 DEFINITIONS

- A. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 14 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and in prominent location in built facility. Keep list current at all times.

## 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its own operations with operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.

8. Startup and adjustment of systems.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
  1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.

6. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor-control center locations.
  - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
8. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

#### 1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.
  1. Attachments shall be electronic files in PDF format.

- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
  3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project software.
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
  8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

## 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
  2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.

- a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.
  4. The following digital data files will be furnished for each appropriate discipline:
    - a. Floor plans.
    - b. Reflected ceiling plans.
- B. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.
  1. Web-based Project management software includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.
    - l. Mobile device compatibility, including smartphones and tablets.
  2. Provide up to seven Project management software user licenses for use of Owner, Architect, and Architect's consultants.
  3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
  4. HYPERLINK "<http://www.specagent.com/Lookup?ulid=13860>"Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Corecon Technologies, Inc.
    - b. Newforma, Inc.
    - c. Procore Technologies, Inc.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
  1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
  3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.9 PROJECT MEETINGS

- A. General: Architect to schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Architect to inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
  - 2. Agenda: Architect to prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
  
- B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
  - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Responsibilities and personnel assignments.
    - b. Tentative construction schedule.
    - c. Phasing.
    - d. Critical work sequencing and long lead items.
    - e. Designation of key personnel and their duties.
    - f. Lines of communications.
    - g. Procedures for processing field decisions and Change Orders.
    - h. Procedures for RFIs.
    - i. Procedures for testing and inspecting.
    - j. Procedures for processing Applications for Payment.
    - k. Submittal procedures.
    - l. Preparation of Record Documents.
    - m. Use of the premises and existing building.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Procedures for disruptions and shutdowns.
    - t. Construction waste management and recycling.
    - u. Parking availability.
    - v. Office, work, and storage areas.
    - w. Equipment deliveries and priorities.
    - x. First aid.
    - y. Security.
    - z. Progress cleaning.
  - 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.
  - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Final Acceptance.
  - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of Record Documents.
    - b. Procedures required prior to inspection for Final Acceptance and for final inspection for acceptance.
    - c. Procedures for completing and archiving web-based Project software site data files.
    - d. Submittal of written warranties.
    - e. Requirements for completing sustainable design documentation.
    - f. Requirements for preparing operations and maintenance data.
    - g. Requirements for delivery of material samples, attic stock, and spare parts.
    - h. Requirements for demonstration and training.
    - i. Preparation of Contractor's punch list.
    - j. Procedures for processing Applications for Payment at Final Acceptance and for final payment.
    - k. Submittal procedures.
    - l. Owner's partial occupancy requirements.
    - m. Installation of Owner's furniture, fixtures, and equipment.
    - n. Responsibility for removing temporary facilities and controls.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at monthly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Status of sustainable design documentation.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site use.
      - 9) Temporary facilities and controls.
      - 10) Progress cleaning.
      - 11) Quality and work standards.
      - 12) Status of correction of deficient items.
      - 13) Field observations.

- 14) Status of RFIs.
  - 15) Status of Proposal Requests.
  - 16) Pending changes.
  - 17) Status of Change Orders.
  - 18) Pending claims and disputes.
  - 19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## SECTION 013200

### CONSTRUCTION PROGRESS DOCUMENTATION

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  1. Startup construction schedule.
  2. Contractor's Construction Schedule.
  3. Construction schedule updating reports.
  4. Daily construction reports.
  5. Material location reports.
  6. Site condition reports.
  7. Unusual event reports.

##### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
  1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  2. Predecessor Activity: An activity that precedes another activity in the network.
  3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
1. Working electronic copy of schedule file, where indicated.
  2. PDF file.
  3. Two paper copies, of sufficient size to display entire period or schedule, as required.
- B. Startup construction schedule.
1. Submittal of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
  2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
  3. Total Float Report: List of activities sorted in ascending order of total float.
  4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at monthly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Unusual Event Reports: Submit at time of unusual event.

- K. Qualification Data: For scheduling consultant.

## 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
  - 1. Review software limitations and content and format for reports.
  - 2. Verify availability of qualified personnel needed to develop and update schedule.
  - 3. Discuss constraints, including phasing work stages area separations interim milestones.
  - 4. Review delivery dates for Owner-furnished products.
  - 5. Review schedule for work of Owner's separate contracts.
  - 6. Review submittal requirements and procedures.
  - 7. Review time required for review of submittals and resubmittals.
  - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
  - 10. Review and finalize list of construction activities to be included in schedule.
  - 11. Review procedures for updating schedule.

## 1.6 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## 1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for commencement of the Work to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    - a. TBD.
  3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than TBD days for startup and testing.
  5. Commissioning Time: Include no fewer than TBD days for commissioning.
  6. Final Completion: Indicate completion in advance of date established for Final Completion and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Completion.
  7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial (Beneficial) occupancy before Final Completion.
    - e. Use-of-premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.

- i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Startup and placement into final use and operation.
    - m. Commissioning.
  8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Temporary enclosure and space conditioning.
    - c. Permanent space enclosure.
    - d. Completion of mechanical installation.
    - e. Completion of electrical installation.
    - f. Final Completion.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
  1. Unresolved issues.
  2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and the Contract Time.
- F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate final completion percentage for each activity.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

## 1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within seven days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

## 1.9 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.
  - 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 1.10 CPM SCHEDULE REQUIREMENTS

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for commencement of the Work.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
  - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.

- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and inspection.
    - j. Commissioning.
    - k. Punch list and final completion.
    - l. Activities occurring following final completion.
  2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.

3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
  - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
  - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

#### 1.11 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Final Completions authorized.

- B. **Material Location Reports:** At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
  - 1. Material stored prior to previous report and remaining in storage.
  - 2. Material stored prior to previous report and since removed from storage and installed.
  - 3. Material stored following previous report and remaining in storage.
  
- C. **Site Condition Reports:** Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
  
- D. **Unusual Event Reports:** When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
  - 1. Submit unusual event reports directly to Owner within one day(s) of an occurrence.  
Distribute copies of report to parties affected by the occurrence.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



## SECTION 013233

### PHOTOGRAPHIC DOCUMENTATION

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final completion construction photographs.
  - 4. Preconstruction video recordings.
  - 5. Periodic construction video recordings.
  - 6. Construction webcam.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Submit photos by uploading to web-based project software site. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description in web-based project software site:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Date photograph was taken.
    - f. Description of location, vantage point, and direction.
    - g. Unique sequential identifier keyed to accompanying key plan.

- C. Video Recordings: Submit video recordings within seven days of recording.
  - 1. Submit video recordings by uploading to web-based project software site. Include copy of key plan indicating each video's location and direction.
  - 2. Identification: With each submittal, provide the following information on web-based project software site:
    - a. Name of Project.
    - b. Name and address of photographer.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Date video recording was recorded.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - 3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.
  
- D. Time-Lapse Video: Submit time-lapse sequence video recordings simultaneously with recording.
  - 1. Submit time-lapse sequence video recordings monthly by uploading to web-based project software site.
  - 2. Identification: For each recording, provide the following information on web-based project software site:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Date(s) and time(s) video recording was recorded.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

#### 1.4 QUALITY ASSURANCE

- A. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

#### 1.5 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
  
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

- C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- D. Metadata: Record accurate date and time and GPS location data from camera.
- E. File Names: Name media files with date Project area and sequential numbering suffix.

## 1.6 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Preconstruction Photographs: Before commencement of excavation, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- C. Periodic Construction Photographs: Take 50 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
  - 1. Frequency: Take photographs Weekly.
  - 2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
    - a. Commencement of the Work, through completion of subgrade construction.
    - b. Above-grade structural framing.
    - c. Exterior building enclosure.
    - d. Interior Work, through date of Final Completion.
- E. Final Completion Construction Photographs: Take 100 photographs after date of Final Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- F. Additional Photographs: Architect or Construction Manager may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
  - 1. Three days' notice will be given, where feasible.
  - 2. In emergency situations, take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:

- a. Special events planned at Project site.
- b. Immediate follow-up when on-site events result in construction damage or losses.
- c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
- d. Final Completion of a major phase or component of the Work.
- e. Extra record photographs at time of final acceptance.
- f. Owner's request for special publicity photographs.

## 1.7 CONSTRUCTION VIDEO RECORDINGS

- A. Preconstruction Video Recording: Before starting excavation, record video recording of Project site and surrounding properties from different vantage points, as directed by Construction Manager.
  1. Flag construction limits before recording construction video recordings.
  2. Show existing conditions adjacent to Project site before starting the Work.
  3. Show existing buildings either on or adjoining Project site to accurately record physical conditions at the start of excavation.
  4. Show protection efforts by Contractor.
- B. Periodic Construction Video Recordings: Record video recording monthly. Select vantage points to show status of construction and progress since last video recordings were recorded. Minimum recording time shall be 30 minutes(s).
- C. Time-Lapse Sequence Construction Video Recordings: Record video recording to show status of construction and progress.
  1. Frequency: During each of the following construction phases, set up video recorder to automatically record one frame of video recording every five minutes, from same vantage point each time, to create a time-lapse sequence of 30 minutes in length as follows:
    - a. Commencement of the Work, through completion of subgrade construction.
    - b. Above-grade structural framing.
    - c. Exterior building enclosure.
  2. Timer: Provide timer to automatically start and stop video recorder so recording occurs only during construction work hours.
  3. Vantage Points: Following suggestions by Architect and Contractor, photographer shall select vantage points.

## 1.8 CONSTRUCTION WEBCAM

- A. Webcam: Provide two fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Architect, with the following characteristics:
  1. Static view Remotely controllable view with mouse-click user navigation for horizontal pan, vertical tile, and optical zoom of 500 percent minimum.
  2. Capable of producing minimum 8 megapixel images.
  3. Provide power supply, active high-speed data connection to service provider's network, and static public IP address for each camera.
- B. Live Streaming Images: Provide web-accessible image of current site image, updated at five-minute intervals during daytime operation.

- C. Web-Based Interface: Provide online interface to allow viewing of each high-definition digital still image captured and stored during construction, from the Internet.
  - 1. Access Control: Provide password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.
  - 2. Storage: Maintain images on the website for reference during entire construction period, and for not less than 30 days after final completion. Provide sufficient memory on remote server to store all Project images.
  - 3. Online Interface: Provide website interface with Project and client information and logos; calendar-based navigation interface for selecting images; pan and zoom capability within high-definition images.
  - 4. Forward and Reverse: Provide capability to browse through images, moving forward and backward in time by individual image and by day.
  - 5. Slideshow: Provide capability to automatically display current images from sites when there are three or more cameras used.
  - 6. Time-Lapse: Provide capability for online display of project time-lapse.
  - 7. Dashboard: Provide capability to view thumbnails of all cameras on one screen.
  - 8. Weather: Provide corresponding weather data for each image captured.
  - 9. Provide public viewer open access to most recent Project camera image.
  
- D. Maintain cameras and web-based access in good working order according to web-based construction photographic documentation service provider's written instructions until final completion. Provide for service of cameras and related networking devices and software.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**



## **SECTION 013300**

### **SUBMITTAL PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Submittal schedule requirements.
  - 2. Administrative and procedural requirements for submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
  - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and final completion construction photographs.
  - 5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
  - 6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
  - 7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

##### **1.3 DEFINITIONS**

- A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

#### 1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal Category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's and Construction Manager's final release or approval.
    - g. Scheduled dates for purchasing.
    - h. Scheduled date of fabrication.
    - i. Scheduled dates for installation.
    - j. Activity or event number.

#### 1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
  - 1. Project name.
  - 2. Date.
  - 3. Name of Architect.
  - 4. Name of Construction Manager.
  - 5. Name of Contractor.
  - 6. Name of firm or entity that prepared submittal.
  - 7. Names of subcontractor, manufacturer, and supplier.
  - 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
  - 9. Category and type of submittal.

10. Submittal purpose and description.
  11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  12. Drawing number and detail references, as appropriate.
  13. Indication of full or partial submittal.
  14. Location(s) where product is to be installed, as appropriate.
  15. Other necessary identification.
  16. Remarks.
  17. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect and Construction Manager on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

## 1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect Construction Manager

- will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.
    - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

## 1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams that show factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.

- d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. BIM Incorporation: Develop and incorporate Shop Drawing files into BIM established for Project.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    - a. Project name and submittal number.
    - b. Generic description of Sample.
    - c. Product name and name of manufacturer.
    - d. Sample source.
    - e. Number and title of applicable Specification Section.
    - f. Specification paragraph number and generic name of each item.
  3. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of

color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

- a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
  - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
  
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
  
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
  
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
  
- G. Certificates:
  1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
  2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
  3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
  4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
  5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
  6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include

names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - a. Name of evaluation organization.
  - b. Date of evaluation.
  - c. Time period when report is in effect.
  - d. Product and manufacturers' names.
  - e. Description of product.
  - f. Test procedures and results.
  - g. Limitations of use.

1.8 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

- C. BIM Incorporation: Incorporate Construction Manager will incorporate delegated-design drawing and data files into BIM established for Project.
  - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as original Drawings, Revit (.rvt).

#### 1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect and Construction Manager will not review submittals received from Contractor that do not have Contractor's review and approval.

#### 1.10 ARCHITECT'S AND CONSTRUCTION MANAGER'S REVIEW

- A. Action Submittals: Architect and Construction Manager will review each submittal, indicate corrections or revisions required, and return it.
  - 1. Submittals by Web-Based Project Software: Architect and Construction Manager will indicate, on Project software website, the appropriate action.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION - NOT USED

#### END OF SECTION

**SUBMITTAL COVER FORM**

**PROJECT:** NCDA&CS - NC State Fairgrounds Midway Event Center

**PROJECT NO.:** 23-013

**TO:** HH Architecture  
1100 Dresser Court  
Raleigh, NC 27609

**FROM:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ CONTRACTOR                      \_\_\_\_\_ SUBCONTRACTOR

We submit for your consideration the following product for the above project:

<b>SPECIFICATION SECTION</b>	<b>SPECIFICATION PARAGRAPH</b>	<b>DESCRIPTION</b>
_____	_____	_____

**TYPE OF SUBMITTAL:**

- \_\_\_\_\_ Specified Brand Product
- \_\_\_\_\_ Proposed Equivalent Product to Specified Brand
- \_\_\_\_\_ Product Meeting Performance Specification (No Brand Specified)

We warrant the following:

- a. We have personally investigated the proposed product, and determined that it is equal in all respects to that specified and/or performance specification requirements;
- b. We will provide the specified guarantee for this product;
- c. We will coordinate installation of this product into the work, making such changes as maybe required for the work to be complete in all respects;
- d. We have clearly indicated by marking as "Non-Complying Feature" each and every requirement of the Specifications that this product does not meet;
- e. And, we waive all claims for additional costs related to this product which subsequently become apparent.

Attached hereto are complete technical data, including applicable laboratory reports, to demonstrate compliance with project requirements.

**SUBMITTED BY:**

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE



## SECTION 014000

### QUALITY REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.

##### 1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or

that requirements specified apply exclusively to specific trade(s).

- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
  - 2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements or as part of permanent construction, consisting of multiple products, assemblies, and subassemblies.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect or Construction Manager.

#### 1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

## 1.5 CONFLICTING REQUIREMENTS

- A. **Conflicting Standards and Other Requirements:** If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for direction before proceeding.
- B. **Minimum Quantity or Quality Levels:** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.6 ACTION SUBMITTALS

- A. **Shop Drawings:** For integrated exterior laboratory mockups.
  - 1. Include plans, sections, and elevations, indicating materials and size of mockup construction.
  - 2. Indicate manufacturer and model number of individual components.
  - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. **Delegated-Design Services Submittal:** In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

## 1.7 INFORMATIONAL SUBMITTALS

- A. **Contractor's Quality-Control Plan:** For quality-assurance and quality-control activities and responsibilities.
- B. **Qualification Data:** For Contractor's quality-control personnel.
- C. **Contractor's Statement of Responsibility:** When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. **Schedule of Tests and Inspections:** Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.

4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

- E. Reports: Prepare and submit certified written reports and documents as specified.
- F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

## 1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
  2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
  3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or

defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, telephone number, and email address of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.

## 1.10 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

- d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
  - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
  - f. When testing is complete, remove test specimens and test assemblies, mockups, and laboratory mockups; do not reuse products on Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
- 1. Build mockups of size indicated.
  - 2. Build mockups in location indicated or, if not indicated, as directed by Architect or Construction Manager.
  - 3. Notify Architect and Construction Manager seven days in advance of dates and times when mockups will be constructed.
  - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
  - 5. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 6. Obtain Architect's and Construction Manager's approval of mockups before starting corresponding work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  - 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 8. Demolish and remove mockups when directed unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
- L. Provide room mockups of the following rooms:
- 1. TBD.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

## 1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
  - 2. Payment for these services will be made from testing and inspection allowances, as authorized by Change Orders.
  - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
  - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 2. Engage a qualified testing agency to perform quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
  - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
  
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
  
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 6. Do not perform duties of Contractor.
  
- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
  
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspection equipment at Project site.
  
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
  
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update as the Work progresses.
  - 1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, Construction Manager, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections attached to this Section, and as follows:
  - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
  - 4. Submitting a final report of special tests and inspections at Final Acceptance, which includes a list of unresolved deficiencies.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  - 6. Retesting and reinspection of corrected work.

- B. Special Tests and Inspections: Conducted by a qualified special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in the Statement of Special Inspections attached to this Section, and as follows:
  - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  - 2. Notifying Architect, Commissioning Authority, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, through Construction Manager, with copy to Contractor and to authorities having jurisdiction.
  - 4. Submitting a final report of special tests and inspections at Final Acceptance, which includes a list of unresolved deficiencies.
  - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  - 6. Retesting and reinspecting corrected work.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

## END OF SECTION

## SECTION 014100 - SPECIAL INSPECTION SERVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Special Inspection services.
- B. Certain structural components of the Project will be subject to the requirements for Special Inspections. Special Inspections will be applicable to the following specification sections:
  - 1. Section 031000 Concrete Forming and Accessories
  - 2. Section 032000 Concrete Reinforcing
  - 3. Section 033000 Cast-In-Place Concrete
  - 4. Section 042000 Concrete Unit Masonry
  - 5. Section 051200 Structural Steel Framing
  - 6. Section 052100 Steel Joist Framing
  - 7. Section 053100 Steel Decking
  - 8. Section 078100 Applied Fireproofing
  - 9. Section 078123 Intumescent Fire Protection
  - 10. Section 078413 Penetration Firestopping
  - 11. Section 311000 Site Clearing
  - 12. Section 312000 Earth Moving
  - 13. Section 315000 Excavation Support and Protection
  - 14. Section 233113 Metal Ducts
  - 15. Section 233416 Centrifugal HVAC Fans
- C. The Owner will procure and bear all costs of the Special Inspector and the Independent Testing Laboratory, except as otherwise noted. The Special Inspector will be the manager of the Special Inspection process. The Special Inspector checks the certification of all other inspecting agents required by Special Inspections and coordinates their activities. The Special Inspector carries the responsibility for coordinating Special Inspections. The Statement of Special Inspections will be required by the Building Official as a condition for building permit issuance.
- D. Requirements for Special Inspections are outlined in the Statement and Schedule of Special Inspections included at the end of this section.
  - 1. Specific quality-assurance and control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.

2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
- E. Special Inspections are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
- F. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 1 Section "Quality Control" specifies requirements for repair and restoration of construction disturbed by inspection and testing activities.

### 1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: Contractor shall provide and include in the Contract Sum, inspections, tests, and other similar quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity.
1. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality-control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.
    - a. The Contractor shall correct deficiencies in work that inspections and laboratory test reports have indicated to be not in compliance with requirements.
    - b. The cost of retesting and reinspection construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
  2. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
    - a. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but are not limited to, the following:
    - a. Provide access to the Work.
    - b. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

- c. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
- d. Provide and maintain for the sole use of the Special Inspector or Inspectors adequate facilities for safe storage and proper curing of test samples on the Project Site.
- e. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
- f. Provide security and protection of samples and test equipment at the Project Site.
- g. The Contractor shall designate a representative (the superintendent or an assistant to the superintendent) who shall be the direct point-of-contact with the Special Inspector during each phase of the work. Discrepancies noted during the progress of the work will be reported to the Contractor's representative for corrective action. Communications given by the Special Inspector to the Contractor's representative shall be as binding as if given to the Contractor.

B. Special Inspector Responsibilities:

1. The Special Inspector shall coordinate and/or conduct and interpret tests, state in each report whether test specimens comply with requirements, specifically state any deviations therefrom, and record work required and performed to correct deficiencies.
2. The Special Inspector will keep records of all inspection and tests which will be furnished to the Building Official, the Architect, and the Structural Engineer of Record.
3. The Special Inspector shall notify the Architect, Construction Manager, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services. All discrepancies will be brought to the immediate attention of the Contractor for correction. If discrepancies are not corrected, the discrepancies will be brought to the attention of the Owner, Building Official, Architect and the Structural Engineer of Record.
4. A final report documenting completion of all required special inspections and corrections of any discrepancies noted will be submitted to the Building Official by the Special Inspector prior to, and as a condition of, issuance of the *Certificate of Use and Occupancy*.
5. The Special Inspector shall not perform any duties of the Contractor.
6. The Special Inspector shall not release, revoke, alter, decrease or increase the Contract Document requirements.

C. Independent Testing Laboratory Responsibilities: The Independent Testing Laboratory engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Architect and the Contractor in performance of the Laboratory's duties. The Laboratory shall provide qualified personnel to perform required inspections and tests.

1. Notify Architect, Construction Manager, Structural Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Shall not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
- D. Coordination: The Contractor and each agency engaged to perform inspection, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

#### 1.4 SUBMITTALS

- A. Within 48 hours of each inspection or test, the Special Inspector and the Independent Testing Laboratory shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Architect and Structural Engineer.
1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  2. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address, and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making the inspection or test.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.
    - i. Test results and an interpretation of test results.
    - j. Ambient conditions at the time of sample taking and testing.
    - k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    - l. Name and signature of laboratory inspector.
    - m. Recommendations on retesting.

#### 1.5 QUALITY ASSURANCE

- A. Qualification for Special Inspector: The Special Inspector shall be a Registered Professional Engineer, Licensed in the State of Virginia, experienced in performing special inspections and shall be approved by the Building Official and the Architect. The credentials of all Inspectors and testing technicians shall be provided if requested.
- B. Qualifications for Independent Testing Laboratory: Engage independent inspection and testing laboratories, that are prequalified as complying with the American Council of Independent Laboratories' "Recommended Requirements for Independent Laboratory Qualification" and that specialize in the types of inspections and tests to be performed.

1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
2. Each independent Inspection and Testing Agency engaged on the Project shall demonstrate that it has the experience and capability to conduct the required field and laboratory testing without delaying the progress of the work. The minimum requirements shall be as follows:
  - a. Reinforced Concrete testing
    - 1) **ACI-CFTT** *Concrete Field Testing Technician – Grade 1*
    - 2) **ACI-LTT** *Laboratory Testing Technician – Grade 1 or 2 and Strength Testing Technician*
    - 3) **NICET-CT** – *Concrete Technician – Level III*
  - b. Reinforced Concrete Inspection
    - 1) **ACI-CCI** *Concrete Construction Inspector*
    - 2) **ICC-RCSI** *Reinforced Concrete Special Inspector*
  - c. Structural Steel
    - 1) **AWS-CWI** *Certified Welding Inspector*
    - 2) **AWS/AISC-CSI** *Certified Steel Inspector*
    - 3) **ICC-SWSI** *Structural Steel and Welding Inspector*
  - d. Non-Destructive Testing – American Society of Non-Destructive.
  - e. Structural Masonry
    - 1) **ICC-SMSI** *Structural Masonry Special Inspector*
  - f. Spray-Applied Fireproofing
    - 1) **ICC-SFSI** *Spray-Applied Fireproofing Special Inspector*
  - g. Soils Testing
    - 1) **NICET-ST** - *Soils Technician Level II*
    - 2) **NICET-GET** – *Geotechnical Engineering Technician Level II*
- B. Pre-Construction Conference – Prior to the start of project construction, the Special Inspector and/or Owner’s Project Manager shall conduct a Pre-Construction Conference to discuss the requirements for Special Inspections as well as the Administrative Procedures to be followed during the course of the project. Protocols for notification, documentation, and individual responsibilities shall be reviewed. Attendees shall include, but are not limited to:
  1. Owner
  2. Owner’s Project Manager
  3. Owner’s Project Inspector
  4. Owner’s Independent Testing Agency
  5. Architect
  6. Structural Engineer
  7. Contractor’s Project Manager
  8. Contractor’s Superintendent

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes. Comply with Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities, and protect repaired construction.
- C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION 014100

## **SECTION 014200**

### **REFERENCES**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

##### **1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.3 DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.5 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.concrete.org](http://www.concrete.org).
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).

23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWPA - American Wood Protection Association; [www.awpa.com](http://www.awpa.com).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CE - Conformance Européenne; <http://ec.europa.eu/growth/single-market/ce-marking/>
51. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
52. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
53. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
54. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
55. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
56. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
57. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
58. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
59. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
60. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - CSA Group; [www.csa.ca](http://www.csa.ca).
65. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
66. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).

67. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
77. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
78. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); [www.intertek.com](http://www.intertek.com).
81. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
82. FCI - Fluid Controls Institute; [www.fluidcontrolsinstitute.org](http://www.fluidcontrolsinstitute.org).
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
85. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
86. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarooft.com](http://www.floridarooft.com).
88. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
89. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
90. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
91. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
92. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
93. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
97. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
98. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
99. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
100. IAS - International Approval Services; (See CSA).
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
103. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
104. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
105. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
106. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
111. IGMMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
112. IGSHA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
113. ILI - Indiana Limestone Institute of America, Inc.; [www.iliai.com](http://www.iliai.com).

114. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA);  
[www.intertek.com](http://www.intertek.com).
115. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems,  
and Automation Society); [www.isa.org](http://www.isa.org).
116. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
117. ISFA - International Surface Fabricators Association; (Formerly: International Solid  
Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
118. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
119. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
120. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
121. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
122. LMA - Laminating Materials Association; (See CPA).
123. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
124. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
125. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
126. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
127. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
128. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
129. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
130. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
131. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
132. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.;  
[www.mss-hq.org](http://www.mss-hq.org).
133. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
134. NACE - NACE International; (National Association of Corrosion Engineers  
International); [www.nace.org](http://www.nace.org).
135. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
136. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
137. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
138. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
139. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
140. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
141. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
142. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
143. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
144. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
145. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
146. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
147. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
148. NFPA - NFPA International; (See NFPA).
149. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
150. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
151. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
152. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
153. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
154. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
155. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
156. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
157. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
158. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
159. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).

160. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).
161. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
162. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
163. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); <http://www.plasa.org>.
164. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
165. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
166. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
167. SAE - SAE International; [www.sae.org](http://www.sae.org).
168. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
169. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
170. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
171. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
172. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
173. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
174. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
175. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
176. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
177. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
178. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
179. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
180. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
181. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
182. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
183. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
184. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
185. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
186. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
187. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
188. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
189. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
190. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
191. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
192. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
193. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
194. TPI - Turfgrass Producers International; [www.turfgrassod.org](http://www.turfgrassod.org).
195. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
196. UL - Underwriters Laboratories Inc.; <http://www.ul.com>.
197. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
198. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
199. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
200. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
201. WA - Wallcoverings Association; [www.wallcoverings.org](http://www.wallcoverings.org).
202. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
203. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
204. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).

205. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).
206. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
207. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
208. WWPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).

3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services;  
[www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
  - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**

## **SECTION 015000**

### **TEMPORARY FACILITIES AND CONTROLS**

#### **PART 1 GENERAL**

##### **1.1 SUMMARY**

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

##### **1.2 USE CHARGES**

- A. Installation, removal, and use charges for temporary facilities to be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.
- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use with metering. Provide connections and extensions of services and metering as required for construction operations.

##### **1.3 INFORMATIONAL SUBMITTALS**

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates

of each temporary utility.

- C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, timesteps, graphic elements, and message content.
- D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Construction Manager personnel responsible for management of fire-prevention program in compliance with NC Fire Code Section 3308 "Owner's Responsibility for Fire Protection".
  - 1. Construction Manager shall issue submittals demonstrating fire-safety compliance to design team for approval.
- E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
  - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
  - 2. Indicate methods to be used to avoid trapping water in finished work.
- F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste-handling procedures.
  - 5. Other dust-control measures.

#### 1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

#### 1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 8 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.
- B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
- D. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).
- E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

### 2.2 TEMPORARY FACILITIES

- A. Field Offices:
  - 1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of 20 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
  - 3. Drinking water and private toilet.
  - 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
  - 5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## PART 3 EXECUTION

### 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

### 3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

- C. Water Service:
  - 1. Install water service and distribution piping in sizes and pressures adequate for construction.
  - 2. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Final Acceptance, restore these facilities to condition existing before initial use.
  
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
  
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
  - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
  
- F. Electric Power Service:
  - 1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
  - 2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
    - a. Install electric power service overhead unless otherwise indicated.
    - b. Connect temporary service to Owner's existing power source, as directed by Owner.
  
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  
- H. Telephone Service: Install WiFi cell phone access equipment for each field office.
  - 1. At each field office, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's emergency after-hours telephone number.
    - d. Architect's office.
    - e. Construction Manager's home office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
  
- I. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

- J. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
  2. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.

### 3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
  2. Maintain support facilities until Architect schedules Final Acceptance inspection. Remove before Final Acceptance. Personnel remaining after Final Acceptance will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Section 312000 "Earth Moving."
  3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Final Acceptance. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Section 321216 "Asphalt Paving."
- D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
  2. Maintain access for fire-fighting equipment and access to fire hydrants.
- E. Parking: Provide temporary parking areas for construction personnel.
- F. Storage and Staging: Use designated areas of Project site for storage and staging needs.

- G. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- H. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  - 1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touch up signs, so they are legible at all times.
- I. Waste Disposal Facilities:
  - 1. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
  - 2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- J. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- K. Temporary Elevator Use: Use of elevators is not permitted.
- L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Final Acceptance.

### 3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
  - 1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control:
  - 1. Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000

"Site Clearing."

- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection:
  - 1. Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."
  - 2. Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Final Acceptance. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
  - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
  - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
  - 1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
  - 2. Paint and maintain appearance of walkway for duration of the Work.
- L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241 and NC Fire Code 3308; manage fire-prevention program.
  - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition utilizing burn permits in accordance with requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  - 4. Provide temporary standpipes and hoses for fire protection.

### 3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  - 1. Protect porous materials from water damage.
  - 2. Protect stored and installed material from flowing or standing water.
  - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
  - 4. Remove standing water from decks.
  - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  - 2. Keep interior spaces reasonably clean and protected from water damage.
  - 3. Periodically collect and remove waste containing cellulose or other organic matter.
  - 4. Discard or replace water-damaged material.
  - 5. Do not install material that is wet.
  - 6. Discard and replace stored or installed material that begins to grow mold.
  - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
  - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    - b. Measure moisture content of materials that have been exposed to moisture during

construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

- c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### 3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Final Acceptance.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Final Acceptance. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  1. Materials and facilities that constitute temporary facilities are property of Construction Manager. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. At Final Acceptance, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

**END OF SECTION**

## SECTION 016000

### PRODUCT REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
  - 2. Section 014200 "References" for applicable industry standards for products specified.

##### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

#### 1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    - a. Form of Architect's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
  - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
  - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
    - a. Name of product and manufacturer.

- b. Model and serial number.
- c. Capacity.
- d. Speed.
- e. Ratings.
3. See individual identification sections in Divisions 21, 22, 23, and 26 for additional identification requirements.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
  1. Store products to allow for inspection and measurement of quantity or counting of units.
  2. Store materials in a manner that will not endanger Project structure.
  3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  6. Protect stored products from damage and liquids from freezing.
  7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
  
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.
  
- B. Product Selection Procedures:
  - 1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    - a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: ...."
  - 2. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, which complies with requirements.
    - a. Non-limited list of products is indicated by the phrase: "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following: ...."
  - 3. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with

requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

- a. Limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, provide products by one of the following: ...."
4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, which complies with requirements.
  - a. Non-limited list of manufacturers is indicated by the phrase: "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following: ...."
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
  - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
  1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
  2. Evidence that proposed product provides specified warranty.
  3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  4. Samples, if requested.
- B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

## PART 3 EXECUTION - NOT USED

## END OF SECTION



## SECTION 017300

### EXECUTION

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for limits on use of Project site.
  - 2. Section 013300 "Submittal Procedures" for submitting surveys.

##### 1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

##### 1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
  - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
    - a. Contractor's superintendent.
    - b. Trade supervisor responsible for cutting operations.

- c. Trade supervisor(s) responsible for patching of each type of substrate.
  - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

## 1.6 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.
    - f. Piping, ductwork, vessels, and equipment.

- g. Noise- and vibration-control elements and systems.
- 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
  - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work.
  - 2. List of detrimental conditions, including substrates.
  - 3. List of unacceptable installation tolerances.
  - 4. Recommended corrections.

- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
  - 1. Establish limits on use of Project site.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Final Acceptance.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Final Acceptance.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419

"Construction Waste Management and Disposal."

- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Final Acceptance.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Final Acceptance.
- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

**END OF SECTION**



## **SECTION 017419**

### **CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Recycling nonhazardous construction waste.
  - 2. Disposing of nonhazardous construction waste.
- B. Related Requirements:
  - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
  - 2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

##### **1.3 DEFINITIONS**

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

##### **1.4 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition and construction waste become property of Contractor.

## 1.5 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

## 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

## 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
  - 1. Total quantity of waste.
  - 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
  - 3. Total cost of disposal (with no waste management).
  - 4. Revenue from salvaged materials.
  - 5. Revenue from recycled materials.
  - 6. Savings in transportation and tipping fees by donating materials.
  - 7. Savings in transportation and tipping fees that are avoided.
  - 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
  - 9. Net additional cost or net savings from waste management plan.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
  - 1. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
  - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.2 RECYCLING AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

### 3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
  - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  - 2. Polystyrene Packaging: Separate and bag materials.
  - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
  
- B. Wood Materials:
  - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
  - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
    - a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.
  
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
  - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
    - a. Comply with requirements in Section 329300 "Plants" for use of clean ground gypsum board as inorganic soil amendment.
  
- D. Paint: Seal containers and store by type.

### 3.4 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  
- B. Burning: Do not burn waste materials.

**END OF SECTION**

## SECTION 017700

### CLOSEOUT PROCEDURES

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Final completion procedures.
  - 2. Warranties.
  - 3. Final cleaning.
  - 4. Repair of the Work.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 3. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Section 017900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Final Acceptance.
- C. Certified List of Incomplete Items: Final submittal at final completion.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

## 1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
  - 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  - 2. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  - 3. Submit final completion photographic documentation.

## 1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 1. Organize list of spaces in sequential order, starting with exterior areas first.
  - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  - 3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Page number.
  - 4. Submit list of incomplete items in one of the following format:
    - a. MS Excel electronic file. Architect, through Construction Manager, will return annotated file.
    - b. PDF electronic file. Architect, through Construction Manager, will return annotated file.
    - c. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

## 1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Final Acceptance, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit on digital media acceptable to Architect by uploading to web-based project software site.
- E. Warranties in Paper Form:
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- F. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## PART 3 EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Final Acceptance.
- B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
  - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

**END OF SECTION**

## SECTION 017823

### OPERATION AND MAINTENANCE DATA

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

##### 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit on digital media acceptable to Architect by uploading to web-based project software site. Enable reviewer comments on draft submittals.
  - 2. Submit three paper copies. Architect, through Construction Manager, will return two copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Final Acceptance and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.
- E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components

- of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
  4. Supplementary Prepared on 8-1/2-by-11-inch white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Construction Manager.
  7. Name and contact information for Architect.
  8. Name and contact information for Commissioning Authority.
  9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to

ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
  - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
  - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
  - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
  
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  - 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  - 2. Performance and design criteria if Contractor has delegated design responsibility.
  - 3. Operating standards.
  - 4. Operating procedures.
  - 5. Operating logs.
  - 6. Wiring diagrams.
  - 7. Control diagrams.
  - 8. Piped system diagrams.
  - 9. Precautions against improper use.
  - 10. License requirements including inspection and renewal dates.
  
- C. Descriptions: Include the following:
  - 1. Product name and model number. Use designations for products indicated on Contract Documents.
  - 2. Manufacturer's name.
  - 3. Equipment identification with serial number of each component.
  - 4. Equipment function.
  - 5. Operating characteristics.
  - 6. Limiting conditions.
  - 7. Performance curves.
  - 8. Engineering data and tests.
  - 9. Complete nomenclature and number of replacement parts.
  
- D. Operating Procedures: Include the following, as applicable:
  - 1. Startup procedures.
  - 2. Equipment or system break-in procedures.
  - 3. Routine and normal operating instructions.
  - 4. Regulation and control procedures.
  - 5. Instructions on stopping.
  - 6. Normal shutdown instructions.
  - 7. Seasonal and weekend operating instructions.
  - 8. Required sequences for electric or electronic systems.
  - 9. Special operating instructions and procedures.
  
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

#### 1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
    - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.

- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of maintenance manuals.

#### 1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**

## SECTION 017839

### PROJECT RECORD DOCUMENTS

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

##### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one of file print, facilitated by using Procure (Construction Document Management System).
      - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

#### 1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding photographic documentation.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

- B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
  - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - 2. Format: Annotated PDF electronic file.
  - 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  - 4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Construction Manager.
    - e. Name of Contractor.

## 1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

## 1.6 RECORD PRODUCT DATA

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as annotated PDF electronic file.
  - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

#### 1.7 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

#### 1.8 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**

## SECTION 017900

### DEMONSTRATION AND TRAINING

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
  - 2. Demonstration and training video recordings.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Qualification Data: For facilitator.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.

- e. Name of Contractor.
- f. Date of video recording.
2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

### 1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  1. Inspect and discuss locations and other facilities required for instruction.
  2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  3. Review required content of instruction.
  4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

### 1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

## 1.7 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Systems and equipment operation manuals.
    - c. Systems and equipment maintenance manuals.
    - d. Product maintenance manuals.
    - e. Project Record Documents.
    - f. Identification systems.
    - g. Warranties and bonds.
    - h. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  - 4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Seasonal and weekend operating instructions.
    - l. Required sequences for electric or electronic systems.
    - m. Special operating instructions and procedures.
  - 5. Adjustments: Include the following:
    - a. Alignments.

- b. Checking adjustments.
- c. Noise and vibration adjustments.
- d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning.
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## 1.8 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

## 1.9 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish an instructor to describe Owner's operational philosophy.
  3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner, through Construction Manager, with at least seven days' advance notice.

- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

#### 1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD modewith vibration reduction technology.
  - 1. Submit video recordings on CD-ROM or thumb drive.
  - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  - 1. Furnish additional portable lighting as required.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

**END OF SECTION**

**SECTION 019913 - GENERAL REQUIREMENTS FOR DIVISIONS 26-WORK**

The "Engineer of Record" for the work defined by Division 01 Sections 019913 is Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605 (919) 832-8118. The term "engineer," "architect-engineer," "engineer-architect," "A-E," "E-A," etc., when used in these Sections shall reference Salas O'Brien.



**RELATED DOCUMENTS**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification sections, apply to this section.

**The requirements specified herein shall govern all Sections in Division 26, whether stated therein or not.**

Where items specified in the other sections of this Division conflict with requirements of this Section, the former shall govern.

**REVIEW OF CONTRACT DOCUMENTS**

The Contract Documents may represent imperfect data and may contain errors, omissions, conflicts, inconsistencies, code violations and improper use of materials. Such deficiencies will be corrected by the A-E when identified. The Contractor shall carefully study and compare the individual Contract Documents with each other and report at once in writing to the A-E any deficiencies the Contractor may discover. The Contractor shall require each subcontractor to likewise study the documents and report at once any deficiencies discovered. The Contractor shall resolve all reported deficiencies with the A-E prior to starting any work. **Any work performed prior to receipt of instructions from the A-E will be done at the Contractor's risk.** If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to the A-E, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

The Contractor shall be responsible for maintaining habitable structures under this Contract rainproof, and for making equipment and utility installations properly perform the intended function. If he is prevented from so doing by any limitations of the drawings or specifications, the Contractor shall immediately notify the A-E in writing of such limitations before proceeding with construction in the area where the problem or limitation exists.

**DEFINITIONS**

**Electrical Work:** Work required by this Contract as defined by specification Division 26.

**Labeled:** Appliances, equipment, materials or products to which has been attached a label, symbol, or other identifying mark of an organization acceptable to the North Carolina Building Code Council and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with identified standards or has been tested and found suitable for a specified purpose.

1 Listed: Appliances, equipment, materials or products included in a list published by an organization acceptable to the  
2 North Carolina Building Code Council and concerned with product evaluation, that maintains periodic inspection of  
3 production of listed equipment or materials, and whose listing states either that the equipment or material meets  
4 appropriate designated standards or has been tested and found suitable for a specified purpose.  
5

6 Concealed: Work within or behind various construction elements or in crawl spaces or trenches that is not exposed  
7 to view when the project is complete.  
8

9 Exposed: Not "concealed" as defined above, or anything exposed to view when the project is complete.  
10

11 Wiring: Cable, raceways, fittings, mechanical supports, wire, junction boxes, device boxes, outlet boxes, switches,  
12 cutouts, and related items.  
13

#### 14 **CODES, LAWS, REGULATIONS, AND STANDARDS**

15  
16 Work on and for the project shall conform to requirements of each applicable volume of the *North Carolina Building*  
17 *Code*; shall comply with the regulations of the N.C. Department of Labor, including the latest revisions and  
18 interpretations of the *Occupational Safety and Health Act of North Carolina*; and be in accordance with all other  
19 codes, laws, rules and regulations that apply to this project.  
20

21  
22 Codes, laws, regulations, and/or industry standards referenced in the Specification or on the Drawings shall be  
23 considered to be part of the Project requirements. Applicable edition of the referenced volume is the edition that  
24 is/was in effect at the time the construction permit was issued or at the time of approval of the Contract Documents by  
25 the Authority Having Jurisdiction.  
26

#### 27 **QUALITY ASSURANCE**

28  
29  
30 The Contract Drawings indicate the extent and general arrangement of the Work. The Contractor shall coordinate the  
31 Work under his Contract so as to avoid conflicts between his work and the work of other trades. He shall carefully  
32 examine the Drawings and shall be responsible for the proper fitting of materials and equipment into the space  
33 provided. If any departures from the Contract Drawings are deemed necessary by the Contractor, detail drawings of  
34 such departures and the reasons therefore shall be submitted as soon as practicable to the A-E for his review. No  
35 such departures shall be made without this review and written clarification or change order.  
36

37 **If manufacturer recommended details or installation instructions differ from the contract drawings or**  
38 **specifications, then the contractor shall notify the A-E immediately of any discrepancies.**  
39

40 The Drawings and Specifications shall be considered supplementary, one to the other, so that materials and/or labor  
41 indicated, called for, or implied by one and not the other shall be provided as though specifically called for in both.  
42

43 Firestop Materials Codes and Standards: Comply with ASTM Standard E814 and applicable categories of UL's  
44 current *Fire Resistance Directory*, Vol. I and II, for compliance with ANSI/UL Standard 1479.  
45

46 Access Doors Fire-Resistance Ratings: Where fire-resistance rating is indicated for construction penetrated by  
47 access units, provide Listed and Labeled units.  
48

#### 49 **SUBMITTALS**

50  
51  
52 Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this  
53 specification. Material and equipment schedules, catalog cuts, manufacturers' data and shop drawings, and field  
54 working drawings as required by individual Sections shall be provided.  
55

56 Shop drawings, technical data and other such submittals required by individual Sections of the Divisions listed above  
57 shall be provided.  
58

1 Equipment drawings, manufacturer's installation instructions as shipped with the equipment, field working and  
2 location drawings, wiring diagrams, and coordination drawings shall be provided by the Contractor for items of  
3 equipment, sleeves, foundations, curbs, wiring, ductwork, piping, etc., as necessary for information and coordination  
4 of all trades. These drawings shall be provided sufficiently in advance of installation to avoid delays and removal and  
5 reworking of installed work, and so as to provide information to other trades when and as required. No work shall be  
6 done until these drawings have been coordinated by the Contractor.

7  
8 Submittals shall be checked before submission by technically qualified employees of Contractor for accuracy,  
9 completeness and compliance with Contract requirement. **All submittals shall be accompanied by the "Submittal  
10 Cover Form" provided at the end of this Section, signed by Contractor.**

11  
12 Contractor shall submit complete lists or schedules of all proposed sub-contractors and material suppliers, and of all  
13 proposed construction materials and equipment. Materials and equipment lists shall be complete with trade names  
14 and/or catalog numbers of each item. Processing of the second and subsequent Certificate for Payment will be  
15 withheld until substantial portions of these lists have been submitted.

16  
17 Products furnished shall be essentially the standard product of the manufacturer. Where two or more units of the  
18 same class of equipment are required, these units shall be products of a single manufacturer.

19  
20 Products proposed by the Contractor shall be new except where specifically noted otherwise. Contractor(s) shall  
21 provide products only from manufacturers who have published data showing compliance with specified requirements  
22 or who certify in writing to such compliance (including laboratory and/or in-place testing, if applicable). All electrical  
23 products shall be both labeled and listed, as defined above. **Prior to purchase of major materials, equipment or  
24 systems, submit manufacturer's data to the A-E for review as hereinafter specified.**

25  
26 Products of the specified type and for the specified application offered by the Contractor(s) for use on this Project  
27 shall comply with the following requirements:

28  
29 Product shall have had satisfactory performance in applications of similar character to that specified for a  
30 period of at least three (3) years.

31  
32 Product shall be from an established national or regional manufacturer. The A-E's experience with the  
33 manufacturer on prior projects relative to product performance, technical support, etc. may be taken into  
34 account to establish suitability of the offered product for this Project.

35  
36 Product shall be provided through an authorized representative of the manufacturer. The representative  
37 shall be capable of providing technical support relative to the installation, operation, and maintenance of the  
38 product. The A-E's experience with the representative on prior projects relative to product performance,  
39 technical support, etc. may be taken into account to establish suitability of the offered product for this  
40 Project.

41  
42 Repair parts and service for the product shall be available within twenty-four (24) hours of notice.

43  
44 **The manufacturer and his authorized representative shall furnish satisfactory evidence in support of these  
45 conditions when requested. The A-E's decision relative to the suitability and acceptability of any product is  
46 final and acceptance of this limitation is implicitly acknowledged by the contractor and the manufacturer  
47 and/or his representative offering the product for use on this Project.**

48  
49 Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this  
50 specification. Where a submitted item does not **comply fully** with each and every requirement of the specifications  
51 the submittal shall clearly indicate such deviations by being marked "**NON-COMPLYING FEATURE**." This indication  
52 shall be applied to the submittals at the appropriate location in a color contrasting with the remainder of the submittal.  
53 Additional information that might assist the Engineer in product evaluation may be included with the submittal. This  
54 information should indicate how a specific non-complying feature is believed by the Contractor to meet the intent of  
55 the specification.  
56

1           **It is the Contractor's responsibility to demonstrate compliance with the specifications and to clearly**  
2           **indicate any features that do not meet the specifications. It is not the Engineer's responsibility to**  
3           **identify non-compliance.** Substantial non-compliance, as determined by the Engineer, is grounds for  
4           rejection of the submittal. Discovery of non-complying features that have not been properly identified as  
5           such on submittals may require, at any stage of construction, the removal and replacement of the non-  
6           complying item(s).

7  
8           The A-E will review manufacturer's data with reasonable promptness. This review is only for general conformance  
9           with the design concept of the project and general compliance with the information given in the Contract Documents.  
10          Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance  
11          with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an  
12          assembly of which the item is a component. Contractor is responsible for dimensions to be confirmed and correlated  
13          at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques,  
14          sequences and procedures of construction; coordination of his or her Work with that of all other trades; and for  
15          performing all work in a safe and satisfactory manner. The Contractor is responsible for any delay caused by his  
16          failure to observe submittals requirements and the time for completion of his Contract will not be extended because of  
17          such delays.

18  
19          The A-E's submittals review stamp categories shall be interpreted as follows:

20  
21                 Reviewed: Fabrication and installation or erection may be undertaken.

22  
23                 Exceptions indicated, revise and proceed: Fabrication and installation of erection may be undertaken.  
24                 However, Contractor shall comply with all notes or corrections indicated.

25  
26                 Exceptions indicated, revise and re-submit: Neither fabrication, installation, nor erection shall be undertaken.  
27                 Re-submit corrected copies for review. Corrections shall be limited to items marked, except that changes  
28                 required in order to coordinate the corrections indicated shall be made. All changes, other than those  
29                 indicated, shall be called specifically to the A-E's attention.

30  
31                 Rejected, re-submit: Neither fabrication, installation, nor erection shall be undertaken. Revise entire  
32                 submission to comply with information given in the Contract Documents and re-submit.

33  
34          Submittals returned to the Contractor with the A-E's "reviewed" or "exceptions indicated, revise and proceed" stamp  
35          need not be resubmitted, except that corrected copies of "exceptions indicated, revise and proceed" submittals shall  
36          be furnished for record when requested.

37  
38          Submittals returned to the Contractor with the A-E's "revise and re-submit" or "rejected, re-submit" stamp shall be  
39          corrected to comply with Contract requirements and re-submitted to the A-E for review. The Contractor shall direct  
40          specific attention, in writing or on re-submitted shop drawings, product data or samples, to revisions other than those  
41          requested by the A-E on previous submittals.

42  
43          Shop drawings of work that involves more than one subcontractor shall be coordinated by the Contractor and  
44          submitted to A-E under one cover. No items shall be fabricated, nor any portion thereof shipped to site, prior to  
45          receipt by the Contractor of all applicable submittals, including manufacturer's data, samples and shop drawings  
46          bearing the A-E's "reviewed" or "exceptions indicated" stamp only.

47  
48          Manufacturer's data submitted as required by the technical specifications sections or requested by A-E shall consist  
49          of four (4) copies of certificates, schedules, catalog cuts, manufacturer's specifications and installation instructions for  
50          each type of product or material. Include maintenance recommendations, fire ratings and other reports when  
51          applicable to show compliance with the Specifications. When catalog cuts are submitted, the specific item to be  
52          considered shall be identified. Items that are not so identified will be returned to the Contractor without action.

53  
54                 Firestop Systems: Submit data on products. Provide manufacturer's certification of UL classification(s)  
55                 required, including copies of UL systems listings and schedule defining each UL system proposed and the  
56                 applicable type of penetration.

57  
58                 Access Units: Submit manufacturer's technical data and installation instructions for each type of access  
59                 door assembly, including setting drawings, templates, instructions and directions for installation of  
60                 anchorage devices.

1 Contractor shall submit for review any samples required by the technical specification sections or that may be  
2 requested by the A-E.  
3

4 With each electrical testing and compliance submittal, Contractor shall submit evidence of compliance that each  
5 manufactured item or component of electrically-operated equipment and that each fabricated assembly of electrically  
6 operated equipment furnished complies with the testing requirements.  
7

#### 8 9 **USE OF BRAND NAMES**

10  
11 Brand names, where scheduled as "basis of design," are to be considered for information purposes and are not  
12 intended to be a product specification.

13 Where the Contractor proposes to use an item of equipment other than that indicated as basis of design that  
14 may require redesign of the structure, partitions, foundations, piping, wiring, or any other part of the  
15 mechanical, electrical, or architectural layout, all such redesign and all new drawings and detailing required  
16 shall be prepared by the Contractor at his own expense and submitted for review by the A-E.  
17

18 Where such deviation requires a different quantity and arrangement of ductwork, piping, wiring, raceway, or  
19 equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such  
20 ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and raceway,  
21 and any other additional equipment required by the system, at no additional cost.  
22

23 Brand names, where used as a product specification, are intended to denote the standard of quality required for the  
24 particular material or product.  
25

26 Where the term "equal" or "equivalent" is present, such specification does not restrict the Contractor to a  
27 specific brand and equivalent products by other manufacturers may be acceptable. The term "equal" or  
28 "equivalent" shall be interpreted to mean a material or product that is similar and equal in type, quality, size,  
29 capacity, composition, finish, color, and other performance characteristics to the material or product  
30 specified by brand name, and that, **in the opinion of the A-E**, is suitable for the same use and capable of  
31 performing the same function as the material or product specified. **Proposed equivalent items must be  
32 reviewed by the A-E before they are purchased or incorporated into the work.**  
33  
34

#### 35 **EQUIPMENT SUBSTITUTIONS AND CHANGES/EXTRA COSTS FOR CHANGES IN BUILDING SERVICES**

36  
37 Where the Contractor proposes to use an item of equipment other than that specified or detailed on the Drawings,  
38 requiring any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the mechanical,  
39 electrical, or architectural layout, all such redesign and all new drawings and detailing required shall be prepared by  
40 the Contractor at his own expense and submitted for review by the A-E.  
41

42 Where such approved deviation requires a different quantity and arrangement of ductwork, piping, wiring, raceway, or  
43 equipment from that specified or indicated on the Drawings, the Contractor shall furnish and install any such  
44 ductwork, piping, structural supports, insulation, controllers, motors, starters, electrical wiring and raceway, and any  
45 other additional equipment required by the system, at no additional cost.  
46  
47

48 It is the responsibility of the Contractor to notify the A-E in all cases where the requirements of proposed equipment  
49 differ from the requirements specified, shown, or implied on the Drawings or within the Specifications. **Failure of the  
50 Contractor to notify the A-E shall not relieve the Contractor of the responsibility of providing compatible  
51 equipment at no additional cost as described above.**  
52  
53

#### 54 **OPERATION AND MAINTENANCE DATA**

55  
56 For each Division of the Work, provide four (4) copies of Operating Manuals, Maintenance Manuals, and Test  
57 Reports, bound in suitable covers, to the A-E at least two (2) weeks **prior** to the final inspection of the project.  
58

1 Each manual shall include a cover sheet listing the following:

2  
3 Project name and location.

4  
5 Division of Work covered by the manual.

6 Contractor data, including name, address, phone and fax numbers, and service contact information (24-hour  
7 number, email address, etc.)

8  
9 Date of project completion.

10  
11 Each manual shall include a table of contents.

12  
13 Operating manual: Provide all relevant information needed for day-to-day operation and management of the building  
14 systems. Include the following for each system:

15  
16 System Description: Identify the areas of the building the system serves, the locations of performance  
17 checkpoints, the expected performance readings at the design load conditions and, where applicable, at  
18 part-load conditions. The system's operation during the day, night, and weekend, as well as seasonal start-  
19 up and shutdown, safety devices and their function, control devices and their function, pollution control  
20 devices, etc., also shall be described. The function of the controls for individual systems shall be described  
21 alongside the description of the system function.

22  
23 Operating Routines and Procedures: Identify activities associated with the normal operation of systems and  
24 equipment. Operating checklists and operating logs shall be provided for each system and all performance  
25 standards shall be identified.

26  
27 Seasonal Start-Up and Shutdown: List seasonal start-up and shutdown procedures, including any  
28 "mothballing" procedures required.

29  
30 Special Procedures: Special procedures related to environmental control, health and safety, productive  
31 work environment, etc., shall be codified.

32  
33 Troubleshooting Procedures: This section shall include questionnaires and diagnostics to allow users to  
34 isolate probable causes of operating problems in an efficient manner.

35  
36 Maintenance manual: The maintenance manual shall be divided into two parts:

37  
38 Part I shall contain information related to the equipment data sheets, nameplate data, operating data, etc.  
39 Include the original purchase order number; date of purchase; name, address, and phone number of vendor;  
40 and warranty information.

41  
42 Part II shall support a maintenance program. The manual shall contain information prepared by the  
43 equipment manufacturers, but shall be supplemented by information provided by the Contractor. Each item  
44 of equipment shall be identified and an individual "Equipment Maintenance Sheet" shall be prepared for  
45 each, with the following information:

46  
47 Description each system and system component, consisting of easily read schematic drawings  
48 showing all components, identified to match Part I data, that requires maintenance.

49  
50 Recommended preventative and predictive maintenance procedures and their recommended  
51 frequency of application for each system component.

52  
53 Recommended list of spare parts with part numbers and place(s) they can be obtained.

54  
55 Copy of manufacturer's Installation instructions for each component.

56  
57 Any other information requested by the A/E to support the operation and maintenance of the  
58 equipment.

1 Test reports: Provide copies of the test protocols used in the construction and commissioning of the systems.  
2 Arrange data so as to allow the results of ensuing tests to be easily added.  
3  
4  
5

6 **PART 2 – PRODUCTS**

7 (NOT USED)  
8  
9

10 **PART 3 – EXECUTION**

11 (NOT USED)  
12  
13  
14



**SUBMITTAL COVER FORM**

**PROJECT:** NC State Fairgrounds Midway Event Center  
NC Department of Agriculture and Consumer Services

**PROJECT NO.:** 2023-03874 SCO#22-25408-02

**TO:** SALAS O'BRIEN  
702 Oberlin Road, Suite 300  
Raleigh, NC 27605

**FROM:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_ CONTRACTOR                      \_\_\_\_\_ SUBCONTRACTOR

We submit for your consideration the following product for the above project:

<b>SPECIFICATION SECTION</b>	<b>SPECIFICATION PARAGRAPH</b>	<b>DESCRIPTION</b>
_____	_____	_____

**TYPE OF SUBMITTAL:**

- \_\_\_\_\_ Specified Brand Product
- \_\_\_\_\_ Proposed Equivalent Product to Specified Brand
- \_\_\_\_\_ Product Meeting Performance Specification (No Brand Specified)

We warrant the following:

- a. We have personally investigated the proposed product, and determined that it is equal in all respects to that specified and/or performance specification requirements;
- b. We will provide the specified guarantee for this product;
- c. We will coordinate installation of this product into the work, making such changes as may be required for the work to be complete in all respects;
- d. We have clearly indicated by marking as "Non-Complying Feature" each and every requirement of the Specifications that this product does not meet;
- e. And, we waive all claims for additional costs related to this product which subsequently become apparent.

Attached hereto are complete technical data, including applicable laboratory reports, to demonstrate compliance with project requirements.

**SUBMITTED BY:**

\_\_\_\_\_  
SIGNATURE

\_\_\_\_\_  
DATE



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**SUBMITTAL REVIEW**

**(SAMPLE FORM - ORIGINAL WITH COMMENTS WILL BE ATTACHED TO  
SUBMITTAL BY A/E)**

PROJECT: \_\_\_\_\_

PROJECT #:

SUBMITTAL ID#:

SPECIFICATION PARAGRAPH:

DESCRIPTION:

Submittal has been reviewed only for conformance with design intent of the contract documents. See Section 019913 "GENERAL REQUIREMENTS FOR ENGINEERED WORK" for complete definition of Submittal Review.

- Reviewed
- Exceptions Noted - Revise & Proceed
- Exceptions Noted - Revise & Resubmit
- Rejected

DATE:

BY:

REVIEW COMMENTS:

**THESE COMMENTS SHALL NOT BE REMOVED FROM THIS DOCUMENT**



## **SECTION 024119 - SELECTIVE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. The Work of this Section Includes:
  - 1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

#### **1.2 DEFINITIONS**

- A. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Existing to Remain: Existing items of construction that are not to be removed.

#### **1.3 MATERIALS OWNERSHIP**

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

#### **1.4 COORDINATION**

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review and finalize selective demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 4. Review areas where existing construction is to remain and requires protection.
  - 5. Review and finalize protection requirements.
  - 6. Review procedures for noise control and dust control.
  - 7. Review storage, protection, and accounting for items to be removed for salvage or reinstallation.

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## 1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.

## 1.7 FIELD CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Hazardous Materials:
  - 1. It is not expected that hazardous materials will be encountered in the Work.
    - a. Hazardous materials will be removed by Owner before start of the Work.
    - b. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- C. On-site sale of removed items or materials is not permitted.

## **PART 2 - PRODUCTS**

### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video. Comply with Section 013233 "Photographic Documentation."
  - 1. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items

for salvage or reinstallation.

### 3.2 PREPARATION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition.

### 3.3 UTILITY SERVICES AND BUILDING SYSTEMS

- A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  - 2. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
  - 3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.
  - 2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete:
  - 1. Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.7 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

## **SECTION 033000 - CAST-IN-PLACE CONCRETE FOR BUILDINGS**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
  - 1. Include special reinforcement required for openings through concrete structures and dimensioned opening locations. Include applicable dimensions, sections, elevations, and details required to complete installation and coordination of the details, and typical details. Plan shall be drawn at a scale of no less than 1/8" per foot.

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1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Fiber reinforcement.
  - 6. Waterstops.
  - 7. Curing compounds.
  - 8. Floor and slab treatments.
  - 9. Bonding agents.
  - 10. Adhesives.
  - 11. Vapor retarders.
  - 12. Semirigid joint filler.
  - 13. Joint-filler strips.
  - 14. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I.

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Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

#### 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

#### 1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 305.1 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

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## **PART 2 - PRODUCTS**

### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301.
  - 2. ACI 117.
  - 3. ACI 315 (ACI 315M).
  - 4. CRSI "Manual of Standard Practice."
  - 5. ACI 318.

### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  - 2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.

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3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flatsheet.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray or ASTM C595, Type IL (MS).
  2. Fly Ash: ASTM C 618, Class F.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Lightweight Aggregate: ASTM C 330/C 330M, 3/4-inch nominal maximum aggregate size.

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- E. Air-Entraining Admixture: ASTM C 260/C 260M.
  - F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
    - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
    - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
    - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
    - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
    - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
    - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
  - G. Water: ASTM C 94/C 94M and potable.

## 2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A, except with maximum water-vapor permeance of 0.01 and minimum 15 mil thickness. Include manufacturer's recommended adhesive or pressure-sensitive tape.

## 2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

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2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150/C 150M, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

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2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent, unless otherwise noted on construction plans.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings, Walls, and Piers: Normal-weight concrete.
  - 1. Minimum Compressive Strength: Reference construction documents.
  - 2. Maximum W/C Ratio: Reference construction documents.
  - 3. Slump Limit: 5 inches, plus or minus 1 inch or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
    - a. Air Content: Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of placement for concrete containing 3/4-inch nominal maximum aggregate size or 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.
- B. Walls and Columns: Normal-weight concrete.
  - 1. Minimum Compressive Strength: Reference construction documents.
  - 2. Maximum W/C Ratio: Reference construction documents.
  - 3. Slump Limit: 5 inches, plus or minus 1 inch or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.

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4. Air Content: Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of placement for concrete containing 3/4-inch nominal maximum aggregate size or 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
4. Slump Limit: 5 inches, plus or minus 1 inch or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture.
5. Air Content: Do not use an air-entraining admixture or allow total air content to exceed 3 percent.

D. Elevated Floor Slabs: Lightweight concrete.

1. Exposure Class: ACI 318 F0 S0 W0 C0.
2. Minimum Compressive Strength: Reference construction documents.
3. Calculated Equilibrium Unit Weight: 113 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567/C 567M.
4. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site.
5. Air Content:
  - a. 5.5 percent, plus or minus 1.5 percent at point of placement for specified floor fire rating.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
7. Maximum Aggregate Size: 3/4-inch nominal.

2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

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## **PART 3 - EXECUTION**

### 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-typescreeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

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### 3.2 EMBEDDED ITEM INSTALLATION

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 48 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.

### 3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

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1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
  - B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
  - C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
  - E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  1. Sawn Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Cut joints the same day as concrete placement and within 8 hours.

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- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
    - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
    - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
    - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
  
  - E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.7 WATERSTOP INSTALLATION

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

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- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### 3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
  2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
  3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of

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formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
  - 1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    - b. Specified overall value of flatness, F(F) 25; for suspended slabs.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

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1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  2. Construct concrete bases to height indicated, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
  3. Minimum Compressive Strength: 3000 psi at 28 days.
  4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  6. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

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- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
  - D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
  - E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
    - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      - a. Water.
      - b. Continuous water-fog spray.
      - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
    - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
      - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
      - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
      - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
    - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
      - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.
    - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

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3.13 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  - 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  - 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and

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- primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
  - F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.14 SPECIAL INSPECTIONS

- A. Special Inspections will be performed by the Special Inspector or the Special Inspection Agency.
- B. Verification and inspection of concrete construction shall be in accordance with Section 1704.4 of the 2018 North Carolina State Building Code and as follows:
- C. Inspections:
  1. Steel reinforcement placement.
  2. Steel reinforcement welding.
  3. Headed bolts and studs.
  4. Verification of use of required design mixture.
  5. Concrete placement, including conveying and depositing.
  6. Curing procedures and maintenance of curing temperature.
  7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:
  1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted

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from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure five standard 4x8 cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one laboratory-cured specimen at 7 days and one set of three specimens at 28 days. Maintain one specimen in reserve for later testing, if required.
  - a. A compressive-strength test shall be the average compressive strength from a set of three specimens obtained from same composite sample and tested at age indicated.
  - b. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

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- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  - F. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
  - G. Measure floor and slab flatness and levelness according to ASTM E 1155 within 24 hours of finishing.

**END OF SECTION 033000**



## **SECTION 051200 - STRUCTURAL STEEL FRAMING**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

#### 1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

#### 1.5 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as work of other sections.
  - 3. Include embedment Drawings.

4. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  5. Include embedment Drawings.
  6. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  7. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- B. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
  2. Electrode manufacturer and trade name, for demand critical welds.
- C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.
  2. AISC 360.
  3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Special Inspector observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## 1.9 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear, braced frame, moment connections and lintel/girt connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer registered in North Carolina, to withstand loads indicated and comply with other information and restrictions indicated.
  - 1. Select and complete connections using schematic details indicated and AISC 360.
  - 2. Use Load and Resistance Factor Design; data are given at ultimate-load level.

## **PART 2 - PRODUCTS**

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992, Grade 50.
- B. Channels, Angles: ASTM A 36, Grade 36.
- C. Plate and Bar: ASTM A 36, Grade 36.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C.
- E. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
  - 1. Finish: Plain.
- C. Headed Anchor Rods: ASTM F 1554, Grade 36 or 55 (weldable), straight.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 4. Finish: Plain.

## 2.3 GALVANIZING REPAIR PAINT

- A. Galvanizing Repair Paint: ASTM A 780/A 780M.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
  - 1. Camber structural-steel members, where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other member transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.
- G. Preparation and Erection of Steel to Receive Intumescent Paint: Erect and prepare in accordance with requirements of AESS Category 3 per ANSI/AISC 303 and per below.
  - 1. Provide weld tabs, bracing, and other temporary fixtures at points that will be concealed from view in the completed structure to greatest extent possible. Where required in exposed locations, remove carefully and repair blemishes, holes, or unsightly surfaces for consistency of final appearance.
  - 2. Do not splice members except where specifically indicated.
  - 3. Remove weld spatter at locations that will be exposed to view in the completed structure.
  - 4. Bolted Connections: Align bolt heads carefully, on the same side of connection throughout the complete space where bolts will be exposed to view.
    - a. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned and cannot be aligned to provide an acceptable final appearance.
  - 5. Welded Connections: Appearance and quality of welds shall be consistent. Employ methods that will maintain alignment of members without warp and maintaining required tolerances. Provide continuous welds of uniform size and profile. Where intermittent or tack welding is indicated

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless otherwise noted.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize lintels, lintel assemblies and shelf angles located in exterior walls.

## 2.8 SPECIAL INSPECTIONS

- A. Special Inspections and tests will be performed by the Special Inspector or Special Inspection Agency.
  - 1. Provide access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and that those procedures are being implemented. This inspection will provide a basis for determination of the fabricator's ability to conform to approved drawings, project specifications, and referenced standards.
    - a. Exception: Special Inspections will not be required where the work is done on the premises of a fabricator registered and approved to perform such work without special inspection.
  - 3. Approval shall be based upon review of the fabricator's written procedural and quality control manuals and periodic auditing of fabrication practices.
  - 4. At completion of fabrication, the fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressivestrength.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tightened anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless otherwise noted.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

### 3.5 SPECIAL INSPECTIONS

- A. Special Inspections and tests will be performed by the Special Inspector or Special Inspection Agency.
- B. Verification and inspection of steel construction shall be in accordance with the requirements of Section 1704.3 of the 2018 North Carolina State Building Code and as follows:

1. Welding: Welding inspection shall be in compliance with AWS D1.1. In addition to visual inspection, welds may be tested and inspected according to AWS D1.1 and the following inspection procedures, at Special Inspector's option:
  - a. Liquid Penetrant Inspection: ASTM E 165.
  - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  - c. Ultrasonic Inspection: ASTM E 164.
  - d. Radiographic Inspection: ASTM E 94.
2. Details: Perform periodic inspections of the erected structural steel framing to verify compliance with the details shown on the construction documents and approved shop drawings such as member locations, spacing, bolted and welded connection details and bracing.
3. High Strength Bolts: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
  - a. General: While Work is in progress, determine that the requirements for bolts, nuts, washers, paint, bolted parts and installation and tightening in such standards are met. For bolts requiring pretensioning, observe the preinstallation testing and calibration procedures when such procedures are required by the installation method or by project plans or specifications; determine that all plies of connected materials have been drawn together and properly snugged and monitor the installation of bolts to verify that the selected procedure for installation is properly used to tighten bolts. For joints required to be tightened only to snug-tight condition, verify that the connected materials have been drawn together and properly snugged.
  - b. Periodic monitoring: Monitoring of bolt installation for pretensioning is permitted to be performed on a periodic basis when using the turn-of-nut method with matchmarking techniques, the direct tension indicator method or the alternate design fastener (twist-off bolt) method. Joints designated as snug tight need be inspected only on a periodic basis.
  - c. Continuous monitoring: Monitoring of bolt installation for pretensioning using the calibrated wrench method or the turn-of-nut method without matchmarking shall be performed on a continuous basis.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Additional testing performed to determine compliance of corrected Work with specified requirements shall be at Contractor's expense.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

**END OF SECTION 051200**

## SECTION 051213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Architecturally exposed structural steel (AESS).
- 2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

- B. Related Requirements:

- 1. Section 099113 "Exterior Painting" Section 099123 "Interior Painting" Section 099600 "High-Performance Coatings" and Section 078123 "Intumescent Fire Protection" for surface preparation and priming requirements.

#### 1.3 DEFINITIONS

- A. AESS: Architecturally exposed structural steel.
- B. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and may be designated AESS 2, AESS Category 2, or Category AESS 2 in the Contract Documents.

#### 1.4 COORDINATION

- A. Coordinate surface preparation requirements for shop-primed items.
- B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

#### 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.6 ACTION SUBMITTALS

### A. Product Data:

1. Tension-control, high-strength, bolt-nut-washer assemblies.
2. Filler.
3. Primer.
4. Galvanized-steel primer.
5. Etching cleaner.
6. Galvanized repair paint.

### B. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS.

1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.
2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Indicate orientation of mill marks and HSS seams.
4. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed. Indicate grinding, finish, and profile of welds.
5. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
6. Indicate exposed surfaces and edges and surface preparation being used.
7. Indicate special tolerances and erection requirements.
8. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

### C. Samples: Submit Mockup Samples to set quality standards for AESS. Paint mockups in accordance Section 078123 "Intumescent Fire Protection" to display final surface appearance.

1. Two steel plates, 3/4 by 8 by 8 inches, placed in a T-shape, with long edges joined by a complete penetration groove weld per AESS 2.
2. Two W8x10 x 1 foot long, mitered at a 90 degree corner and joined with complete penetration groove welds, continuous from top flange, through web, to bottom flange, per AESS 2. Remove backer bars and fill weld access holes.
3. Two W8x10 x 1 foot long, placed in a T-configuration to form a beam to girder moment connection. Join flanges with complete penetration groove welds, and webs with fillet welds on each side, per AESS 2. Remove backer bars and fill weld access holes.

## 1.7 INFORMATIONAL SUBMITTALS

### A. Qualification Data: For Installer, fabricator, shop-painting applicator.

### B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, Category CSE, and is experienced in erecting AESS similar to that indicated on this Project.
- C. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
  - 1. Build mockup of typical portion of AESS as described in these specifications.
  - 2. Coordinate intumescent paint requirements with Section 078123 "Intumescent Fire Protection" for surface preparation and priming requirements.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.
  - 1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
  - 2. Replace damaged materials or structures as directed.

## 1.10 FIELD CONDITIONS

- A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade A325, hex-head assemblies; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish:
  - a. Interior: Plain.
  - b. Exterior exposed to weather: Mechanically deposited zinc coating.

## 2.3 FILLER

- A. Polyester filler intended for use in repairing dents in automobile bodies.

## 2.4 PRIMER

- A. Steel Primer:

1. Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," Section 099600 "High-Performance Coatings," and Section 078123 "Intumescent Fire Protection".
2. SSPC-Paint 23, latex primer; two coats, and compatible with topcoat.

- B. Galvanized-Steel Primer: MPI#26 or MPI#134. MPI#101 When epoxy or other two component systems are specified.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

## 2.5 FABRICATION

- A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

- B. Category AESS 2:

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
6. Limit butt and plug weld projections to 1/16 inch (1.6 mm).
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.

9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
  1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.7 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
  1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:
  1. Surfaces to be field welded.
- B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  1. SSPC-SP 6 (WAB)/NACE WAB-3.
- C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

- D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe prime corners, crevices, bolts, welds, and eased edges.
  - 2. Apply two coats of shop primer to all surfaces. Change color of second coat to distinguish it from first.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.
- B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Repair damage in accordance with the category of AESS specified to the satisfaction of the Architect.

#### 3.3 ERECTION

- A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
  - 1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
    - a. Repair damage in accordance with the category of AESS specified to the satisfaction of the Architect.
  - 2. Grind tack welds smooth.
  - 3. Remove backing and runoff tabs, and grind welds smooth.

4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
  5. Remove erection bolts in AESS, fill holes with weld metal or filler, and grind or sand smooth to achieve surface quality approved by Architect.
  6. Fill weld access holes in all AESS with weld metal or filler and grind, or sand smooth to achieve surface quality as approved by Architect.
  7. Conceal fabrication and erection markings from view in the completed structure.
- B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
1. Erection of Category AESS 2:
    - a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
    - b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
    - c. Remove weld spatter, slivers, and similar surface discontinuities.
    - d. Grind off butt and plug weld projections larger than 1/16 inch.
    - e. Continuous welds shall be of uniform size and profile.
    - f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
    - g. Splice members only where indicated on Drawings.
    - h. No torch cutting or field fabrication is permitted.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

### 3.5 REPAIR

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop primer, and paint exposed areas with the same material as used for shop priming, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
    - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," Section 099600 "High-Performance Coatings," and Section 078123 "Intumescent Fire Protection".

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.
- B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION 051213

## **SECTION 053100 - STEEL DECKING**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Roof deck.
  - 2. Composite floor deck.
  - 3. Shear studs for composite floor slabs.

#### 1.3 ACTION SUBMITTALS

- A. Shop Drawings:
  - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- B. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

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1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilation to avoid condensation.

1.7 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings from an applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

**PART 2 - PRODUCTS**

2.1 ROOF DECK

- A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
  - 2. Deck Profile: Type N, wide rib, or as indicated.
  - 3. Profile Depth: 3 inches, or as indicated.
  - 4. Design Uncoated-Steel Thickness: As indicated.
  - 5. Span Condition: Triple span or more.
  - 6. Side Laps: Overlapped.

2.2 COMPOSITE FLOOR DECK

- A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50, G60 zinc coating.
2. Deck Profile: Type VL, composite.
3. Profile Depth: 2 inches.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

### 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Galvanizing Repair Paint: ASTM A 780.

## **PART 3 - EXECUTION**

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

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- B. Locate deck bundles to prevent overloading of supporting members.
  - C. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
  - D. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
  - E. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
  - F. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
  - G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: As indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and weld.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

### 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  1. Weld Diameter: 5/8 inch, nominal.
  2. Weld Spacing: As indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated, and as follows:
  1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z- closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### 3.5 SPECIAL INSPECTIONS

- A. Special Inspections and tests shall be performed by the Special Inspector or Special Inspection Agency.
- B. Verification and inspection of metal deck construction shall be in accordance with Table 1704.3 of the 2018 North Carolina State Building Code, and as follows:
  1. Welding: Welding inspection shall be in compliance with AWS D1.3.
  2. Details: Perform periodic inspections of the erected steel decking to verify compliance with the details shown on the construction documents and approved shop drawings such as deck type, gage, layout, bearing and laps and quantity, spacing and quality of support welds and sidelap screw fastening.
- C. Shear Studs: Test and inspect welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Visually verify spacing, quantity, diameter and final installed length of all shear studs. Visually inspect welds to verify continuous 360-degree flash.
  2. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  3. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

### **END OF SECTION 053100**

## **SECTION 054000 - COLD-FORMED METAL FRAMING**

### **PART 1 - GENERAL**

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. All exterior non-load-bearing wall framing that receives lateral wind loading including exterior wall framing, screen walls, roof parapet walls, and exterior fascia/soffit framing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  - 3. For cold-formed metal framing indicated to comply with design loads, include shop drawings and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

#### 1.4 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

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- C. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

- 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

- 1. Design Loads: As indicated.
  - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

- a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.

- 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
  - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

- a. Upward and downward movement of 1 inch..

- 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

- C. Cold-Formed Steel Framing Design Standards:

- 1. Wall Studs: AISI S211.
  - 2. Headers: AISI S212.
  - 3. Lateral Design: AISI S213.

- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

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## **PART 2 - PRODUCTS**

### **2.1 COLD-FORMED STEEL FRAMING, GENERAL**

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: As required by structural performance.
  - 2. Coating: G60.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: 50, Class 1.
  - 2. Coating: G90.

### **2.2 EXTERIOR NON-LOAD-BEARING WALL FRAMING**

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.054 inch (16 mil).
  - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.054 inch (16 mil).
  - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

### **2.3 FRAMING ACCESSORIES**

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.

## 2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36 threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

## 2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.

## 2.6 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by screw fastening as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
  - 4. Fasten other materials to cold-formed steel framing by screw fastening, according to Shop Drawings.

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- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
  - C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
    - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
    - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION, GENERAL**

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by screw fastening. Wire tying of framing members is not permitted.
    - a. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

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- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
  - F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
  - G. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
  - H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
  - I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
    - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.3 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track. Space studs as follows:
  - 1. Stud Spacing: 16 inches, maximum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Connect vertical deflection clips to bypassing studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  - 2. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.4 SPECIAL INSPECTIONS

- A. Special Inspections and tests shall be performed by the Special Inspector or Special Inspection Agency.
- B. Verification and inspection of cold-formed metal framing construction shall be in accordance with Table 1704.3 of the 2018 North Carolina State Building Code, and as follows:
  - 1. Details: Perform periodic inspections of the installed cold-formed metal framing to verify compliance with the details shown on the construction documents and approved shop drawings such as member size, spacing, gage and connection details.
- C. Remove and replace work where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

**END OF SECTION 054000**



## **SECTION 055000**

### **METAL FABRICATIONS**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Steel framing and supports for countertops.
  - 2. Steel framing and supports for mechanical and electrical equipment.
  - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 4. Elevator machine beams, hoist beams, and divider beams.
  - 5. Steel shapes for supporting elevator door sills.
  - 6. Shelf angles.
  - 7. Metal ladders.
  - 8. Elevator pit sump covers.
  - 9. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
  - 2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
  - 3. Section 051200 "Structural Steel Framing."

### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
  - 2. Paint products.
  - 3. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for overhead doors and grilles.
  - 2. Steel framing and supports for countertops.
  - 3. Steel framing and supports for mechanical and electrical equipment.
  - 4. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 5. Elevator machine beams, hoist beams, and divider beams.
  - 6. Steel shapes for supporting elevator door sills.
  - 7. Shelf angles.
  - 8. Metal ladders.
  - 9. Elevator pit sump covers.
  - 10. Metal downspout boots.
  - 11. Loose steel lintels.
- C. Samples for Verification: For each type and finish of extruded nosing.
- D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer licensed in the State of North Carolina and responsible for their preparation.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.

- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer licensed in the State of North Carolina, as defined in Section 014000 "Quality Requirements," to design ladders.
- B. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- G. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Harsco Industrial IKG, a Division of Harsco Corporation.
    - b. ROSS TECHNOLOGY CORP.
    - c. W.S. Molnar Company.
- H. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- I. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Zinc-Coated Steel Wire Rope: ASTM A 741.
  - 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.079-inch nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B 0.0677-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- L. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- M. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- N. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- O. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- P. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

### 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.

- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- C. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with primer specified in Section 099600 "High-Performance Coatings" where indicated.

## 2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
  - 1. Provide mitered and welded units at corners.
  - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.8 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, except for elevator pit ladders.
  - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
  - 1. Space siderails 18 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
  - 3. Rungs: 1-inch-diameter steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
  - 6. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.

7. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
8. Prime exterior ladders, including brackets and fasteners, with primer specified in Section 099600 "High-Performance Coatings."

## 2.9 ELEVATOR PIT SUMP COVERS

- A. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 1/2 inch in least dimension.
- B. Provide steel angle supports as indicated.

## 2.10 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with primer specified in Section 099600 "High-Performance Coatings."

## 2.11 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize plates.
- C. Prime plates with primer specified in Section 099600 "High-Performance Coatings."

## 2.12 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Galvanize and prime loose steel lintels located in exterior walls.
- C. Prime loose steel lintels located in exterior walls with primer specified in Section 099600 "High-Performance Coatings."

### 2.13 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

### 2.14 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

### 2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with primers specified in Section 099113 "Exterior Painting" primers specified in Section 099123 "Interior Painting" unless primers specified in Section 099600 "High-Performance Coatings" are indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

### 2.16 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.
- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## PART 3 EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  - 1. Cast Aluminum: Heavy coat of bituminous paint.
  - 2. Extruded Aluminum: Two coats of clear lacquer.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for ceiling hung toilet partitions and overhead grilles securely to, and rigidly brace from, building structure.
- C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

- D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
  - 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### 3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with non-shrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" or Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

**END OF SECTION**



## **SECTION 055113**

### **METAL PAN STAIRS**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Preassembled steel stairs with concrete-filled treads (ST-01 and ST-02).

##### **1.3 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs.
  - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
  - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For metal pan stairs and the following:
  - 1. Prefilled metal-pan-stair treads.
  - 2. Shop primer products.
  - 3. Nonslip-aggregate concrete finish.
  - 4. Abrasive-coating finish to formed-metal stairs.
  - 5. Grout.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
  - 3. Include plan at each level.

4. Indicate locations of anchors, weld plates, and blocking for attachment of handrails.
- C. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State of North Carolina.
- B. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
  2. Protect steel members and packaged materials from corrosion and deterioration.
  3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
    - a. Repair or replace damaged materials or structures as directed.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft.
  2. Concentrated Load: 300 lbf applied on an area of 4 sq. in.
  3. Uniform and concentrated loads need not be assumed to act concurrently.
  4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  5. Limit deflection of treads, platforms, and framing members to  $L/360$  or  $1/4$  inch, whichever is less.

## 2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- D. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- E. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

## 2.3 FASTENERS

- A. General: Provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5 where built into exterior walls.
  - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be shop primed with zinc-rich primer.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish system indicated.
- D. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- E. Prefilled Concrete Treads:
  - 1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi and maximum aggregate size of 1/2 inch unless otherwise indicated.
  - 2. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and nonglazing; unaffected by freezing, moisture, or cleaning materials.
  - 3. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
    - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- F. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs in shop to greatest extent possible.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Weld exposed corners and seams continuously unless otherwise indicated.
  5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  2. Locate joints where least conspicuous.
  3. Fabricate joints that will be exposed to weather in a manner to exclude water.
  4. Provide weep holes where water may accumulate internally.

## 2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Commercial Class, unless more stringent requirements are indicated.
- B. Stair Framing:
1. Fabricate stringers steel rectangular tubes.
    - a. Stringer Size: As required to comply with "Performance Requirements" Article.
    - b. Provide closures for exposed ends of channel and rectangular tube stringers.
    - c. Finish: Shop primed.
  2. Construct platforms of steel plate or channel or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article.
    - a. Provide closures for exposed ends of channel and rectangular tube framing.
    - b. Finish: Shop primed.
  3. Weld stringers to headers; weld framing members to stringers and headers.
  4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below.
    - a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
  5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch.
1. Steel Sheet: Uncoated, cold-rolled steel sheet.
  2. Directly weld metal pans to stringers; locate welds on top of subtreads where they will be concealed by concrete fill. Do not weld risers to stringers.
  3. Shape metal pans to include nosing integral with riser.
  4. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.
  5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
    - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

## 2.7 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
  - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
  - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates.
    - a. Clean bottom surface of plates.
    - b. Set plates for structural members on wedges, shims, or setting nuts.
    - c. Tighten anchor bolts after supported members have been positioned and plumbed.
    - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
    - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
      - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
      - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  - 3. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."
  - 1. Install abrasive nosings with anchors fully embedded in concrete.
  - 2. Center nosings on tread width.
- G. Install precast concrete treads with adhesive supplied by manufacturer.

### 3.3 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

**END OF SECTION**



## SECTION 055213

### PIPE AND TUBE RAILINGS

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel pipe railings.
- B. Related Requirements:
  - 1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
  - 2. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.

##### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
  - 3. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- C. Samples: For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
  - 2. Fittings and brackets.
  - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
    - a. Show method of connecting and finishing members at intersections.
- D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- E. Evaluation Reports: For post installed anchors, from ICC-ES.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
- B. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft.
    - b. Infill load and other loads need not be assumed to act concurrently.
  - 3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 4. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

## 2.3 STEEL AND IRON

- A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

## 2.4 FASTENERS

- A. General: Provide the following:
  - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
  - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
  - 3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
  - 1. Provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
  - 2. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
  - 3. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Intermediate Coats and Topcoats: Provide products that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Anchoring Cement: Factory-packaged, nonshrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form Changes in Direction as Follows:
  - 1. By bending or by inserting prefabricated flush-elbow fittings.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-

resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.
- Q. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

## 2.7 STEEL AND IRON FINISHES

- A. Galvanized Railings:
  - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
  - 2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  - 3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
  - 4. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- D. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  - 1. Shop prime uncoated railings with primers specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" unless indicated.
- G. Shop-Painted Finish: Comply with.
  - 1. Color: As selected by Architect from manufacturer's full range.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

### 3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

### 3.4 ANCHORING POSTS

- A. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.
- B. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

### 3.5 ATTACHING RAILINGS

- A. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

### 3.6 ADJUSTING AND CLEANING

- A. Clean and by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.
- C. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

### 3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Final Acceptance.

### **END OF SECTION**

## SECTION 057100

### DECORATIVE METAL STAIRS

#### PART 1 GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### 1.2 SUMMARY

- A. Section includes decorative metal stairs.
- B. Related Requirements:
  - 1. Section 096623 "Resinous Matrix Terrazzo Flooring" for terrazzo treads and landings.
  - 2. Section 055113 "Metal Pan Stairs" for metal pan treads and anchors.
  - 3. Section 057300 "Decorative Metal Railings".
  - 4. Section 057500 "Decorative Formed Metal" for monumental stair risers.

##### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs.
  - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry.
  - 2. Deliver such items to Project site in time for installation.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For metal stairs and the following:
  - 1. Shop primer products.
  - 2. Precast terrazzo treads.
  - 3. Grout.
  - 4. Wire mesh riser panel.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
  - 3. Include plan at each level.

4. Wire mesh riser panels.
  5. Precast/cast terrazzo tread assemblies.
- C. Samples for Verification: For each type and finish of tread.
1. Wire mesh samples for initial selection.
  2. Mock up of wire mesh riser panel.
- D. Delegated-Design Submittal: For stairs, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that the engineer is licensed in the State of North Carolina, where the Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, and railings, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
- C. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
- D. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
- E. Uniform and concentrated loads need not be assumed to act concurrently.
- F. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.

- G. Limit deflection of treads, platforms, and framing members to  $L/720$  or 1/4 inch (6.4 mm), whichever is less.
- H. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to structural requirements, see sheets S001.
- I. Component Importance Factor: See structural sheet S001 for Importance Factor requirements.

## 2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M (cold formed) or ASTM A 513/A 513M.
- D. Stainless Steel Bars and Shapes: ASTM A 276/A 276M, Type 304.
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.
- F. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- G. Stainless Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, stretcher-leveled standard of flatness.

## 2.3 ABRASIVE NOSINGS

- A. Abrasive Inserts: Shall consist of silicon carbide and black epoxy as indicated on drawings.

## 2.4 FASTENERS

- A. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- B. Post-Installed Anchors: chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941/F 1941M, Class Fe/Zn 5, unless otherwise indicated.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Electrodes: Comply with AWS requirements.
- B. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- D. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, steel, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated on Drawings.
- E. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
  - 1. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
  - 2. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs in shop to greatest extent possible.
  - 1. Disassemble units only as necessary for shipping and handling limitations.
  - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
  - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
  - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Weld exposed corners and seams continuously unless otherwise indicated.

5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
  1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
  2. Locate joints where least conspicuous.

## 2.7 FABRICATION OF STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.
- B. Stair Framing:
  1. Fabricate stringers of steel plates, channels or steel tubes in configuration indicated on Drawings.
    - a. Stringer Size: As required to comply with "Performance Requirements" and as indicated on Drawings to meet the aesthetic appearance indicated on drawings.
    - b. Provide closures for exposed ends of tube stringers.
    - c. Finish: shop primed.
  2. Construct platforms of steel plate, channel or rectangular tube headers and miscellaneous framing members as required to comply with "Performance Requirements" Article and to meet the aesthetic appearance indicated on drawings.
    - a. Provide closures for exposed ends of tube framing.
    - b. Finish: Shop primed.
  3. Weld stringers to headers; weld framing members to stringers and headers.
- C. Risers.
  1. See Section 057500 "Decorative Formed Metal" for monumental stair risers.

## 2.8 STAIR RAILINGS

- A. Comply with applicable requirements in Section 057300 "Decorative Metal Railings."

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLING METAL STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
  - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
  - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates.
    - a. Clean bottom surface of plates.
    - b. Set plates for structural members on wedges, shims, or setting nuts.
    - c. Tighten anchor bolts after supported members have been positioned and plumbed.
    - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
    - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
      - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
      - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- E. Fit exposed connections accurately together to form hairline joints.
  - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
  - 2. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
  - 3. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

### 3.3 REPAIRS

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

**END OF SECTION**

## SECTION 057300

### DECORATIVE METAL RAILINGS

#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section Includes:
  - 1. Aluminum decorative metal railings at the monumental stairs.
- B. Related Requirements:
  - 1. Section 055213 "Pipe and Tube Railings" for nonornamental railings fabricated from pipes and tubes.
  - 2. Section 057100 "Decorative Metal Stairs."

##### 1.2 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not meet structural performance requirements.

##### 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Manufacturer's product lines of decorative metal railings assembled from standard components.
  - 2. Vertical picket infill panels.
  - 3. Fasteners.
  - 4. Post-installed anchors.
  - 5. Finishes.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
- C. Sustainable Design Submittals:
  - 1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
- D. Finish Samples for Initial Selection: For products involving selection of color, texture, or design.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: The manufacturer of railing system or a qualified installation firm that is approved, authorized, or licensed by railing system manufacturer to install manufacturer's products.

#### 1.5 MOCKUPS

- A. Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
  - 1. Build mockups as full-height assembly.

#### 1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

### PART 2 PRODUCTS

#### 2.1 SOURCE LIMITATIONS

- A. Obtain decorative metal railing systems from single source from single manufacturer. Systems must be designed, engineered, and fabricated by manufacturer of railing system.

#### 2.2 MANUFACTURERS

- A. Interior Aluminum Decorative Metal Railings:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide VIVA Railings, LLC (info@vivarailings, 972-353-8482); SLAT Picket Railing System or comparable product by one of the following:
    - a. All Fab Railings & Metalworks.
    - b. American Security & Gate Company.
    - c. US Glass Fence.
- B. Exterior Aluminum Decorative Metal Railings.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide VIVA Railings, LLC; STRUC PANEL Railing System or comparable product by one of the following:
    - a. All Fab Railings & Metalworks.
    - b. American Security & Gate Company.
    - c. US Glass Fence.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 016000 "Product Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory

data to Architect for review.

- D. Structural Performance: Decorative metal railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.

## 2.3 METALS

- A. Pickets & Top Rail: Extruded Bars and Shape per ASTM B221 (ASTM B221M), Alloy 6063-T5/T52.
- B. Handrail: Tubular stainless steel pipe with round cross-section shape.
- C. Laser-Cut "Structural" Panels: Aluminum sheet, with [pattern design as selected from VIVA Railings' Library] [custom pattern in accordance with Architect's design] with folded structural edges on all sides.
1. Aluminum Sheet: AA5052-H32 alloy and temper; thickness per engineering requirements, delegated design by manufacturer.
  2. Pattern: Architect to select from manufacturer's full range of patterns and finishes.

## 2.4 FABRICATION

- A. General: Fabricate decorative metal railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Form work true to line and level with accurate angles and surfaces.
- C. Fabricate connections that will be exposed to weather in a manner to exclude water.
1. Provide weep holes where water may accumulate.
  2. Locate weep holes in inconspicuous locations.
- D. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- E. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings.
1. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  2. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

## 2.5 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Stainless Steel Finishes:
  - 1. Handrail: Powder-coat; Custom color match to Architect's sample.

## 2.6 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Top and Bottom Rail: Custom color match to Architect's sample.
  - 2. Aluminum Pickets: Custom color match to Architect's sample.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Installation Tolerances: Structural steel and concrete slabs to be within 1/8 inch (3 mm) in 10 ft. (3.048 m) horizontally and 1/8 inch (3 mm) vertically. Correct out-of-tolerance conditions to meet railing manufacturer's requirements.

### 3.2 INSTALLATION, GENERAL

- A. Comply with Drawings and manufacturer's written instructions for installing glazed decorative metal railings, accessories, and other components.
- B. Perform cutting, drilling, and fitting required for installing railings.
  - 1. Fit exposed connections together to form tight, hairline joints.
  - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
  - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.3 METAL RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

### 3.4 INSTALLATION OF METAL RAILING

- A. Metal Railings and Guards: Install assembly to comply with railing manufacturer's written instructions and with requirements in other Part 3 articles.

### 3.5 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Final Acceptance.
- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

**END OF SECTION**



## **SECTION 077200**

### **ROOF ACCESSORIES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Roof curbs.
  - 2. Equipment supports.
  - 3. Roof hatches.
- B. Related Sections:
  - 1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.

##### **1.3 COORDINATION**

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of roof accessory.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
  - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Delegated-Design Submittal: For roof curbs and equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
  1. Size and location of roof accessories specified in this Section.
  2. Method of attaching roof accessories to roof or building structure.
  3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
  4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

#### 1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Final Acceptance.

### PART 2 PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design roof curbs and equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Wind-Restraint Performance: As indicated on Drawings.

## 2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate with specified equipment.
- D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick.
  - 1. Finish: Baked enamel or powder coat.
  - 2. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
  - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
  - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
  - 3. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
  - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
  - 5. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
  - 6. Liner: Same material as curb, of manufacturer's standard thickness and finish.
  - 7. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
  - 8. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing required to meet wind uplift requirements.
  - 9. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
  - 10. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
  - 11. Security Grille: Provide for all units.
  - 12. Damper Tray: Provide damper tray or shelf with opening of size indicated.

## 2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.

- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate with specified equipment.
- D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick.
  - 1. Finish: Baked enamel or powder coat.
  - 2. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
  - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
  - 2. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
  - 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
  - 4. Nailer: Factory-installed continuous wood nailers 5-1/2 inches (140 mm) wide on top flange of equipment supports, continuous around support perimeter.
  - 5. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
  - 6. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
  - 7. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
  - 8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
  - 9. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
  - 10. Security Grille: Provide for all units.

## 2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

## 2.5 MANUFACTURERS:

- A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Acudor Products, Inc.
  - 2. AES Industries, Inc.
  - 3. Architectural Specialties, Inc.
  - 4. Babcock-Davis.
  - 5. Custom Solution Roof and Metal Products.
  - 6. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - 7. Milcor; Commercial Products Group of Hart & Cooley, Inc.

8. Nystrom, Inc.
  9. O'Keeffe's Inc.
  10. Precision Ladders, LLC.
- B. Type and Size: Single-leaf lid, 36 by 48 inches (750 by 900 mm.).
- C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.
1. Thickness: Manufacturer's standard thickness for hatch size indicated.
  2. Finish: Baked enamel or powder coat.
  3. Color: As selected by Architect from manufacturer's full range.
- E. Construction:
1. Insulation: Polyisocyanurate board.
    - a. R-Value: 12.0 according to ASTM C 1363.
  2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
  3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
  4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
  5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
  6. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
  7. Sloping Roofs: Equip hatch with water diverter or cricket on side that obstructs water flow.
- F. Hardware: Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
1. Height: 42 inches above finished roof deck.
  2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
  3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
  4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
  5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
  6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
  7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
  8. Fabricate joints exposed to weather to be watertight.
  9. Fasteners: Manufacturer's standard, finished to match railing system.
  10. Finish: Manufacturer's standard.
    - a. Color: As selected by Architect from manufacturer's full range.

- H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
  - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
  - 2. Height: 42 inches (1060 mm) above finished roof deck.
  - 3. Material: Steel tube.
  - 4. Post: 1-5/8-inch- (41-mm-) diameter pipe.
  - 5. Finish: Manufacturer's standard baked enamel or powder coat.
    - a. Color: As selected by Architect from manufacturer's full range.

## 2.6 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
  - 1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil (0.005 mm).
  - 2. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).
- B. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

## 2.7 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

## 2.8 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
  - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
  - 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

- E. Roof-Hatch Installation:
  - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
  - 2. Attach safety railing system to roof-hatch curb.
  - 3. Attach ladder-assist post according to manufacturer's written instructions.

### 3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

**END OF SECTION**

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## **SECTION 221316 - SANITARY WASTE AND VENT PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Ductile-iron pipe and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

**B. Related Requirements:**

1. Section 221329 "Sanitary Sewerage Pumps" for effluent and sewage pumps.
2. Section 226600 "Chemical-Waste Systems for Laboratory and Healthcare Facilities" for chemical-waste and vent piping systems.
3. Section 333115 "Site Sanitary Sewerage Piping" for sanitary sewerage piping and structures outside the building.

#### **1.2 ACTION SUBMITTALS**

**A. Product Data:** For each type of product.

**B. Sustainable Design Submittals:**

**C. Shop Drawings:** For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

#### **1.3 INFORMATIONAL SUBMITTALS**

**A. Coordination Drawings:** Plans and elevations, or Building Information Model (BIM) drawn to scale, showing items described in this Section and coordinated with all building trades.

**B. Seismic Qualification Certificates:** For waste and vent piping, accessories, and components, from manufacturer.

1. **Basis for Certification:** Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

**C. Field quality-control reports.**

#### **1.4 FIELD CONDITIONS**

**A. Interruption of Existing Sanitary Waste Service:** Do not interrupt service to facilities occupied by Owner

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or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:

1. Notify [Architect][Construction Manager][Owner] no fewer than [two]<Insert number> days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without [Architect's][Construction Manager's][Owner's] written permission.

## 1.5 WARRANTY

- A. Listed manufacturers to provide labeling and warranty of their respective products.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:
  1. Soil, Waste, and Vent Piping: **[10 ft. head of water]**<Insert pressure>.
  2. Waste, Force-Main Piping: **[50 psig][100 psig][150 psig]**<Insert pressure>.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation to withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7]<Insert requirement>. See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment":
  1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[ **and the unit will be fully operational after the seismic event**]."
  2. Component Importance Factor: **[1.5][1.0]**.
- C. <Insert requirements for Component Amplification Factor and Component Response Modification Factor>.

### 2.2 PIPING MATERIALS

- A. Piping materials to bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

### 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, **[provide products by the following][provide products by one of the following][available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]**:
  1. **[American Cast Iron Pipe Company]**
  2. **[Apollo Valves; a part of Aalberts Integrated Piping Systems]**

3. [McWane Ductile; a part of the McWane family of companies]
4. [U.S. Pipe]
5. <Insert manufacturer's name>

B. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

D. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends in accordance with AWWA C606.

## 2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections of same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

## 2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A674 or AWWA C105/A 21.5.

B. Material: [Linear low-density polyethylene film of **0.008-inch**][or][high-density, cross-laminated polyethylene film of **0.004-inch**] minimum thickness.

C. Form: [Sheet][or][tube].

D. Color: [Black][or][natural]<Insert color>.

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## **PART 3 - EXECUTION**

### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### **3.2 INSTALLATION OF PIPING**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in **[Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment"]****[Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"]**.
- K. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.

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- L. Lay buried building waste piping beginning at low point of each system.
    - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
    - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
    - 3. Maintain swab in piping and pull past each joint as completed.
  
  - M. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
    - 1. Building Sanitary Waste: Two percent downward in direction of flow for piping **NPS 3** and smaller; [1][2]<Insert number> percent downward in direction of flow for piping **NPS 4** and larger.
    - 2. Horizontal Sanitary Waste Piping: [**Two**]<Insert number> percent downward in direction of flow.
    - 3. Vent Piping: [**One**]<Insert number> percent down toward vertical fixture vent or toward vent stack.
  
  - N. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
    - 1. Install encasement on underground piping in accordance with ASTM A674 or AWWA C105/A 21.5.
  
  - O. Install steel piping in accordance with applicable plumbing code.
  
  - P. Install stainless steel piping in accordance with ASME A112.3.1 and applicable plumbing code.
  
  - Q. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."
  
  - R. Install aboveground ABS piping in accordance with ASTM D2661.
  
  - S. Install aboveground PVC piping in accordance with ASTM D2665.
  
  - T. Install underground [**ABS**][and][**PVC**] piping in accordance with ASTM D2321.
  
  - U. Install engineered soil and waste and vent piping systems as follows:
    - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
    - 2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
    - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
  
  - V. Install underground, ductile-iron, force-main piping according to AWWA C600.
    - 1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
    - 2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
    - 3. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
  
  - W. Install underground, copper, force-main tubing in accordance with CDA's "Copper Tube Handbook."
    - 1. Install encasement on piping in accordance with ASTM A674 or AWWA C105/A 21.5.
  
  - X. Install force mains at elevations indicated.
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- Y. Plumbing Specialties:
1. Install backwater valves in sanitary waster gravity-flow piping.
    - a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
  2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
    - a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
    - b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
  3. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- Z. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- AA. Install sleeves for piping penetrations of walls, ceilings, and floors.
  1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."
- BB. Install sleeve seals for piping penetrations of concrete walls and slabs.
  1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."
- CC. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

### 3.3 JOINT CONSTRUCTION

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.
- C. Hubless, Cast-Iron Soil Piping Coupled Joints:
  1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.
  1. Cut threads full and clean using sharp dies.
  2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as

follows:

- a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
  - c. Do not use pipe sections that have cracked or open welds.
- E. Join stainless steel pipe and fittings with gaskets in accordance with ASME A112.3.1.
- F. Join copper tube and fittings with soldered joints in accordance with ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.
- G. Grooved Joints: Cut groove ends of pipe in accordance with AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket, with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join in accordance with ASTM D2235 and ASTM D2661 appendixes.
  3. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendixes.
- J. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
    - a. Provide axial restraint for pipe and fittings [**5 inches**]**<Insert dimensions>** and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
    - b. Provide rigid sway bracing for pipe and fittings [**4 inches**]**<Insert dimensions>** and larger, upstream and downstream of all changes in direction 45 degrees and greater.
    - c. Provide rigid sway bracing for pipe and fittings [**5 inches**]**<Insert dimensions>** and larger, upstream and downstream of all changes in direction and branch openings.

### 3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

#### A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: [**Unshielded**][**Shielded**], nonpressure transition couplings.
3. In Aboveground Force Main Piping: Fitting-type transition couplings.
4. In Underground Force Main Piping:
  - a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
  - b. NPS 2 (DN 50) and Larger: Pressure transition couplings.

#### B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric [**nipples**][**unions**].
3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric [**flanges**][**flange kits**][**nipples**].
4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.5 INSTALLATION OF VALVES

- A. General valve installation requirements for general-duty valve installation are specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- B. Shutoff Valves:
  1. Install shutoff valve on each sewage pump discharge.
  2. Install [**gate**][**full-port ball**] valve for piping NPS 2 and smaller.
  3. Install [**gate**]<Insert type> valve for piping NPS 2-1/2 and larger.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  1. Horizontal Piping: Horizontal backwater valves. [ **Use normally closed type unless otherwise indicated.**]
  2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
  3. Install backwater valves in accessible locations.
  4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

### 3.6 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in [**Section 220529 "Hangers and Supports for Plumbing Piping and Equipment"**][**Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment"**].
  1. Install [**carbon-steel**]<Insert material> pipe hangers for horizontal piping in noncorrosive environments.
  2. Install [**stainless steel**][**fiberglass**] pipe hangers for horizontal piping in corrosive environments.
  3. Install [**carbon-steel**]<Insert material> pipe support clamps for vertical piping in noncorrosive environments.
  4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
  5. Vertical Piping: MSS Type 8 or Type 42 clamps.
  6. Install individual, straight, horizontal piping runs:
    - a. 100 Ft. (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Ft. (30 m): MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Ft. (30 m) if Indicated: MSS Type 49, spring cushion rolls.
  7. Multiple, Straight, Horizontal Piping Runs 100 Ft. (30 m) or Longer: MSS Type 44 pipe rolls.

- 
- Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.
- C. Install hangers for [**cast-iron**][**steel**][**stainless steel**][**and**][**copper**] soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- D. Install hangers for [**ABS**][**and**][**PVC**] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- E. Support horizontal piping and tubing within **12 inches** of each fitting[, **valve,**] and coupling.
- F. Support vertical runs of [**cast-iron**][**steel**][**stainless steel**][**and**][**copper**] soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- G. Support vertical runs of [**ABS**][**and**][**PVC**] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  5. Install horizontal backwater valves [**with cleanout cover flush with floor**][**in pit with pit cover flush with floor**]-<Insert description>.
  6. Comply with requirements for [**backwater valves**][**cleanouts**][**and**][**drains**] specified in Section 221319 "Sanitary Waste Piping Specialties."
  7. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections **NPS 2-1/2** and larger.
- D. Connect force-main piping to the following:
1. Sanitary Sewer: To exterior force main.
  2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

- 
- F. Make connections in accordance with the following unless otherwise indicated:
1. Install unions, in piping **NPS 2** and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping **NPS 2-1/2** and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.8 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.9 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. **Roughing-in Inspection:** Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. **Final Inspection:** Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. **Reinspection:** If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. **Reports:** Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  3. **Roughing-in Plumbing Test Procedure:** Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than **10 ft. head of water**.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  4. **Finished Plumbing Test Procedure:** After plumbing fixtures have been set and traps filled with
-

water, test connections and prove they are gastight and watertight.

- a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of **1 inch wg**.
  - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
  - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
  - d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.
- E. Test force-main piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  2. Cap and subject piping to static-water pressure of **50 psig** above operating pressure, without exceeding pressure rating of piping system materials.
    - a. Isolate test source and allow to stand for four hours.
    - b. Leaks and loss in test pressure constitute defects that must be repaired.
  3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  4. Prepare reports for tests and required corrective action.

### 3.10 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed Plastic Piping: Protect [**ABS**][**PVC**] plumbing vents exposed to sunlight with two coats of water-based latex paint.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

### 3.11 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller are to be the following:
  1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.

- 
2. Hubless, cast-iron soil pipe and fittings[ **and hubless, single-stack aerator fittings**]; [CISPI][**heavy-duty**] hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
  5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  6. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.
  7. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
  8. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings [ **and hubless, single-stack aerator fittings**]; [CISPI][**heavy-duty**] hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings, sealing rings, and gasketed joints.
  5. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
  6. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.
- D. Aboveground, vent piping NPS 4 (DN 100) is to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; [CISPI][**heavy-duty**] hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. Stainless steel pipe and fittings gaskets, and gasketed joints.
  5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  6. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.
  7. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
  8. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.
- E. Aboveground, vent piping NPS 5 (DN 125) and larger is to be the following:
1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
  2. Hubless, cast-iron soil pipe and fittings; [CISPI][**heavy-duty**] hubless-piping couplings; and coupled joints.
  3. Galvanized-steel pipe, drainage fittings, and threaded joints.
  4. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
  5. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.
- F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller are to be the following:
1. [**Extra-heavy**][**Service**] cast-iron soil piping; [**gaskets; and gasketed**][**caulking materials; and caulked**] joints.
  2. Hubless, cast-iron soil pipe and fittings; [CISPI][**heavy-duty**][**cast-iron**] hubless-piping couplings; and coupled joints.
  3. Stainless steel pipe and fittings, gaskets, and gasketed joints.
  4. [**Solid-wall**][**Cellular-core**] ABS pipe, ABS socket fittings, and solvent-cemented joints.
  5. [**Solid-wall**][**Cellular-core**] PVC pipe, PVC socket fittings, and solvent-cemented joints.
  6. Dissimilar Pipe-Material Couplings: [**Unshielded**][**Shielded**], nonpressure transition couplings.
-

- 
- G. Underground, soil and waste piping NPS 5 (DN 125) and larger are to be the following:
1. **[Extra-heavy][Service]**, cast-iron soil piping; **[gaskets; and gasketed][caulking materials; and caulked]** joints.
  2. Hubless, cast-iron soil pipe and fittings; **[CISPI][heavy-duty][cast-iron]** hubless-piping couplings; coupled joints.
  3. **[Solid-wall][Cellular-core]** PVC pipe, PVC socket fittings, and solvent-cemented joints.
  4. Dissimilar Pipe-Material Couplings: **[Unshielded][Shielded]**, nonpressure transition couplings.
- H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) are to be the following:
1. Hard copper tube, **Type L**; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
- I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) are to be the following:
1. Hard copper tube, **Type L**; copper pressure fittings; and soldered joints.
  2. Galvanized-steel pipe, pressure fittings, and threaded joints.
  3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
- J. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller are to be the following:
1. **[Hard][Soft]** copper tube, **Type L**; **[wrought-]**copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Ductile-iron, push-on-joint piping and push-on joints.
  4. Ductile-iron, grooved-joint piping and grooved joints.
  5. Fitting-type transition coupling for piping smaller than **NPS 1-1/2** and pressure transition coupling for **NPS 1-1/2** and larger if dissimilar pipe materials.
- K. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger are to be the following:
1. Hard copper tube, **Type L**; **[wrought-]**copper pressure fittings; and soldered joints.
  2. Ductile-iron, mechanical-joint piping and mechanical joints.
  3. Ductile-iron, push-on-joint piping and push-on joints.
  4. Ductile-iron, grooved-joint piping and grooved joints.
  5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221316



**SECTION 260000 - SUMMARY OF ELECTRICAL WORK**

Engineer of Record for electrical work is Matthew J. Johnson, PE, Salas O'Brien, 702 Oberlin Road, Suite 300, Raleigh, NC 27605. Electrical work shall be defined by drawings numbered with the prefix "E", the general provisions of the Contract including General Conditions and Supplementary Conditions, Division 1 Specifications sections, and Division 26-28 Technical Specifications listed below. In addition, electrical work may be defined by reference to other documents from any of the above-named sources as well as by project addenda.



**DIVISION 26 - ELECTRICAL**

<b>Section</b>	<b>Title</b>
260000	Summary of Electrical Work
260500	Basic Electrical Requirements
262413	Switchboards
262550	Generator Docking Station
263213	Diesel Generator Set
263623	Automatic and Non-Automatic Transfer Switches

**END OF SECTION 260000**



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**SECTION 260500 - BASIC ELECTRICAL REQUIREMENTS**

**PART 1 - GENERAL**

**RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

**SCOPE**

The electrical design for this project is based on the requirements of the *National Electrical Code (NEC)*, NFPA-70, 2020 Edition. Where not restricted to more stringent requirements by the Drawings and Specifications, the minimum requirements of the NEC shall prevail.

**DEFINITIONS**

**Labeled:** Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization accredited by NCBCC (North Carolina Building Code Council) to label electrical equipment and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

**Listed:** Equipment or materials included in a list published by an organization accredited by NCBCC (North Carolina Building Code Council) to label electrical equipment and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials, and whose listing states either that the equipment or material meets appropriate designated standards or has been tested and found suitable for use in a specified manner.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**DUTIES OF CONTRACTOR**

The Drawings are generally diagrammatic in nature and are neither intended to show each fitting, box, elbow, offset, hanger, *etc.*, nor a complete detail of all work to be done. The Drawings are for the purpose of illustrating the type of system, showing raceway sizes, *etc.*, and special conditions considered necessary for the experienced mechanic to take off materials and lay out work. This Contractor shall be responsible for taking such measurement as may be necessary at the job and adapting his work to local conditions.

**SUBMITTALS**

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

**Manufacturer's Data:** Submit manufacturer's technical product data.

1 **NAMEPLATE DATA**

2  
3 Each item of electrical utilization equipment shall be provided with a permanent operational data nameplate that shall,  
4 as a minimum, indicate the following: equipment manufacturer, product name, model number, serial number,  
5 capacity, voltage requirements, and either full load current or full load volt-amperes. Labels of tested compliances  
6 and similar essential data shall be a part of this label or located nearby. All equipment nameplates shall be in an  
7 accessible location.

8  
9 In the event that the installation of equipment renders the manufacturer's nameplate inaccessible, the above  
10 information shall be etched onto a laminated plastic nameplate securely fastened to the equipment by no less than  
11 two machine screws or by other fastening methods approved by the A-E.

12  
13  
14 **FLASH PROTECTION WARNING**

15  
16 Each piece of new electrical equipment, such as switchboards, parallel switchgear, panelboards, circuit breaker  
17 enclosures, control panels, motor control centers, transfer switches, etc. that are likely to require examination,  
18 adjustment, servicing or maintenance while energized, shall be field marked in a clearly visible location on the  
19 equipment enclosure to warn qualified persons of potential electric arc flash hazards, in accordance with NEC  
20 110.16.

21  
22  
23 **TESTING LABORATORY APPROVAL**

24  
25 All equipment shall be approved for the intended use and shall be Labeled or Listed. In any case where the suitability  
26 for a particular application is in question by the A-E or inspection authorities the Contractor shall furnish appropriate  
27 standards covering the specific piece of equipment in question. Such standards, if required, shall be requested by  
28 the A-E in writing and shall be furnished by the Contractor at no additional cost.

29  
30  
31 **END OF SECTION 260500**

**SECTION 262413 - SWITCHBOARDS**

**PART 1 - GENERAL**

**RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

**QUALITY ASSURANCE**

**Manufacturers:** Firms regularly engaged in manufacture of switchboards, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment. Subject to compliance with requirements provide equipment equivalent to that provided by one of the following manufacturers:

- Square D
- Cutler Hammer
- GE/ABB
- Siemens

**Codes and Standards:**

**Electrical Code Compliance:** Comply with applicable State code requirements of the authority having jurisdiction, and that portion of the NEC that pertains to installation and construction of switchboards.

**Testing Laboratory Compliance:** Comply with applicable requirements of UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," UL 489, "Molded-Case Circuit Breakers and Circuit Breaker Enclosures", and UL 891, "Dead-Front Electrical Switchboards", pertaining to installation and construction of switchboards. Provide switchboards and components that are Listed and Labeled. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment.

**IEEE Compliance:** Comply with applicable requirements of IEEE Std. 241, "Recommended Practice for Electric Power Systems in Commercial Buildings", pertaining to switchboards.

**ANSI Compliance:** Comply with applicable requirements of ANSI standards pertaining to switchboard assemblies.

**NEMA Compliance:** Comply with applicable portions of NEMA Stds. Pub/No. PB 2, "Dead-front Distribution Switchboards"; PB 2.1, "General Instruction for Proper Handling, Installation, Operation and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less"; and SG 3, "Low-Voltage Power Circuit Breakers"; pertaining to switchboard assemblies.

**SUBMITTALS**

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

**Product Data:** Submit manufacturer's data on switchboards including, but not limited to, voltages, number of phases, frequency, and short-circuit and continuous current ratings. Provide application data for main and branch circuit-breakers, sections, main buses, and basic insulation levels.

**Submit Time-Current Timing Charts:** Provide response curves for all overcurrent protection devices furnished as a part of the project. Provide specific circuit breaker and trip unit model numbers for all specified electronic trip breakers, with available settings for engineer's use in developing system coordination.

1 Shop Drawings: Submit layout drawings of switchboards showing accurately scaled basic equipment sections  
2 including auxiliary compartments, section components, and combination sections.

3  
4 Wiring Diagrams: Submit wiring diagrams for switchboards showing connections to electrical power feeders and  
5 distribution branches. Differentiate between portions of wiring that are manufacturer-installed and portions that are  
6 field-installed.

7  
8  
9 **PART 2 - PRODUCTS**

10  
11  
12 **EQUIPMENT SECTIONS AND COMPONENTS**

13  
14 General: Except as otherwise indicated, provide switchboards and ancillary components of types, sizes,  
15 characteristics, and ratings indicated, which comply with manufacturer's standard design, materials, components, and  
16 which are constructed in accordance with published product information, and as required for complete installation.

17  
18 AC Dead-Front Distribution Switchboards: Provide factory-assembled, dead-front, front accessible, 48" maximum  
19 depth metal-enclosed, self-supporting secondary power switchboard, of types, sizes, electrical ratings and  
20 characteristics indicated. Switchboard shall consist of vertical panel units and shall contain circuit-breakers or circuit  
21 breaker assemblies of quantities, ratings and types indicated. Provide copper main bus and connections to switching  
22 devices and circuit-breaker branches of sufficient capacity to limit rated continuous current operating temperature rise  
23 of no greater than 65°C above average ambient temperature of 30°C. Main bus and tap connections shall be silver-  
24 surfaced and bolted tightly according to manufacturer's torquing requirements for maximum conductivity. All bussing  
25 shall be braced for short-circuit stresses up to maximum interrupting capacity. Provide accessibility of line and load  
26 terminations from front of switchboard. Provide mimic bus on front of switchboard to indicate interior connection and  
27 switching arrangement. Switchboard shall be primed and coated with manufacturer's standard finish and color.  
28 Equip units with built-in lifting eyes and yokes; provide vertical individual panel units, suitable for bolting together at  
29 project site.

30  
31 Enclosures:

32  
33 Construct dead-front switchboard, suitable for floor mounting, with front cabling/wiring accessibility, and  
34 conduit accessibility as indicated or required by the application. Provide welded steel channel framework;  
35 hinge wireway front covers to permit ready access to branch circuit-breaker load side terminals or equivalent  
36 terminal accessibility; circuit breaker nameplates and ratings plates shall be visible when terminal covers are  
37 in place. Coat enclosure with manufacturer's standard corrosive-resistant finish where indicated by the  
38 drawings.

39  
40 Enclosure construction shall be NEMA1 for indoor locations and NEMA 3R for outdoor locations.

41  
42 Paint shall be light gray epoxy paint ANSI 61 for the exterior of enclosure.

43  
44 Main and Vertical Buses:

45  
46 The metal of the buses shall be silver plated copper.

47  
48 Operating temperature, at 40°C ambient, of all buswork and joints shall not exceed prevailing ANSI limits.

49  
50 The end of the main bus shall be arranged such that future extension of the switchgear is possible.

51  
52 Minimum ampacity of main bus shall be as indicated on the Drawings.

53  
54 Vertical bus capacity shall be as indicated on the Drawings.

55  
56 All feeder breaker taps and plug-in connectors shall have an ampacity that is at least as large as the  
57 connected device but in no case shall the connectors have an ampacity less than 800 A capacity.

1 Bus (or "line") connections to circuit breakers shall be as indicated on the Drawings.

2

3 Bus bracing shall be as indicated on the Drawings but in no case shall the RMS symmetrical ampere  
4 interrupting rating be less than 42,000 Amperes.

5

6 Redundant Spaces:

7

8 Compartments designated on the Drawings as "SPACE" shall be completely equipped for future addition of  
9 a circuit breaker of the frame size indicated.

10

11 Ground Bus: A main bolted copper ground bus shall run throughout the length of the switchgear along the bottom.

12

13 Two bolted type connectors, one at each end, shall be provided for #4/0 cables, bolt size shall be 3/8"  
14 diameter.

15

16 All framework, metal enclosures, and non-current carrying parts of equipment shall be securely grounded by  
17 means of this ground bus.

18

19 The ampacity of the ground bus shall equal half the capacity of the phase bus or a minimum of 1,600 A.

20

21 Neutral Bus:

22

23 A neutral bus shall be provided with an ampacity of the main bus and extend the full length of the  
24 switchgear.

25

26 The neutral bus shall be fully insulated from ground except at one point where connection to the ground bus  
27 will be made by a removable conductor supplied with the switchgear and sized equally to the neutral bus.

28

29 Nameplates:

30

31 A 1-1/2" x 4" laminated phenolic nameplate engraved to show white letters on a black background shall be  
32 attached to the door of each compartment. Three lines of 3/16" high lettering should be provided.

33

34 Permanent nameplates shall be provided identifying each instrument switch, circuit breaker, meter, relay, or  
35 other item of equipment. Submit all nameplate wording for approval before constructing nameplates.

36

37 Nameplates shall be fastened with self-tapping metal screws and shall be removable. Adhesive shall not be  
38 used.

39

40 Main Feeder Entrance: The main feeder shall enter the equipment as indicated on the Drawings.

41

42 Conduit Exit: Provision shall be made for feeder conduits or armored cables to exit top or bottom of switchboard  
43 housing for field changes.

44

45 Circuit Breakers:

46

47 General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes,  
48 ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials,  
49 components, and constructed in accordance with published product information, and as required for a  
50 complete installation.

51

1            Insulated-Case Circuit Breakers:

2  
3            Provide factory-assembled draw-out type, insulated-case circuit breakers of frame sizes and ampere rating  
4 as indicated for main breakers in switchboard. Unless otherwise indicated in the Drawings, all circuit  
5 breakers are to be rated 480 Volts, 60 Hz, 3-poles with a minimum 42,000 RMS symmetrical Ampere  
6 interrupting rating. Provide breakers with solid state trip control units **(L, S, I, G)** responsive to current in  
7 each pole and ampere ratings as indicated. Provide breakers rated at 1,200 Amps and larger with  
8 maintenance switch and associated indicator light to permit the reduction of arc energy at and beyond the  
9 load side terminals for the breaker. Construct circuit breakers with pushbuttons for opening and closing  
10 contacts via mechanical operator. Pushbuttons shall have independently lockable transparent cover blocks.  
11 Provide with locking provisions for off position. Breaker shall also have door interlock to prevent closure of  
12 contracts while door is opened. Draw out mechanism shall be mechanically interlocked with circuit breaker's  
13 trip mechanism so that breaker must be OPEN before it can be moved into or out of the connected position.  
14 The breaker shall automatically trip open if it is withdrawn while in closed position. Breaker shall also trip  
15 open before it is racked into the engaged position. Construct breakers capable of being operated in an  
16 ambient temperature of 40°C.

17  
18            Molded-Case Circuit Breakers:

19  
20            Provide factory-assembled molded-case circuit breakers of frame sizes and ampere rating as indicated.  
21 Unless otherwise indicated in the Drawings, all circuit breakers are to be rated 480 Volts, 60 Hz, 3-poles with  
22 a minimum 42,000 RMS symmetrical Ampere interrupting rating. Provide breakers rated 400 Amps and  
23 larger with solid state trip control units **(L, S, I, G) or (L, S, I)** responsive to current in each pole and ampere  
24 ratings as indicated. Provide breakers rated at 1,200 Amps and larger with maintenance switch and  
25 associated indicator light to permit the reduction of arc energy at and beyond the load side terminals for the  
26 breaker. Construct circuit breakers with overcenter, trip-free, toggle-type operating mechanisms with  
27 quick-make, quick-break action and positive handle trip indication. Provide push-to-trip button on enclosure  
28 cover for mechanically tripping circuit breakers. Construct breakers for mounting and operating in any  
29 physical position and capable of being operated in an ambient temperature of 40°C. Provide breakers with  
30 mechanical screw type removable connector lugs, AL/CU rated, and with NEMA Type 1 general purpose  
31 enclosures.

32  
33            Electronic Trip Circuit Breakers: Provide electronic trip units for breakers, where required in this section, with field-  
34 replaceable rating plug and RMS sensing, responsive to current in each pole. Provide following field-adjustable  
35 settings:

- 36  
37            1. Instantaneous trip.  
38            2. Long and short-time pickup levels.  
39            3. Long and short-time delay adjustments.

40  
41            Provide ground fault pickup for breakers rated 1,000 amps and larger, where unit serves as a main disconnecting  
42 means, as required under NEC.

- 43  
44            1. Ground-fault pickup level, time delay and I<sup>2</sup>t response.

45  
46            Fully Rated Circuit Breakers: Unless specifically indicated on the Drawings all circuit breakers shall be fully rated.  
47 The use of 'series ratings' is not permitted.

48  
49            Internal Breaker Accessories: Provide molded-case breaker accessories as indicated in the Drawings or as required  
50 for the operations described in the Drawings.

51  
52            Busing: Provide switchboard busing with sufficient cross-sectional area to fulfill UL 891 pertaining to temperature  
53 rise. Construct through-bus of silver-plated copper with ampacity rating as indicated and with a minimum short-circuit  
54 current rating of 42,000 A RMS symmetrical or as otherwise indicated in the Drawings.

55  
56            Metering: Provide metering compartments for CT's, PT's and instrument transfer switches, and connect meters for  
57 sequence metering. Mount meters recessed in front doors and install meter wiring and lacing with sufficient flexibility  
58 at hinged edge of meter front mounting plates to prevent damage.

1 Ground-Fault Protectors: Provide solid-state ground-fault protection units of types, and ratings indicated, equipped  
2 with static relays, sensors, pilot lights and push-buttons for fault indication and reset, including fuse blocks, fuses,  
3 control power transformers or other accessories necessary for proper operation.  
4

5  
6 **AUXILIARY EQUIPMENT**

7  
8 Metering, Main Bus:

9  
10 Main switchboard metering is to be located in the main breaker section as shown on drawings. Metering is  
11 to be of the solid state type and shall provide, as a minimum the metering and remote indicating functions  
12 indicated.  
13

14 Instrument Transformer Fuses: Potential and control power transformers, where used, shall be provided with primary  
15 current-limiting fuses.  
16

17  
18 **ARRANGEMENT**

19  
20 General: Switchboard is to be arranged and mounted as indicated on the Drawings.  
21

22 Data to be Furnished when the Equipment is Shipped: The vendor shall furnish four copies of all shop drawings,  
23 operations and maintenance manuals of this equipment.  
24

25 Inspection: The equipment covered by this specification shall be subject to inspection by Owner or his  
26 Representative prior to shipment from the factory. Deficiencies noted by the Owner or the Owner's Representative  
27 shall be corrected prior to shipment.  
28

29  
30 **END OF SECTION 262413**



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**SECTION 262550 – GENERATOR DOCKING STATION**

**PART 1 - GENERAL**

**RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**SCOPE**

This section pertains to equipment arranged as a permanent part of the facility electrical distribution system to permit connections to a portable load bank and a temporary generator. The generator docking station shall allow the selection of the permanent generator or the temporary generator by means of a manual transfer switch that is an integrated component of the docking station.

**QUALITY ASSURANCE**

**Manufacturers:** Firms regularly engaged in manufacture of generator docking stations, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Third party agencies shall be amongst those accredited by the NCBC (North Carolina Building Code Council) to label electrical and mechanical equipment. Subject to compliance with requirements provide equipment equivalent to that provided by one of the following manufacturers:

Schneider/ASCO Power Technologies (Series 300 MTDQ)  
ESL Power Systems, Inc. (Triple Switch)  
Try-Star LLC (TMTS-5)

**Codes and Standards:**

**Electrical Code Compliance:** Comply with applicable State electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of electrical power transfer switches. Equipment and installation shall meet all applicable requirements of NEC 700.3 (F).

**Testing Laboratory Compliance:** Comply with applicable requirements of UL 1008, "Automatic Transfer Switches". Provide manual transfer switches and components that are Listed and Labeled. Third party agencies shall be amongst those accredited by the NCBC (North Carolina Building Code Council) to label electrical and mechanical equipment.

**NEMA Compliance:** Comply with applicable requirements of NEMA Stds Pub/No.'s ICS 2, "Industrial Control Devices, Controllers and Assemblies," ICS 6 and 250, pertaining to transfer switches.

**IEEE Compliance:** Comply with applicable requirements of IEEE Standard 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.

**SUBMITTALS**

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

**Product Data:** Submit manufacturer's data and installation instructions for generator docking station.

**Shop Diagrams:** Submit layout drawings of generator docking station showing accurately scaled equipment locations and spatial relationships to associated electrical equipment in proximity.

1 Wiring Diagrams: Submit wiring diagrams for generator docking station, and associated control devices showing  
2 connections to prime and alternate power sources, electrical load, and equipment components. Differentiate between  
3 portions of wiring that are manufacturer-installed and portions that are field-installed.  
4

5  
6 **PART 2 - PRODUCTS**  
7

8  
9 **DOCKING STATION ENCLOSURE**  
10

11 Assembly shall be furnished in a free standing, NEMA type 3R enclosure. Provide strip heater with thermostat.  
12

13 The complete assembly shall be degreased, and thoroughly cleaned. The finish shall be ANSI-61, light gray,  
14 electrostatically charged polyester powder paint over a phosphate coating, at a minimum of 2.0 mils in density. Finish  
15 shall be suitable for outdoor environments.  
16

17 Permanent electrical connections shall be factory installed broad range set-screw mechanical type, located behind a  
18 physical barrier.  
19

20 Enclosure doors shall be hinged, gasketed and have latch provisions to accept Owner provided pad-lock.  
21

22  
23 **TRANSFER SWITCH**  
24

25 General: Except as otherwise indicated, provide manufacturer's standard design, materials and components as  
26 indicated by published product information, designed and constructed as recommended by manufacturer for duty  
27 indicated, and as required for a complete installation.

28 Transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically  
29 interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off.  
30

31 Transfer switch shall be positively locked and unaffected by momentary outages so that contact pressure is  
32 maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and  
33 operating life.

34 All main contacts shall be silver alloy composition. Switches rated 800 amperes and above shall have blow-on  
35 contact design for high withstand current capability and be protected by separate arcing contacts.

36 Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages  
37 and without disconnection of power conductors.  
38

39  
40 **MANUAL OPERATION PROVISIONS**  
41

42 The transfer switch shall be arranged for manual operation.  
43

44 The manual operating handle shall be capable of external operation without opening the enclosure door.  
45

46 There shall be three positions for manual operation:

47 Connected to Source 1

48 Connected to Source 2

49 Connected to Center (OFF)  
50

51 Switch position when connected to Source 1, or Source 2 shall be lockable with external provisions.  
52

53 Mechanical interlock may be accomplished using Kirk Key arrangement with molded case switch for the incoming  
54 permanent generator connection and the access door to the temporary generator quick connection provisions.  
55 Molded case breakers are not desired in this arrangement.  
56  
57

1 **ELECTRICAL**

2  
3 Factory fabricated assembly shall be rated 200 Amperes, 480Y/277 Volts, 3 phase, 4 wire, 60 Hz, 4-pole. Bus  
4 assembly shall be silver plated copper. Equipment ground bus shall be bonded to enclosure. Neutral bus shall have  
5 the same rating as the phase bus and isolated from the ground bus and enclosure.  
6

7 Withstand and Closing (WCR) Testing: Transfer switch shall be tested in accordance with UL 1008 to close into and  
8 withstand fault currents up to 10,000 RMS Symmetrical Amps.

9 Quick connect provisions shall have input and output connections rated up to 600 VAC, as required to match voltage  
10 characteristics of permanent generator.

11  
12 Input - Recessed male connectors.

13  
14 Output - Female connectors with flip covers.

15  
16 All electrical connectors shall be cam type single pole connectors compatible with Marincor or Leviton 16 Series CAM  
17 Locks™ and available color coded as follows:

18  
19 250V and below: phase 1 = black, phase 2 = red, phase 3 = blue.

20  
21 480V: phase 1 = brown, phase 2 = orange, phase 3 = yellow.

22  
23 Ground shall always be green. Neutral shall always be white.

24  
25 Where molded case circuit breaker is supplied for load bank output, breaker shall be rated to match the overall  
26 docking station assembly.

27  
28 Additional accessories shall be included as follows:

- 29  
30 A. Two Wire Auto Start  
31 B. Battery Charger Receptacle 20A GFCI 120VAC  
32 C. Block Heater Receptacle 20A, 120VAC  
33 D. Contacts to annunciate permanent generator disconnected.  
34 E. Strip Heater & Thermostat  
35 F. Phase Rotation Monitor  
36 G. Shut trip provisions for load bank breaker.  
37

38  
39 **PART 3 - EXECUTION**

40  
41  
42 **TESTING AND CERTIFICATION**

43  
44 Manual Transfer Switch shall be factory tested to ensure proper operation of the individual components and correct  
45 overall sequence of operation and to ensure compliance with the specification requirements.

46  
47 Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of  
48 this specification including compliance with the above codes and standards and withstand and closing ratings. The  
49 certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than  
50 those stipulated at the time of the submittal, shall be included in the certification.  
51

52  
53 **END OF SECTION 262550**



**SECTION 263213 - DIESEL GENERATOR SET**

**PART 1 - GENERAL**

**RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**QUALITY ASSURANCE**

**Manufacturers:** Firms regularly engaged in manufacture of generators, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment. Subject to compliance with requirements provide equipment equivalent to that provided by one of the following manufacturers:

- Caterpillar, Inc.
- Cummins/Onan Corporation
- Kohler
- MTU Onsite Energy

**Agreement to Maintain:** Engage installer who is willing to execute with the Owner, required agreement for continued maintenance of diesel engine driven generator units.

**Codes and Standards:**

**Electrical Code Compliance:** Comply with applicable local code requirements of the authority having jurisdiction and NEC Articles 517, 700, 701, and 702 pertaining to construction and installation of emergency and standby systems as appropriate to the installation.

**NFPA Compliance:** Comply with applicable requirements of NFPA 30, *Flammable & Combustible Liquids Code*; NFPA 37, *Installation and Use of Stationary Combustion Engines and Gas Turbines*; NFPA 101, *Code for Safety to Life from Fire in Buildings and Structures*; and NFPA 110, *Standard for Emergency and Standby Power Systems*. The present system is considered to be a Level 1 Emergency Power Supply.

**UL Compliance:** Comply with applicable requirements of UL 1008, *Automatic Transfer Switches*; UL 486A, *Wire Connectors and Soldering Lugs for Use with Copper Conductors*, UL 486B, *Wire Connectors for Use with Aluminum Conductors* and UL 2200, *Stationary Engine Generator Assemblies*.

**ANSI/NEMA Compliance:** Comply with applicable requirements of ANSI/NEMA MG 1, *Motors and Generators*; and MG 2, *Safety and Use of Electric Motors and Generators*.

**NEMA Compliance:** Comply with applicable requirements of NEMA's Stds. Pub No. 250, *Enclosures for Electrical Equipment (1,000-Volts Maximum)*.

**IEEE Compliance:** Comply with applicable portions of IEEE Std. 446, *IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications*.

**SUBMITTALS**

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

1 **Product Data:** Submit manufacturer's data on diesel engine driven generator sets and components. Include  
2 manufacturer's standard product warranty, for duration of not less than one-year, for replacement of materials and  
3 equipment used in diesel generator systems. As a minimum provide the following product information:  
4

- 5 • Generator set physical and electrical specifications.
- 6 • Dimensional outline plan and elevations drawings of engine generator set and other components  
7 being furnished.
- 8 • Thermal damage curve for generator
- 9 • Time-current characteristic curves for generator protective device.

10  
11 **Shop Drawings:** Submit layout drawings of diesel engine driven generator units and accessories including, but not  
12 limited to, remote mounted automatic transfer switch, fuel line piping, exhaust line piping, remote start-stop stations,  
13 annunciator stations, and instrumentation. In addition, show diesel generator set unit and its spatial relationship to  
14 associated equipment. Allow adequate clearance space for removal of engine generator elements for maintenance  
15 purposes.  
16

17 **Wiring Diagrams:** Submit wiring diagrams for diesel engine driven generator units showing connections to electrical  
18 power panels, feeders, automatic transfer switches, annunciators, and ancillary equipment. Differentiate between  
19 portions of wiring that are manufacturer-installed and portions that are field installed.  
20

21 **Certifications:** Provide diesel engine driven generator sets certified test record of the following final production  
22 testing:  
23

- 24 Single-step load pickup
- 25 Transient and steady-state governing
- 26 Safety shutdown device testing
- 27 Voltage regulation
- 28 Rated power
- 29 Maximum power

30  
31 **Provide certified test record** prior to engine-driven generator set being shipped from factory to project location.  
32

33 **Agreement to Maintain:** Prior to time of final acceptance, the Contractor shall submit four (4) copies of an agreement  
34 for continued service and maintenance of diesel engine driven generator set, for Owner's acceptance. Offer terms  
35 and conditions for furnishing parts and providing continued testing and servicing, including replacement of materials  
36 and equipment, for one-year period with option for renewal of Agreement by Owner.  
37

## 38 **PART 2 - PRODUCTS**

### 39 **DIESEL GENERATOR SETS**

40  
41  
42 **General:** Except as otherwise indicated, provide manufacturer's standard diesel engine-driven generator set and  
43 auxiliary equipment as indicated by published product information, and as required for a complete installation.  
44

45  
46 **Diesel Engine-Driven Generator:** Provide packaged electrical power diesel engine-driven generator assembly unit as  
47 indicated, rated 200 kW, 250 kVA at 0.8 PF, at a governed speed of 1,800 RPM, and standby rated at 80 percent  
48 power factor for operation at 480Y/277 Volt, 3-phase, 4-wire, 60 Hz, 301 Amperes at 500 feet altitude, at 105° F.  
49 Alternator shall be 2/3 electrical pitch. Equip generator with 4-cycle, 6-cylinder, 320 HP diesel engine sized to  
50 support the generator load, and fueled with diesel fuel, Grade DF-2. Maximum piston speed shall not exceed 2,250  
51 feet/minute. The generator prime mover shall be liquid cooled with a unit-mounted radiator, blower fan, water pump,  
52 thermostat, and radiator duct flange capable of cooling engine with up to 0.25 inches water static pressure on fan.  
53 Connect engine drive directly to revolving-field type single, maintenance-free, sealed bearing generator through  
54 semi-flexible steel disk coupling. Equip set with associated control equipment to automatically start engine, transfer  
55 load to standby power upon failure of normal power source, transfer load back to normal power upon its restoration,  
56 and stop engine.  
57  
58

1 Cushion-mount engine-generator on heavy steel base with vibration isolators to reduce possibility of torsional  
2 vibration. Equip engine with low-oil pressure, high-water temperature, and automatic overspeed safety shutdown  
3 devices. Equip generator with exciter and voltage regulator to maintain voltage within ½ percent of rated value from  
4 no load to full load. Construct unit in compliance with applicable standards; and with additional construction features  
5 as indicated.  
6

7 Where a generator enclosure is specified in this section, enclosure shall not contribute to de-rating of generator below  
8 values specified above. Incorporate provisions into enclosure and/or radiator system designs to offset resulting  
9 reductions in generator capacity and maintain specified ratings.  
10

11 While the fire pump is in operation, the generator shall continue to produce rated nameplate power without shutdown  
12 or derate for alarms and warnings or failed engine sensors, except for overspeed shutdown.  
13

14 Generator Set Indicating and Protective Devices and Controls: As a minimum provide an illuminated generator set  
15 mounted control panel with the following:

- 16 AC voltmeter.
- 17 AC ammeter.
- 18 AC frequency meter.
- 19 DC voltmeter (alternator battery charging).
- 20 Engine-coolant temperature gage.
- 21 Engine lubricating-oil pressure gage.
- 22 Running-time meter.
- 23 Ammeter-voltmeter, phase-selector switch(es).
- 24 Generator-voltage adjusting rheostat.
- 25 Off-Automatic-Run switch.
- 26 Overspeed shutdown device.
- 27 Coolant high-temperature shutdown device.
- 28 Coolant low-level shutdown device.
- 29 Oil low-pressure shutdown device.
- 30 Fuel tank derangement alarm.
- 31 Fuel tank high-level shutdown of fuel supply alarm.  
32

33 Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support  
34 specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where  
35 not indicated, locate to suit manufacturer's standard.  
36

37 Connection to Data Link: A separate terminal block, factory wired to Form "C", dry contacts, for each alarm and  
38 status indication is reserved for connections for data link transmission of indications to remote data terminals. Data  
39 system connections to terminals are covered in another Section.  
40

41 Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary  
42 contacts and terminals in control and monitoring panel. Locate audible device and silencing means where indicated.  
43

44 Generator Set Performance: The generator set shall meet the following minimum performance requirements. It shall  
45 be permissible to oversize the generator and/or engine from the above stated values to meet the requirements of this  
46 section.  
47

48 Steady State Voltage Operational Bandwidth: within 2 percent band of rated output voltage from  
49 no load to full load.  
50

51 Steady-State Voltage Modulation Frequency: Less than 1 Hz.  
52

53 Transient Voltage Performance: Not more than 20 percent variation for 90 percent step-load  
54 increase or decrease. Voltage shall recover and remain within the steady-state operating band  
55 within 1.5 seconds.  
56

57 Steady State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full  
58 load.  
59  
60

1            Steady-State Frequency Stability: When system is operating at any constant load within rated load,  
2 there are no random speed variations outside the steady-state operational band and no hunting or  
3 surging of speed.

4  
5            Transient Frequency Performance: Less than 5 percent variation for a 90 percent step-load  
6 increase or decrease. Frequency recovers to remain within the steady-state operating band within  
7 five seconds.

8  
9            Output Waveform: At no load and for any load up to rated load with power factors between 80 and  
10 100 percent, Total Harmonic Distortion (THD) of the voltage waveform measured line to line or line  
11 to neutral shall not exceed 5 percent and 3 percent for single harmonics. The telephone influence  
12 factor, determined according to NEMA MG 1, shall not exceed 50.

13  
14            Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals,  
15 the system will supply a minimum of 250 percent of rated full-load current for not less than 10  
16 seconds and then clear the fault automatically, without damage to any generator system  
17 component.

18  
19            Excitation System: Generator automatic voltage regulation system shall use three-phase sensing  
20 to isolate regulator from voltage distortion caused by non-linear loads applied to the generator set.  
21 Regulator circuits shall be filtered to isolate field control power from effects of load distortion.

22  
23            Maximum Start & Load Transfer Time: 10 Seconds.

24  
25            Generator Disconnect: Provide circuit breaker main disconnect(s) for generator. The circuit breaker(s) shall have  
26 screw adjustments for timing function adjustment and shall be equipped with a sealable cover to prevent tampering.

27  
28            Fire Pump: 80 Amp, 480Y/277 Volt, 3 pole, 10,000 AIC, with short circuit function only. This breaker shall be  
29 coordinated with the breaker in the fire pump ATS/Controller prior to purchase, allowing a 30 second minimum  
30 retention at locked rotor current.

31  
32            Emergency Source: 100 Amp, 480Y/277 Volt, 3 pole, 10,000 AIC, electronic trip unit function.

33            Standby Source: 100 Amp, 480Y/277 Volt, 3 pole, 10,000 AIC, thermal magnetic function.

34  
35            Circuit breakers shall be selectively coordinated as directed by the project engineer. Selective coordination shall be  
36 demonstrated for all branches of the emergency power system for all sources including the normal power supply  
37 system.

38  
39            Ground Fault Sensor: The generator circuit breaker shall be equipped with an adjustable sensor, sized to  
40 match the circuit breaker size, to detect ground fault conditions. The sensor shall be field programmable to  
41 either trip generator disconnect circuit breaker or to close a set of dry contacts.

42  
43            Ground Fault Remote Annunciator: Provide a remote annunciator for ground fault conditions. The alarm  
44 shall provide a visual and aural alarm in the event of a ground fault in excess of the setting of the ground  
45 fault sensor of the generator circuit breaker. Use of a spare light on the generator remote annunciator is  
46 acceptable provided that the light is labeled to match other labeling on the annunciator.

47  
48            The circuit breaker, including neutral current transformer, shall be factory assembled to the generator. The circuit  
49 breaker with related components and enclosure shall be suitable for use in wet locations for outside generator sets.

50

1 Starting System: Provide engine-generator unit with 24-Volt, negative ground, starting system including 24-Volt  
2 positive engagement solenoid shift-starting motor, batteries and 35-Ampere, or greater, automatic battery charging  
3 alternator with solid-state voltage regulation. The starting battery shall be sized to provide a minimum of five full  
4 cranking cycles at a temperature of 20° F without recharging.

5  
6 Starting Batteries: Starting Batteries shall be lead-acid type. Batteries shall be racked on corrosion  
7 resistant rack(s) located adjacent to the generator set or as shown on the Drawings. Line supplied and  
8 generator mounted charging alternator shall be configured to match battery type furnished with the  
9 generator set.

10  
11 Battery Heater: Provide a line powered battery heater to maintain the temperature of the cranking battery no  
12 lower than 40° F.

13  
14 Starting Battery Disconnect: Provide a battery disconnect(s) capable of being locked on the "off" position  
15 with a hasp-type lock(s). The battery disconnect shall be electrically arranged such that when it is in the "off"  
16 position all battery voltage is effectively removed from the generator and related systems. The battery  
17 disconnect shall be configured to comply with OSHA Hazardous Energy (Lockout/Tagout) as described in 29  
18 CFR 1910.147.

19  
20  
21 **ENGINE-GENERATOR SET ACCESSORIES**

22  
23 Weather Protective Housing: Provide rust-resistant sound attenuating weather-protective housing for diesel  
24 generator unit made of heavy gage reinforced steel; mate and match to the unit enclosed, which permits proper  
25 cooling, and access to both controller and service points. Enclosure shall be vandal-resistant and lockable with pin-  
26 type locks; access panels, once unlocked, shall be removable without the use of tools. Doors shall permit escape  
27 from within, once locked from the outside. Overall, the structure shall be constructed to withstand loads imposed by  
28 120 MPH winds. The maximum sound level permitted shall not exceed 74 dBA at a distance of 23 feet from the  
29 generator set enclosure. Ventilation opening louvers shall be motor operated for closed position and spring loaded  
30 for open position. All exterior components of the enclosure shall be assembled utilizing stainless steel hardware and  
31 all seams shall be sealed to prevent leaks. The enclosure shall primed with minimum of two (2)  
32 coats of rust inhibiting primer and two (2) finish coats. Color of the enclosure shall be as selected by the  
33 Designer/Owner.

34  
35 Protective Enclosure Illumination: Provide switched illumination for the interior of the generator enclosure  
36 powered from the generator cranking battery system. Illumination shall be a minimum of 30 fc at all  
37 locations within the generator enclosure requiring maintenance or inspection. Switch for controlling lights  
38 shall be a wind-up timer type, with pre-set limit of 1 hour.

39  
40 Diesel Generator Set Access Platform: Provide OSHA approved generator access platform to match generator sub-  
41 base tank. Generator access platform shall be constructed of steel, shall have a minimum clear width of 42", a safety  
42 railing, and shall provide access to all genset doors; provide additional walkway width if necessary to clear genset  
43 door swing. Elevation of the platform walkway shall be at the base elevation of the genset. Platform shall have stair  
44 or ladder from ground elevation to the walkway. Access platform shall be painted with a black corrosion resistant  
45 finish and shall be set in concrete footings that match the generator concrete base depth and general construction.  
46 Provide platform shop drawings for review prior to construction.

47  
48 Provide factory-fabricated free standing automatic load-transfer switch control as specified in Section 263623,  
49 *AUTOMATIC AND NON-AUTOMATIC TRANSFER SWITCHES.*

50  
51 Provide integral, UL-142 listed, double walled sub-base diesel tank, 1000 gallons capacity, completely installed under  
52 generator set upon arrival to job site.

53  
54 Sub-Base tank assembly shall consist of a frame to support the total weight of the generator set with the fuel  
55 tank separate and contained within the frame. No generator weight is to be supported by the tank. The  
56 frame shall be constructed suitably to form a rupture basin for the tank if a leak should develop. Provide a  
57 drain plug at one end of the rupture basin. Provide vibration isolators between generator set and tank  
58 assembly. Provide fuel low level and leak detection alarm contacts to remote mounted annunciator.  
59

1 The exterior surface of the sub-base tank assembly shall be protected from corrosion by the factory  
2 application of a corrosion-resistant coating. The sub-base tank shall be physically arranged such that the  
3 lower surface of the tank does not come into direct contact with the generator set concrete pad. Provide  
4 additional fill/return ports in fuel tank for future connection of mobile fuel polishing system.  
5

6 Provide remote annunciation system per NFPA 76A, 101, and 110. Remote annunciator panels shall have visual and  
7 audible alarms to monitor and warn of emergency operating conditions affecting line and generator power sources.  
8 As a minimum the remote annunciator shall indicate the following:  
9

10 Engine high-temperature shutdown.  
11 Lube-oil low-pressure shutdown.  
12 Overspeed shutdown.  
13 Remote emergency-stop shutdown.  
14 Engine high-temperature pre-alarm.  
15 Lube-oil low-pressure pre-alarm.  
16 Fuel tank low level.  
17 Overcrank shutdown.  
18 Coolant low-temperature alarm.  
19 Control switch not in auto position.  
20 Battery-charger malfunction alarm.  
21 Battery low-voltage alarm.  
22 Additional items as described elsewhere.  
23

24 Remote Shutdown Switch: The remote annunciator panel shall have a red locking-type mushroom head emergency  
25 generator shut-down button either built into the annunciator panel or located adjacent to the annunciator panel  
26 location. Activation of the emergency shut-down button shall cause the generator to shut-down and shall illuminate a  
27 "generator not in automatic" light on generator control panel and the annunciator panel.  
28

29 Provide engine block heater, (1500 Watt, 120 Volts, single phase) with thermostatic controls to maintain engine  
30 coolant at proper temperature. Block heater shall be de-energized when genset is running.  
31

32 Provide line operated (120 VAC) float type battery charger connected to maintain the cranking battery in a charged  
33 condition. The battery charger shall be matched to the starting battery voltage and have panel mounted meters to  
34 indicate the charging current level and the voltage across the starting battery terminals. The charger shall have self-  
35 contained provisions for fault detection and shall be connected to the remote annunciator to indicate an overcharged,  
36 undercharged, or other abnormal condition of the starting batteries or charging system. The battery charger, when  
37 installed in the weather proof housing shall be suitable for use in wet locations.  
38

39 Provide insulated critical grade exhaust silencer with drain, piping, and bellows adaptor, completely sealed, metal  
40 prime finish, mounted on generator enclosure. The silencer shall be mounted such that weight is supported  
41 independent from engine. Thermal expansion of exhaust system shall not impose stress on engine assembly. Match  
42 bellows flange to vertical exhaust stack flange. Provide rain cap to prevent entrance of moisture into system.  
43 Measured sound level at a distance of 23 feet from the exhaust discharge must be 74 dBA or less.  
44

45 Provide anchor bolts of galvanized steel, of types and sizes recommended by manufacturer.  
46

47 Provide glycol base antifreeze coolant suitable for operation at -20° F.  
48  
49

### **PART 3 - EXECUTION**

#### **FIELD QUALITY CONTROL**

51  
52  
53  
54 Start-up Testing:

55  
56 Engage local equipment manufacturer's representative to perform start-up and building load tests upon  
57 completion of installation, with the A-E in attendance; provide certified test record. Tests are to include all  
58 tests required in NFPA 110 Section 7.13 and the following:  
59

1                    Check fuel, lubricating oil, and antifreeze in liquid cooled models for conformity to the  
2 manufacturer's recommendations under environmental conditions present.

3  
4                    Test prior to cranking engine for proper operation, accessories that normally function while the set  
5 is in a standby mode. Accessories include: engine heaters, battery charger, generator strip heater,  
6 remote annunciator.

7  
8                    Check, during start-up test mode, for exhaust leaks, path of exhaust gases outside the building,  
9 cooling air flow, movement during starting and stopping, vibration during running, normal and  
10 emergency line-to-line voltage and phase rotation.

11  
12                    Test, by means of simulated power outage, automatic start-up by remote-automatic starting, transfer of load,  
13 and automatic shut-down. Prior to this test adjust, for proper system coordination, transfer switch timers.  
14 Monitor throughout the test, engine temperature, oil pressure, battery charge level, generator voltage,  
15 amperes, and frequency. The capability of the system to pick up full standby service load within 10 seconds  
16 of power outage shall be demonstrated.

17  
18                    Measure voltage total harmonic distortion (THD) for each line-to-line (L-L) and line-to-neutral (L-N)  
19 combination at 50 kW increments up to rated power and at rated power factor.

20  
21                    Prior to acceptance of the installation, the generator shall be subjected to a 4 hour test. This test  
22 shall be performed at the job site by the equipment vendor and documented. It shall include 1 hour  
23 at 50% load, 1 hour at 75% load, 1 hour at 100% load and 1 hour at 50% load. Upon completion of  
24 the four hour load test, the generator shall be shut-down after the cooling period. The generator  
25 shall be started immediately upon reaching rated rpm, 100% load shall be applied to demonstrate  
26 one step full load capability.

27  
28                    Upon completion of installation demonstrate capability and compliance of system with requirements. Where possible,  
29 correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new  
30 units, and proceed with retesting. Initial testing and retesting to be at no cost to Owner.

31  
32                    At the conclusion of testing and demonstrations fill the fuel tank to its rated capacity and verify that all other  
33 consumables are at their maximum level. Unless instructed otherwise by the A-E, leave the unit set up for automatic  
34 operation.

### 35 36 37 **DOCUMENTATION**

38  
39                    Prior to acceptance, the manufacturer shall supply three (3) copies of complete instruction manuals to the Owner.  
40 The manuals shall include operation and maintenance procedures, complete parts lists, dimensional drawings, unit  
41 wiring diagrams and schematics, and interconnection wiring drawings.

### 42 43 **WARRANTY**

44  
45                    The emergency generator, transfer switch and associated equipment shall be warranted by the manufacturer for a  
46 period of five (5) years, from the date of final inspection and acceptance. The warranty shall include all parts, labor  
47 (including travel and expenses) and equipment necessary to perform replacement and/or repairs.

### 48 49 50 **PERSONNEL TRAINING**

51  
52                    Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and  
53 operating diesel engine-driven generator sets. In addition, train Owner's personnel in periodic maintenance of  
54 batteries.

55  
56  
57 **END OF SECTION 263213**



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**SECTION 263623 - AUTOMATIC AND NON-AUTOMATIC TRANSFER SWITCHES**

**PART 1 - GENERAL**

**RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**QUALITY ASSURANCE**

**Manufacturers:** Firms regularly engaged in manufacture of transfer switches, of types and ratings required in this Section, whose products are Listed and Labeled for the purpose intended. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment. Subject to compliance with requirements provide equipment equivalent to that provided by one of the following manufacturers:

Automatic Switch Company (ASCO)  
Ruselectric Inc.  
Zenith Controls Inc.  
Onan Corporation

**Codes and Standards:**

**Electrical Code Compliance:** Comply with applicable State electrical code requirements of the authority having jurisdiction and NEC as applicable to construction and installation of electrical power transfer switches.

**Testing Laboratory Compliance:** Comply with applicable requirements of UL 1008, "Automatic Transfer Switches," and UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide transfer switches and components that are Listed and Labeled. Third party agencies shall be amongst those accredited by the NCBCC (North Carolina Building Code Council) to label electrical and mechanical equipment.

**NEMA Compliance:** Comply with applicable requirements of NEMA Stds Pub/No.'s ICS 2, "Industrial Control Devices, Controllers and Assemblies," ICS 6 and 250, pertaining to transfer switches.

**NFPA Compliance:** Comply with applicable requirements of NFPA 101; "Code for Safety to Life from Fire in Buildings and Structures," pertaining to transfer switches.

**SUBMITTALS**

Submittals shall be made in strict accordance with the requirements of Section 019913. Specific submittal requirements are defined in each section of this Division.

**Product Data:** Submit manufacturer's data and installation instructions for electrical power transfer switches.

**Shop Diagrams:** Submit layout drawings of electrical power transfer switches showing accurately scaled equipment locations and spatial relationships to associated electrical equipment in proximity.

**Wiring Diagrams:** Submit wiring diagrams for electrical transfer switches, and associated control devices showing connections to prime and alternate power sources, electrical load, and equipment components. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed.

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**PART 2 - PRODUCTS**

**AUTOMATIC TRANSFER SWITCHES**

General: Except as otherwise indicated, provide manufacturer's standard design, materials and components as indicated by published product information, designed and constructed as recommended by manufacturer for duty indicated, and as required for a complete installation.

Automatic Transfer Switches: Provide factory fabricated, Listed per UL Standard 1008, automatic transfer switches and auxiliary equipment rated 100 Amperes, 480Y/277 Volts, 3 phase, 4 wire, 60 Hz, 4-pole. Neutral contacts shall have the same rating as the phase contacts. Switches shall be double throw construction, with positive electrical and mechanical interlocking by a simple mechanical beam to prevent simultaneous closing. Switch shall be mechanically held in both normal and emergency positions. The switch shall perform quick-make, quick-break operation. The switch shall be approved for manual operation under full load by integrally mounted, permanently attached manual operating handles. Switch operator shall be powered by 120 Volt AC sources provided by transformers within the transfer switch enclosure. Molded case circuit breaker type switches are not acceptable.

Provide wall mounted welded steel NEMA Type 1 enclosure with swing out service panel and door locks. All transfer switch coils, springs, and control elements shall be easily visible and conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors. Main contacts shall be of silver alloy composition. Coat enclosure with manufacturer's standard color acrylic enamel finish over a corrosion-resisting primer.

Provide the Following Features in Addition to Automatic Transfer Function:

Remote engine starting contacts.

Indicating lights to indicate emergency transfer switch position: red for emergency power, green for normal power. Additional indicating lights for exercising mode active and in-phase monitor active. Provide a pushbutton test switch which simultaneously tests all indicator lights.

Solid state undervoltage sensors monitoring all three phase.

Provide exerciser clock to set the day, time and duration of generator set exercising period, including "WITH/WITHOUT LOAD" selector switch, 7 day dial minimum.

Provide battery charger, SCR voltage regulated type, float and taper features, 6 Amp at 24 VDC, with charging ammeter and fuse protection.

One additional normally open contact on both normal and emergency relays.

One set of normally open auxiliary contacts for remote indication of normal power failure.

Programmed transition feature from 0.5 to 5.0 seconds.

Under/over frequency sensor for generator side of automatic transfer switch.

Panel mounted switch to control transfer switch position.

Terminal connector strip, pre-connected for external remote control of the transfer switch position.

The automatic transfer switch control panel for three-phase service shall utilize solid-state sensing on normal and emergency for automatic, positive operation. The following shall be provided:

For three-phase switches all phases of the normal shall be monitored line-to-line.

Close differential voltage sensing shall be provided on all phases.

- 1 The pickup voltage shall be adjustable from 85 percent to 100 percent of nominal and the dropout voltage
- 2 shall be adjustable from 75 percent to 98 percent of the pickup value.
- 3
- 4 The transfer to emergency will be initiated when source drops below a range of 70-95% of rated voltage
- 5 (factory set at 85%) The transfer switch shall transfer to emergency as soon as the generator voltage has
- 6 reached a range of 75-100% of rated voltage (factory set at 90%) and generator rated frequency of 85-100%
- 7 (factory set at 90%).
- 8
- 9 A time delay to override momentary normal source outages to delay all transfer switch and engine starting
- 10 signals.
- 11
- 12 The time delay shall be field adjustable from 0.5 to 6 seconds and factory set at three (3) seconds.
- 13
- 14 After restoration of normal power on all phases to 90% of rated voltage, an adjustable time delay period
- 15 shall delay re-transfer to normal power until it has stabilized. If the emergency power source should fail
- 16 during the time delay period, the time delay shall be by-passed and the switch shall return, immediately, to
- 17 the normal source.
- 18
- 19 The time delay shall be field adjustable from 0 to 30 minutes and factory set at 5 minutes. Key
- 20 operated bypass shall be provided.
- 21
- 22 An unloaded running time delay for emergency generator cool-down.
- 23
- 24 The time delay shall be field adjustable from 0 to 5 minutes and factory set at five (5) minutes.
- 25
- 26 A time delay on transfer to emergency.
- 27
- 28 Initially set at zero but field adjustable up to one (1) minute for controlled timing of load transfer to
- 29 emergency, where indicated.
- 30
- 31 Independent single-phase voltage and frequency sensing of the emergency source.
- 32
- 33 The pickup of voltage shall be adjustable from 85% to 100% of nominal.
- 34
- 35 The pickup frequency shall be adjustable from 90% to 100% of nominal.
- 36
- 37 A contact that closes when normal source fails for initiating engine starting, rated 10 Amperes, 32 VDC.
- 38
- 39 Contacts to be gold plated for low voltage service.
- 40
- 41 Two (2) auxiliary contacts that are closed when transfer switch is connected to normal and two (2) auxiliary
- 42 contacts that are closed when transfer switch is connected to emergency.
- 43
- 44 Rated 10 Amperes, 250 Volts, 60 Hz AC.
- 45
- 46 A test switch to momentarily stimulate normal source failure.
- 47
- 48 Generator exercising time switch with load/no-load selector switch.
- 49

**PART 3 - EXECUTION**

**FACTORY TESTING**

Certified laboratory test data on a switch of the same design and rating shall be provided to confirm the following switching abilities: Overload and endurance at 480 Volts AC per Tables 21.2, 23.1 and 23.2 of UL Standard No. 1008 when enclosed according to Paragraph 1.6; temperature rise tests after the overload and endurance tests to confirm the ability of the transfer switches to carry their rated current within the allowable temperature limits of the insulation in contact with current-carrying parts.

1 Withstand and Closing (WCR) Testing: Switches shall be tested in accordance with UL 1008 to close into and  
2 withstand fault currents according to the following table:  
3  
4

<b>WITHSTAND CURRENT RATINGS WHEN USED WITH "ANY CIRCUIT BREAKERS"</b>	
RMS Symmetrical Amps	
Switch Rating (Amps)	WCR
100	42,000
200	42,000

5  
6  
7 No welding of contacts will be permitted. Transfer switch must be operable to alternate source after the withstand  
8 current tests. Switch shall pass dielectric tests at 1,960 Volts, RMS, minimum after the withstand current test.  
9

10 All Production Units Should Be Subjected to the Following Factory Tests: The complete automatic transfer switch  
11 shall be tested to ensure proper operation of the individual components and correct overall sequence of operation  
12 and to ensure that the operation transfer time, voltage, frequency and time delay settings are in compliance with the  
13 specification requirements; the switch shall be subjected to a dielectric strength test per NEMA Standard No. 1-  
14 109.21; the control panel shall meet or exceed the voltage surge withstand capability in accordance with IEEE  
15 Standard No. 472-1974 (ANSI Standard No. C37-.90a-1974) and the impulse withstand voltage test in accordance  
16 with the proposed NEMA Standard No. ICS 1-109.  
17

18 The manufacturer shall provide a notarized letter certifying compliance with all the requirements of this specification.  
19 The certification shall identify, by serial number(s), the equipment involved. No exceptions to the Specifications other  
20 than those stipulated at the time of submittal shall be included in the certification.  
21

22  
23 **PERSONNEL TRAINING**  
24

25 Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and  
26 operating transfer switches and auxiliary equipment.  
27

28  
29 **END OF SECTION 263623**

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## SECTION 311000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities.
6. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

#### 1.2 DEFINITIONS

- A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than **2 inches** in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 MATERIAL OWNERSHIP

- A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
  - 1. Use sufficiently detailed photographs or video recordings.
- B. Topsoil stripping and stockpiling program.
- C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

## 1.6 QUALITY ASSURANCE

- A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

## 1.7 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.
- D. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

## **PART 2 - PRODUCTS**

### 2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."
  - 1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

#### **3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

#### **3.3 EXISTING UTILITIES**

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.
  - 1. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed.

#### **3.4 CLEARING AND GRUBBING**

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
    - 1. Grind down stumps and remove roots larger than **3 inches** in diameter, obstructions, and debris to a depth of **18 inches** below exposed subgrade.
-

2. Use only hand methods or air spade for grubbing within protection zones.
3. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of **8 inches**, and compact each layer to a density equal to adjacent original ground.

### 3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of **6 inches** in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than **2 inches** in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to **72 inches**.
2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.

### 3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

### 3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000



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## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Warning tape.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

#### 1.2 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than **10 feet** in width and more than **30 feet** in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock:

1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock

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material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct preexcavation conference at Project site.
  - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
    - a. Personnel and equipment needed to make progress and avoid delays.
    - b. Coordination of Work with utility locator service.
    - c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
    - d. Extent of trenching by hand or with air spade.
    - e. Field quality control.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D2487.
  - 2. Laboratory compaction curve according to ASTM D698.
- C. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

### 1.5 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

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## 1.6 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations.
- C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than **3 inches** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a **1-1/2-inch** sieve and not more than 12 percent passing a **No. 200** sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a **1-1/2-inch** sieve and not more than 8 percent passing a **No. 200** sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a **1-1/2-inch** sieve and not more than 12 percent passing a **No. 200** sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a **1-inch** sieve and not more than 8 percent passing a **No. 200** sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel;

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ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a **NO. 8** sieve.

- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a **1-inch** sieve and zero to 5 percent passing a **NO. 4** sieve.
- J. Sand: ASTM C33/C33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of **6 inches** wide and **4 mils** thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to **30 inches** deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

### 3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
- D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

### 3.3 EXPLOSIVES

- A. Explosives:
  1. Do not use explosives.

### 3.4 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
  1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
    - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. **24 inches** outside of concrete forms other than at footings.
    - b. **12 inches** outside of concrete forms at footings.
    - c. **6 inches** outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. **6 inches** beneath bottom of concrete slabs-on-grade.
    - f. **6 inches** beneath pipe in trenches and the greater of **24 inches** wider than pipe or **42 inches** wide.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus **1 inch**. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

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### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to **12 inches** higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: **12 inches** each side of pipe or conduit.
- C. Trench Bottoms:
  - 1. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
    - a. For pipes and conduit less than **6 inches** in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
    - b. For pipes and conduit **6 inches** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
    - c. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
    - d. Excavate trenches **6 inches** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.8 EXCAVATION FOR ELEVATOR CYLINDER

- A. Provide well casing as necessary to retain walls of well hole.

### 3.9 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons** to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular

- to first direction. Limit vehicle speed to **3 mph**.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of **2500 psi**, may be used when approved by Architect.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

### 3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  2. Surveying locations of underground utilities for Record Documents.
  3. Testing and inspecting underground utilities.
  4. Removing concrete formwork.
  5. Removing trash and debris.
  6. Removing temporary shoring, bracing, and sheeting.
  7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.13 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

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- C. Trenches under Footings: Backfill trenches excavated under footings and within **18 inches** of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
  - D. Backfill voids with satisfactory soil while removing shoring and bracing.
  - E. Initial Backfill:
    - 1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than **1 inch** in any dimension, to a height of **12 inches** over the pipe or conduit.
      - a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
  - F. Final Backfill:
    - 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
  - G. Warning Tape: Install warning tape directly above utilities, **12 inches** below finished grade, except **6 inches** below subgrade under pavements and slabs.

### 3.14 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.15 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **8 inches** in loose depth for material compacted by heavy compaction equipment and not more than **4 inches** in loose depth for material

compacted by hand-operated tampers.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top **12 inches** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 92 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top **6 inches** below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

### 3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus **1 inch**.
  - 2. Walks: Plus or minus **1 inch**.
  - 3. Pavements: Plus or minus **1/2 inch**.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of **1/2 inch** when tested with a **10-foot** straightedge.

### 3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Place base course material over subbase course under hot-mix asphalt pavement.
  - 2. Shape subbase course and base course to required crown elevations and cross-slope grades.
  - 3. Place subbase course and base course **6 inches** or less in compacted thickness in a single layer.
  - 4. Place subbase course and base course that exceeds **6 inches** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches** thick or less than **3 inches** thick.
  - 5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.

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### 3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course **6 inches** or less in compacted thickness in a single layer.
  - 3. Place drainage course that exceeds **6 inches** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches** thick or less than **3 inches** thick.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

### 3.20 FIELD QUALITY CONTROL

- A. Special Inspections: Contractor will engage a qualified special inspector to perform the following special inspections:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
  - 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Contractor will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every **2000 sq. ft.** or less of paved area or building slab but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every **100 feet** or less of wall length but no fewer than two tests.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every **150 feet** or less of trench length but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000



## **SECTION 321216 - ASPHALT PAVING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Hot-mix asphalt paving.

**B. Related Requirements:**

1. Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.

#### **1.2 PREINSTALLATION MEETINGS**

**A. Preinstallation Conference: Conduct conference at Project site.**

1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

#### **1.3 ACTION SUBMITTALS**

**A. Product Data: Include technical data and tested physical and performance properties.**

1. Joint sealant.

**B. Hot-Mix Asphalt Designs:**

1. Certification, by authorities having jurisdiction, of approval of each hot-mix asphalt design proposed for the Work.
2. For each hot-mix asphalt design proposed for the Work.

#### **1.4 INFORMATIONAL SUBMITTALS**

**A. Qualification Data: For paving-mix manufacturer and testing agency.**

**B. Material Certificates: Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.**

1. Aggregates.
2. Asphalt binder.
3. Asphalt cement.
4. Emulsified asphalt prime coat.
5. Tack coat.

- C. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.
- B. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of latest specifications of <NCDOT> for asphalt paving work.
1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
1. Prime Coat: Minimum surface temperature of 60 deg F.
  2. Tack Coat: Minimum surface temperature of 60 deg F.
  3. Slurry Coat: Comply with weather limitations in ASTM D3910.
  4. Asphalt Base Course and Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

- D. Mineral Filler: ASTM D242/D242M, rock or slag dust, hydraulic cement, or other inert material.

## 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: ASTM D6373 binder designation PG 64-22.
- B. Emulsified Asphalt Prime Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- C. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397/D2397M cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- D. Water: Potable.

## 2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.
- B. Sand: ASTM D1073, Grade No. 2 or No. 3.

## 2.4 MIXES

- A. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction. Limit vehicle speed to **3 mph**.

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons**.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

### 3.3 PATCHING

- A. **Asphalt Pavement:** Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending **12 inches** into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. **Portland Cement Concrete Pavement:** Break cracked slabs and roll as required to reseal concrete pieces firmly.
  1. **Undersealing:** Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseal pieces firmly.
  2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.
- C. **Tack Coat:** Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of **0.05 to 0.15 gal./sq. yd.**
  1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. **Placing Single-Course Patch Material:** Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- E. **Placing Two-Course Patch Material:** Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

### 3.4 SURFACE PREPARATION

- A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. **Herbicide Treatment:** Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
  1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.
- C. **Emulsified Asphalt Prime Coat:** Apply uniformly over surface of compacted unbound-aggregate base course at a rate of **0.10 to 0.30 gal./sq. yd. per inch depth**. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
  1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

### 3.5 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course and binder course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course and binder course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive

displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to **185 deg F**.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  1. Average Density, Marshall Test Method: 96 percent of reference laboratory density in accordance with ASTM D6927, but not less than 94 percent or greater than 100 percent.
  2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.8 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:
  1. Base Course and Binder Course: Plus or minus **1/2 inch**.
  2. Surface Course: Plus **1/4 inch**, no minus.
- B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a **10-foot** straightedge applied transversely or longitudinally to paved areas:
  1. Base Course and Binder Course: **1/4 inch**.
  2. Surface Course: **1/8 inch**.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is **1/4 inch**.
- C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus **1/8 inch** of height indicated above pavement surface.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.
    - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    - b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.10 WASTE HANDLING

- A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216



## **SECTION 321313 - CONCRETE PAVING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes concrete paving including the following:
  - 1. Driveways.
  - 2. Curbs and gutters.
  - 3. Walks.
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
  - 2. Section 321723 "Pavement Markings."

#### **1.2 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### **1.3 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to concrete paving, including but not limited to, the following:
    - a. Concrete mixture design.
    - b. Quality control of concrete materials and concrete paving construction practices.
  - 2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete paving Subcontractor.
    - e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

- B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.
- B. Material Certificates: For the following, from manufacturer:
  - 1. Cementitious materials.
  - 2. Steel reinforcement and reinforcement accessories.
  - 3. Fiber reinforcement.
  - 4. Admixtures.
  - 5. Curing compounds.
  - 6. Applied finish materials.
  - 7. Bonding agent or epoxy adhesive.
  - 8. Joint fillers.
- C. Material Test Reports: For each of the following:
  - 1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").
- B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
  - 1. Personnel conducting field tests must be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

## 1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

## 1.8 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

- 
- B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
1. When air temperature has fallen to or is expected to fall below **40 deg F**, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than **50 deg F** and not more than **80 deg F** at point of placement.
  2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.
- C. Hot-Weather Concrete Placement: Comply with **ACI 301** and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature below **90 deg F** at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE, GENERAL**

- A. ACI Publications: Comply with **ACI 301** unless otherwise indicated.

### **2.2 FORMS**

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
1. Use flexible or uniformly curved forms for curves with a radius of **100 feet** or less. Do not use notched and bent forms.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

### **2.3 CONCRETE MATERIALS**

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
1. Portland Cement: ASTM C150/C150M, gray portland cement Type I.
  2. Fly Ash: ASTM C618, Class C or Class F.
- B. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S, uniformly graded. Provide aggregates from a single source[ **with documented service-record data of at least 10 years' satisfactory service in**

**similar paving applications and service conditions using similar aggregates and cementitious materials].**

1. Maximum Coarse-Aggregate Size: **1-1/2 inches** nominal.
  2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
1. Aggregate Sizes: **3/4 to 1 inch** nominal.
  2. Aggregate Source, Shape, and Color: **<Insert requirements>**.
- D. Air-Entraining Admixture: ASTM C260/C260M.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  2. Retarding Admixture: ASTM C494/C494M, Type B.
  3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
  4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
  6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
- F. Water: Potable and complying with ASTM C94/C94M.

## 2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately **9 oz./sq. yd.** dry or cotton mats.
- B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

## 2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber ASTM D1752, cork or self-expanding cork or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- C. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing **3/8-inch** sieve and 85 percent retained on a **No. 8** sieve.

## 2.6 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to **ACI 301**, for each type and strength of normal-

weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
  2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Pozzolan: 25 percent.
  2. Slag Cement: 50 percent.
  3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content, 1-1/2-inch Nominal Maximum Aggregate Size: 4-1/2 percent plus or minus 1-1/2 percent.
  2. Air Content, 1-inch Nominal Maximum Aggregate Size: [6][4-1/2][3] percent plus or minus 1-1/2 percent.
  3. Air Content, 3/4-inch Nominal Maximum Aggregate Size: [6][5][3-1/2] percent plus or minus 1-1/2 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.
- G. Concrete Mixtures: Normal-weight concrete.
1. Compressive Strength (28 Days): 4000 psi.
  2. Maximum W/C Ratio at Point of Placement: 0.45.
  3. Slump Limit: 4 inches, plus or minus 1 inch.

## 2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more

- than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.
- B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
  1. Completely proof-roll subbase in one direction. Limit vehicle speed to 3 mph.
  2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

### **3.3 EDGE FORMS AND SCREED CONSTRUCTION**

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

### **3.4 JOINTS**

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
  1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

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- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
  2. Provide tie bars at sides of paving strips where indicated.
  3. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of **50 feet** unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler not less than **1/2 inch** or more than **1 inch** below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a **1/4-inch** radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
    - a. Tolerance: Ensure that grooved joints are within **3 inches** either way from centers of dowels.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut **1/8-inch**- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
    - a. Tolerance: Ensure that sawed joints are within **3 inches** either way from centers of dowels.
  3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a **1/4-inch** radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

### 3.5 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

- 
- B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.
  - C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
  - D. Comply with **ACI 301** requirements for measuring, mixing, transporting, and placing concrete.
  - E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.
  - F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
  - G. Consolidate concrete according to **ACI 301** by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
    - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating joint devices.
  - H. Screed paving surface with a straightedge and strike off.
  - I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
  - J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

### 3.6 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
  - 1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching **0.2 lb/sq. ft. x h** before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying

concrete but before float finishing.

- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by a combination of these as follows:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with **12-inch** lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least **12 inches**, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

### 3.8 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
  - 1. Elevation: **3/4 inch**.
  - 2. Thickness: Plus **3/8 inch**, minus **1/4 inch**.
  - 3. Surface: Gap below **10-feet-** long; unlevelled straightedge not to exceed **1/2 inch**.
  - 4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: **1/2 inch per 12 inches** of tie bar.
  - 5. Lateral Alignment and Spacing of Dowels: **1 inch**.
  - 6. Vertical Alignment of Dowels: **1/4 inch**.
  - 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: **1/4 inch per 12 inches** of dowel.
  - 8. Joint Spacing: **3 inches**.
  - 9. Contraction Joint Depth: Plus **1/4 inch**, no minus.
  - 10. Joint Width: Plus **1/8 inch**, no minus.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M will be performed according to the following requirements:
  - 1. Testing Frequency: Obtain at least one composite sample for each **5000 sq. ft.** or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or

from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is **40 deg F** and below and when it is **80 deg F** and above, and one test for each composite sample.
  5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
  6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
    - a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than **500 psi**.
- D. Test results to be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency will make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Concrete paving will be considered defective if it does not pass tests and inspections.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- I. Prepare test and inspection reports.

### 3.10 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement.

When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313



## **SECTION 321723 - PAVEMENT MARKINGS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Painted markings applied to asphalt paving.

#### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to marking asphalt paving or concrete surfaces including, but not limited to, the following:
    - a. Asphalt-paving or concrete-surface aging period before application of pavement markings.
    - b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: Include technical data and tested physical and performance properties.
  - 1. Pavement-marking paint, alkyd.
- B. Shop Drawings:
  - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
  - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

#### **1.4 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of <Insert applicable standards> of NCDOT for pavement-marking work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

#### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, and not exceeding 95 deg F.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

### **2.2 PAVEMENT-MARKING PAINT**

- A. Source Limitations: Obtain pavement-marking paints from single source from single manufacturer.
- B. Pavement-Marking Paint, Alkyd: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952F.
  - 1. Color: As indicated.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that pavement-marking substrate is dry and in suitable condition to begin pavement marking in accordance with manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

### **3.2 PAVEMENT MARKING**

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow asphalt paving or concrete surfaces to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of **15 mils**.
  - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to asphalt paving or concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
  - 2. Broadcast glass beads uniformly into wet markings at a rate of **6 lb/gal.**

### 3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723



## **SECTION 331415 - SITE WATER DISTRIBUTION PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Ductile-iron pipe and fittings.
  - 2. Piping joining materials.
  - 3. Gate valves.
  - 4. Gate valve accessories and specialties.
  - 5. Check valves.
  - 6. Detector check valves.
  - 7. Corporation valves, curb valves, and meter valves.
  - 8. Backflow preventers.
  - 9. Protective enclosures.
  - 10. Fire hydrants.
  - 11. Fire department connections.
  
- B. Related Requirements:
  - 1. Section 211000 "Water-Based Fire-Suppression Systems."

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  
- B. Shop Drawings:
  - 1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
  - 2. Include diagrams for power, signal, and control wiring for alarms.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
  
- B. Field Quality-Control Submittals:
  - 1. Field quality-control reports.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of product indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare piping, valves, meters, backflow prevention devices, and fire hydrants according to the following:
  - 1. Ensure that piping, valves, meters, backflow prevention devices, and fire hydrants are dry and internally protected against rust and corrosion.
  - 2. Protect threaded ends and flange faces against damage.
  - 3. Set piping, valves, meters, backflow prevention devices, and fire hydrants in best position for handling and to prevent rattling.
- B. During Storage: Use precautions for piping, valves, meters, backflow prevention devices, and fire hydrants according to the following:
  - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
  - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle products if size requires handling by crane or lift. Rig products to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service in accordance with requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of water-distribution service without Owner's written permission.

## 1.7 COORDINATION

- A. Coordinate connection to water main with utility company.
- B. Content includes water-distribution piping and related components outside the building for combined domestic water service and fire-suppression water service and terminated **5 ft.** from building. Terminate water-service piping with appropriate fitting for extension by Divisions 21 and 22.

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## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
- B. Comply with standards of authorities having jurisdiction for domestic water-service piping, including materials, installation, testing, and disinfection.
- C. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- D. Piping materials to bear label, stamp, or other markings of specified testing agency.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- F. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.
- G. Comply with FM Approvals' "Approval Guide" and/or UL's "Fire Protection Equipment Directory" for fire-suppression water-service products.
- H. Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.
- I. All piping and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372 or are certified in compliance with NSF 61/NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

### **2.2 PIPING MATERIALS**

- A. Comply with requirements in "Piping Applications" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and service sizes.
- B. Potable-water piping and components comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

### **2.3 DUCTILE-IRON PIPE AND FITTINGS**

- A. Mechanical-Joint, Ductile-Iron Pipe:
  - 1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 2. AWWA C104/A21.4 cement mortar-lined.
- B. Mechanical-Joint, Ductile-Iron Fittings:
  - 1. AWWA C110, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron

- compact pattern.
- 2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- 3. AWWA C104/A21.4 cement mortar-lined.

C. Push-on-Joint, Ductile-Iron Pipe:

- 1. AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
- 2. AWWA C104/A21.4 cement mortar-lined.

D. Push-on-Joint, Ductile-Iron Fittings:

- 1. AWWA C110, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
- 2. Gaskets: AWWA C111/A21.11, rubber.
- 3. AWWA C104/A21.4 cement mortar-lined.

E. Flanges: ASME 16.1, Class 125, cast iron.

## 2.4 PIPING JOINING MATERIALS

- A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

## 2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

- A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately **5 inches** in diameter.
  - 1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.
- B. Indicator Posts: UL 789, FM Global approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

## 2.6 DETECTOR CHECK VALVES

- A. Description: Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
  - 1. Standards: UL listed and FM Global approved.
  - 2. Pressure Rating: **175 psig**.
- B. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

## 2.7 PROTECTIVE ENCLOSURES

- A. Enclosure Bases: **4-inch-** minimum thickness precast concrete, of dimensions required to extend at least **6 inches** beyond edges of enclosure housings. Include openings for piping.

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## 2.8 ALARM DEVICES

- A. Alarm Devices: UL 753 and FM Global approved, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for **250 psig** working pressure; designed for horizontal or vertical installation; with 2 SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125 V ac and 0.25 A, 24 V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: SPDT; designed to signal valve in other than fully open position.
- D. Pressure Switches: SPDT; designed to signal increase in pressure.

## **PART 3 - EXECUTION**

### 3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

### 3.2 PIPING APPLICATIONS

- A. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
- B. Do not use flanges or unions for underground piping.
- C. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- D. Underground water-service piping **NPS 4 to NPS 8** to be the following:
  - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- E. Aboveground water-service piping **NPS 4 to NPS 8** to be any of the following:
  - 1. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.
- F. Underground fire-service-main piping **NPS 4 to NPS 12** to be the following:
  - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
- G. Aboveground fire-service-main piping **NPS 4 to NPS 12** to be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- H. Underground Combined Water-Service and Fire-Service-Main Piping **NPS 6 to NPS 12** to be the following:
  - 1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.

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### 3.3 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for **NPS 3** and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM Global, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for **NPS 2** and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
  - 2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FM Global, cast-iron, nonrising-stem gate valves with indicator post.
  - 3. Use the following for valves in vaults and aboveground:
    - a. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
    - b. Check Valves: AWWA C508, swing type.
  - 4. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

### 3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Comply with Section 330500 "Common Work Results for Utilities" for piping-system common requirements.
- B. Provide a continuous bare copper or aluminum tracer wire not less than **0.10 inch** in diameter in sufficient length over each separate run of nonmetallic pipe.

### 3.5 INSTALLATION OF PIPING

- A. Water-Main Connection:
  - 1. Tap water main in accordance with requirements of water utility company and of size and in location indicated.
- B. Make connections larger than **NPS 2** with tapping machine according to the following:
  - 1. Install tapping sleeve and tapping valve in accordance with MSS SP-60.
  - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
  - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
  - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- C. Install ductile-iron, water-service piping in accordance with AWWA C600 and AWWA M41.
- D. Bury piping with depth of cover over top at least **30 inches**, with top at least **12 inches** below level of maximum frost penetration, and according to the following:
  - 1. Under Driveways: With at least **36 inches** of cover over top.

- E. Extend water-service and fire-suppression water-service piping and connect to water-supply source and building and fire-suppression piping systems at outside face of building wall in locations and pipe sizes indicated.
  - 1. Terminate water-service and fire-suppression water-service piping at building wall until building water-piping and fire-suppression piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water-piping and fire-suppression piping systems when those systems are installed.
- F. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210500 "Common Work Results for Fire Suppression" and Section 220500 "Common Work Results for Plumbing."
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- H. Comply with Section 211000 "Water-Based Fire-Suppression Systems" for fire-suppression-water piping inside the building.
- I. Comply with Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

### 3.6 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
  - 1. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.
  - 2. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
  - 3. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts in accordance with coupling manufacturer's written instructions.

### 3.7 INSTALLATION OF ANCHORAGE

- A. Anchorage: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
  - 1. Concrete thrust blocks.
  - 2. Locking mechanical joints.
  - 3. Set-screw mechanical retainer glands.
  - 4. Bolted flanged joints.
  - 5. Heat-fused joints.
  - 6. Pipe clamps and tie rods.
  - 7. <Insert devices>.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
  - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: In accordance with AWWA C600.
  - 2. Gasketed-Joint, PVC Water-Service Piping: In accordance with AWWA M23.
  - 3. Bonded-Joint Fiberglass, Water-Service Piping: In accordance with AWWA M45.
  - 4. Fire-Service-Main Piping: In accordance with NFPA 24.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous

anchorage devices.

### 3.8 INSTALLATION OF VALVES

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

### 3.9 INSTALLATION OF PROTECTIVE ENCLOSURES

- A. Install concrete base level and with top approximately 2 inches above grade.
- B. Install protective enclosure over valves and equipment.
- C. Anchor protective enclosure to concrete base.

### 3.10 INSTALLATION OF FIRE HYDRANTS

- A. Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA Fire Hydrants: Comply with AWWA M17.
- C. UL/FM Global Fire Hydrants: Comply with NFPA 24.

### 3.11 CONNECTIONS

- A. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.
- B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

### 3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in **50 psig** increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to **0 psig**. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is **2 quarts** per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

### 3.13 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

### 3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
  - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
  - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for three hours.
  - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
  - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331415



## **SECTION 333115 - SITE SANITARY SEWERAGE PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. ABS pipe and fittings.
  - 2. PVC pipe and fittings.
  - 3. Concrete pipe and fittings.
  - 4. Encasement for piping.
  - 5. Manholes.
  - 6. Concrete.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings:
  - 1. Plans and elevations, or Building Information Model (BIM), drawn to scale, showing items described in this Section and coordinated with all building trades. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
  - 2. Show system piping in profile. Draw profiles to horizontal scale of not less than **1 inch equals 50 ft.** and to vertical scale of not less than **1 inch equals 5 ft.** Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- B. Product Certificates: For each type of pipe and fitting.
- C. Field quality-control reports.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes in accordance with manufacturer's written rigging instructions.

## 1.5 QUALITY ASSURANCE

- A. Provide materials bearing label, stamp, or other markings of specified testing agency.

## 1.6 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service in accordance with requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of service.
  - 2. Do not proceed with interruption of service without Owner's written permission.

## **PART 2 - PRODUCTS**

### 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Sanitary Sewage Piping: 10-ft. head of water.

### 2.2 PVC PIPE AND FITTINGS

- A. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.
- B. Piping materials to bear label, stamp, or other markings of specified testing agency.
- C. PVC Type PSM Gravity Sewer Piping:
  - 1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
  - 2. Fittings: ASTM D3034, PVC with bell ends.
  - 3. Gaskets: ASTM F477, elastomeric seals.

### 2.3 NONPRESSURE-TYPE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials:
  - 1. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.

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## 2.4 MANHOLES

### A. Standard Precast Concrete Manholes:

1. Standard: ASTM C478/C478M.
2. Description: Precast, reinforced concrete, of depth indicated, with provision for sealant joints.
3. Diameter: **48 inches** minimum unless otherwise indicated.
4. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
5. Base Section: **6-inch** minimum thickness for floor slab and **4-inch** minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
6. Riser Sections: **4-inch** minimum thickness, of length to provide depth indicated.
7. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
8. Joint Sealant: **ASTM C990**, bitumen or butyl rubber.
9. Resilient Pipe Connectors: ASTM C923/C923M, cast or fitted into manhole walls, for each pipe connection.
10. Steps: Individual FRP steps or FRP ladder; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch** intervals. Omit steps if total depth from floor of manhole to finished grade is less than **60 inches**.
11. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended in writing by ring manufacturer.
12. Grade Rings: Reinforced-concrete rings, **6- to 9-inch** total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

### B. Designed Precast Concrete Manholes:

1. Standards: ASTM C913 and ASTM C890.
2. Description: Designed in accordance with ASTM C890 for A-16 designation, heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
3. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
4. Joint Sealant: **ASTM C990**, bitumen or butyl rubber.
5. Resilient Pipe Connectors: ASTM C923/C923M, cast or fitted into manhole walls, for each pipe connection.
6. Steps: Individual FRP steps or FRP ladder; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch** intervals. Omit steps if total depth from floor of manhole to finished grade is less than **60 inches**.
7. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended in writing by ring manufacturer.
8. Grade Rings: Reinforced-concrete rings, **6- to 9-inch** total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.

### C. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch- minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A536, Grade 60-40-18 ductile iron unless otherwise indicated.

## 2.5 CONCRETE

- A. Description: Cast-in-place concrete complying with ACI 318, **ACI 350**, and the following:
  1. Cement: ASTM C150/C150M, Type II.
  2. Fine Aggregate: ASTM C33/C33M, sand.
  3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: **4000 psi** minimum, with 0.45 maximum water/cementitious materials ratio.
  1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A615/A615M, **Grade 60** deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, **4000 psi** minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
  1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: 1 percent through manhole.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, **3000 psi** minimum, with 0.58 maximum water/cementitious materials ratio.
  1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A615/A615M, **Grade 60** deformed steel.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### 3.2 INSTALLATION OF PIPING

- A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation

is not indicated, follow piping manufacturer's written instructions.

- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure, drainage piping in accordance with the following:
  - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
  - 2. Install piping with **36-inch** minimum cover.
  - 3. Install PVC Type PSM sewer piping in accordance with ASTM D2321 and ASTM F1668.
- G. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

### 3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping in accordance with the following:
  - 1. Join PVC Type PSM sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.

### 3.4 INSTALLATION OF MANHOLES

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants in accordance with ASTM C891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops **3 inches** above finished surface elsewhere unless otherwise indicated.

### 3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with ACI 318.

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### 3.6 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 221316 "Sanitary Waste and Vent Piping."
- B. Connect force-main piping to building's sanitary force mains specified in Section 221316 "Sanitary Waste and Vent Piping." Terminate piping where indicated.
- C. Make connections to existing piping and underground manholes.
  - 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus **6-inch** overlap with not less than **6 inches** of concrete with 28-day compressive strength of **3000 psi**.
  - 2. Make branch connections from side into existing piping, **NPS 4 to NPS 20**. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than **6 inches** of concrete with 28-day compressive strength of **3000 psi**.
  - 3. Make branch connections from side into existing piping, **NPS 21** or larger, or to underground manholes by cutting opening into existing unit large enough to allow **3 inches** of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in **6 inches** of concrete for minimum length of **12 inches** to provide additional support of collar from connection to undisturbed ground.
    - a. Use concrete that will attain a minimum 28-day compressive strength of **3000 psi** unless otherwise indicated.
    - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
  - 4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- D. Connect to grease interceptors specified in Section 221323 "Sanitary Waste Interceptors."

### 3.7 CLOSING ABANDONED SANITARY SEWER SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
  - 1. Close open ends of piping with at least **8-inch-** thick, brick masonry bulkheads.
- B. Backfill to grade in accordance with Section 312000 "Earth Moving."

### 3.8 IDENTIFICATION

- A. Comply with requirements in Section 312000 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
  - 1. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

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### 3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately **24 inches** of backfill is in place, and again at completion of Project.
1. Submit separate report for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Hydrostatic Tests: Test sanitary sewerage in accordance with requirements of authorities having jurisdiction and the following:
    - a. Fill sewer piping with water. Test with pressure of at least **10-ft.** head of water, and maintain such pressure without leakage for at least 15 minutes.
    - b. Close openings in system and fill with water.
    - c. Purge air and refill with water.
    - d. Disconnect water supply.
    - e. Test and inspect joints for leaks.
  6. Air Tests: Test sanitary sewerage in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
    - a. Test plastic gravity sewer piping in accordance with ASTM F1417.
    - b. Test concrete gravity sewer piping in accordance with ASTM C1628.
  7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than one and one-half times the maximum system operating pressure, but not less than **150 psig.**
    - a. Ductile-Iron Piping: Test in accordance with AWWA C600, "Hydraulic Testing" Section.
    - b. PVC Piping: Test in accordance with AWWA M23, "Testing and Maintenance" Chapter.
  8. Manholes: Perform hydraulic test in accordance with **ASTM C969.**
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances
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specified.

### 3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 333115

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## **SECTION 334200 - STORMWATER CONVEYANCE**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Concrete pipe and fittings.
  - 2. Catch basins.
  - 3. Stormwater inlets.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Manholes: Include plans, elevations, sections, details, frames, and covers.
  - 2. Catch basins stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
  - 3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than **1 inch equals 50 feet** and vertical scale of not less than **1 inch equals 5 feet**. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.
- C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.
- D. Field quality-control reports.

#### **1.4 QUALITY ASSURANCE**

- A. Piping materials are to bear label, stamp, or other markings of specified testing agency.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes in accordance with manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets in accordance with manufacturer's written rigging instructions.

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE PIPE AND FITTINGS**

- A. Source Limitations: Obtain concrete pipe and fittings from single manufacturer.
- B. Reinforced-Concrete Sewer Pipe and Fittings: **ASTM C76**.
  - 1. Bell-and-spigot or tongue-and-groove ends and gasketed joints with **ASTM C443**, rubber gaskets
  - 2. Class IV, Wall A.

### **2.2 CONCRETE**

- A. General: Cast-in-place concrete in accordance with **ACI 318**, **ACI 350**, and the following:
  - 1. Cement: **ASTM C150/C150M**, Type II.
  - 2. Fine Aggregate: **ASTM C33/C33M**, sand.
  - 3. Coarse Aggregate: **ASTM C33/C33M**, crushed gravel.
  - 4. Water: Potable.
- B. Portland Cement Design Mix: **4000 psi** minimum, with 0.45 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: **ASTM A1064/A1064M**, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: **ASTM A615/A615M**, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, **4000 psi** minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
  - 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: 1 percent through manhole.
  - 2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, **3000 psi** minimum, with 0.58 maximum water/cementitious materials ratio.
  - 1. Reinforcing Fabric: **ASTM A1064/A1064M**, steel, welded wire fabric, plain.
  - 2. Reinforcing Bars: **ASTM A615/A615M**, Grade 60 (420 MPa) deformed steel.

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## 2.3 CATCH BASINS

### A. Standard Precast Concrete Catch Basins:

1. Description: **ASTM C478**, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Base Section: **6-inch** minimum thickness for floor slab and **4-inch** minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
3. Riser Sections: **4-inch** minimum thickness, **48-inch** diameter, and lengths to provide depth indicated.
4. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
5. Joint Sealant: **ASTM C990**, bitumen or butyl rubber.
6. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
7. Grade Rings: Include two or three reinforced-concrete rings, of **6- to 9-inch** total thickness, that match **24-inch-** diameter frame and grate.
8. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch** intervals. Omit steps if total depth from floor of catch basin to finished grade is less than **60 inches**.
9. Pipe Connectors: **ASTM C923**, resilient, of size required, for each pipe connecting to base section.

### B. Designed Precast Concrete Catch Basins: ASTM C913, precast, reinforced concrete; designed in accordance with ASTM C890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for joint sealants.

1. Joint Sealants: **ASTM C990**, bitumen or butyl rubber.
2. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
3. Grade Rings: Include two or three reinforced-concrete rings, of **6- to 9-inch** total thickness, that match **24-inch-** diameter frame and grate.
4. Steps: Individual FRP steps or FRP ladder, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at **12- to 16-inch** intervals. Omit steps if total depth from floor of catch basin to finished grade is less than **[60 inches]**<>.
5. Pipe Connectors: **ASTM C923**, resilient, of size required, for each pipe connecting to base section.

### C. Rectangular Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include flat grate with small square or short-slotted drainage openings.

1. Size: **24 by 24 inches** minimum unless otherwise indicated.
2. Grate Free Area: Approximately 50 percent unless otherwise indicated.

### D. Round Frames and Grates: ASTM A536, Grade 60-40-18, ductile iron designed for A-16 (AASHTO HS20-44), structural loading. Include **24-inch** ID by **7- to 9-inch** riser with **4-inch-** minimum width flange, and **26-inch-** diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent unless otherwise indicated.

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## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

### **3.2 INSTALLATION OF PIPING**

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- F. Install gravity-flow, nonpressure drainage piping in accordance with the following:
  - 1. Install piping pitched down in direction of flow.
  - 2. Install piping **NPS 6** and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
  - 3. Install piping with **36-inch-** minimum cover.
  - 4. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

### **3.3 PIPE JOINT CONSTRUCTION**

- A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
  - 1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
  - 2. Join hub-and-spigot, cast-iron soil piping with caulked joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
  - 3. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
  - 4. Join ductile-iron culvert piping in accordance with AWWA C600 for push-on joints.
  - 5. Join ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
  - 6. Join corrugated-steel sewer piping in accordance with ASTM A798/A798M.

7. Join corrugated-aluminum sewer piping in accordance with ASTM B788/B788M.
8. Join ABS sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
9. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
10. Join PVC cellular-core piping in accordance with ASTM D2321 and ASTM F891 for solvent-cemented joints.
11. Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
12. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
13. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
14. Join fiberglass sewer piping in accordance with ASTM D3839 for elastomeric-seal joints.
15. Join nonreinforced-concrete sewer piping in accordance with ASTM C14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
16. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

B. Join force-main pressure piping in accordance with the following:

1. Join ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41 for push-on joints.
2. Join ductile-iron special fittings in accordance with AWWA C600 or AWWA M41 for push-on joints.
3. Join PVC pressure piping in accordance with AWWA M23 for gasketed joints.
4. Join PVC water-service piping in accordance with ASTM D2855 for solvent-cemented joints.
5. Join dissimilar pipe materials with pressure-type couplings.

### 3.4 INSTALLATION OF CATCH BASINS

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

### 3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete in accordance with ACI 318.

### 3.6 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 221414 "Storm Drainage Piping."
- B. Make connections to existing piping and underground manholes.
  1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus **6-inch** overlap, with not less than **6 inches** of concrete with 28-day compressive strength of **3000 psi**.
  2. Make branch connections from side into existing piping, **NPS 4 to NPS 20**. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than **6 inches** of concrete with 28-day compressive strength of **3000 psi**.

3. Make branch connections from side into existing piping, **NPS 21** or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow **3 inches** of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in **6 inches** of concrete for minimum length of **12 inches** to provide additional support of collar from connection to undisturbed ground.
  - a. Use concrete that will attain a minimum 28-day compressive strength of **3000 psi** unless otherwise indicated.
  - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

### 3.7 IDENTIFICATION

- A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
  1. Use detectable warning tape over nonferrous piping and over edges of underground structures.

### 3.8 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately **24 inches** of backfill is in place, and again at completion of Project.
  1. Submit separate reports for each system inspection.
  2. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  1. Do not enclose, cover, or put into service before inspection and approval.
  2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
  3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
  4. Submit separate report for each test.
  5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:

- a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.9 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334200