



PROJECT MANUAL for
Bradford Public Library

ADDITION & RENOVATION

138 E. MAIN STREET, BRADFORD, OHIO 45308

SHP Comm. No. 2026032.01

SHP

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EARLY SITE PACKAGE
September 14, 2026

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September 2, 2026

Mr. Ryan O'Callaghan
SHP
311 Elm Street
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Cincinnati, Ohio 45202

Re: **Geotechnical Exploration Report
Proposed Addition and Renovation Project
Braford Public Library
138 East Main Street
Bradford, Miami County, Ohio 45308
PSI Report No. 01253857**

Dear Mr. O'Callaghan:

As requested, **Professional Service Industries, Inc. (PSI)**, an Intertek Company, is pleased to submit this Geotechnical Exploration Report for the proposed Addition and Renovation Project for the Braford Public Library. The project is located at 138 East Main Street Bradford, Miami County, Ohio 45308. Included in this report are the results of the geotechnical exploration and recommendations concerning design and construction of the proposed development.

It is considered imperative that the geotechnical engineer and/or their representative be present during earthwork operations, foundation, and floor slab installations to observe the field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.

We appreciate the opportunity to have provided you with our geotechnical engineering services and look forward to participation in the construction phase of this project. If you have any questions concerning this report or if we may be of further service in any manner, please contact our office.

Respectfully submitted,
PROFESSIONAL SERVICE INDUSTRIES, INC.

A handwritten signature in black ink that reads "Brandon France".

Brandon France
Project Manager

A handwritten signature in black ink that reads "Chris Carson".

Christopher L. Carson, P.E.
Principal Consultant

The above signatures are an electronic reproduction of the original. An original hard copy is available upon request. This electronic reproduction shall not be construed as an original or certified document.

Enclosures

Geotechnical Exploration Report

For

Proposed Addition and Renovation Project
Braford Public Library
138 East Main Street
Bradford, Miami County, Ohio 45308

Prepared for

SHP
311 Elm Street
Suite 600
Cincinnati, Ohio 45202

Prepared by

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Report Date: September 2, 2026

PSI Project No. 01253857



Brandon France

Project Manager

Christopher L. Carson, P.E.
Principal Consultant



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1 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

This report presents the results of a geotechnical exploration and foundation evaluation conducted for the proposed Addition and Renovation Project for the Bradford Public Library. The project is located at 138 East Main Street Bradford, Miami County, Ohio 45308. PSI's services for this project were performed in accordance with PSI Proposal Number 0125-482341, dated July 9, 2026, and approved via SHP Project Specific Agreement dated July 29, 2026.

1.2 PROJECT DESCRIPTION

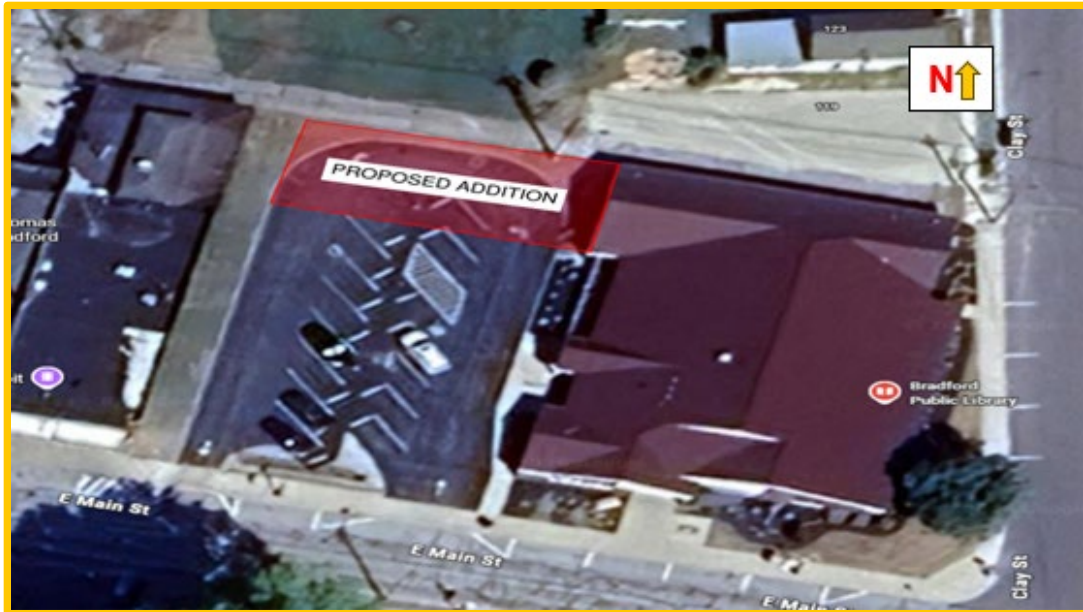
Based on the information provided, a summary of our project understanding is provided below in the Project Description table.

Table 1: Project Description

Project Items	New single-story building addition measuring approximately 2,600 SF in plan area to be attached near the northwest corner of the existing building. No below grade structures are proposed. (Provided)
Building Construction Types	Building addition to be metal building and slab-on-grade floors. (provided)
Existing Grade Change	± 2 Feet Estimated (992 to 990 MSL) (Google Earth Pro).
Finished Floor Elevations	Not provided, PSI estimates +/- 2 feet from existing grades. (Report Basis).
Requested or Anticipated Foundation Types	Conventional shallow spread/continuous footings (provided).
Building Maximum Design Column/Wall/Floor Loads	Column: 100 kips Wall: 3 kips per lineal foot Floor: 150 pounds per square foot (psf) (Report Basis)
Pavement for Parking and Drives	Flexible Asphalt (HMAC) and/or Rigid Concrete Pavement (Report Basis)
Design Traffic Load	Not provided at time of submittal



The image below was provided by the client and shows the proposed addition and current site development.



The geotechnical recommendations presented in this report are based on the available project information, the proposed location and orientation of the structure, and the subsurface materials described in this report. If any of the information we have is incorrect, please contact us so that we may amend the recommendations presented accordingly. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

1.3 SCOPE OF SERVICES

The purpose of this study was to explore the subsurface conditions at the site to prepare recommendations for foundation systems and other design parameters for the proposed development. PSI's contracted scope of services included drilling soil test borings, a select laboratory testing program, and preparation of this geotechnical report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:

- General site development and subgrade preparation recommendations.
- Estimated potential soil movements associated with collapsing, shrinking, and swelling soils and methods to reduce these movements to acceptable levels.
- Recommendations for site excavation, fill compaction, and the use of on-site and imported fill material under the structure.
- Recommendations for building pad preparation for ground supported slabs having a maximum movement potential, due to heave or settlement.
- Recommendations for the design of foundations for supporting the proposed structure.
- Seismic design site classification per the 2021 International Building Code (2024 OBC).
- General recommendations and soil parameters for below grade structures
- Recommendations for the design of flexible asphaltic and rigid concrete pavement systems for the proposed parking and drive areas.



The scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on, below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Prior to further development of this site, an environmental assessment is advisable.

PSI's scope also did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminants in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence or the amplification of the same. The Client should be aware that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The Client should also be aware that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or reoccurrence of mold amplification.



2 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND CONDITIONS

The proposed project site area is located at 138 East Main Street Bradford, Miami County, Ohio 45308. Specifically, the addition will be connected to the northwest corner of the existing building. PSI has provided additional site description information in the table below.

Table 2: Site Description

Site Location	Latitude: 40.1324; Longitude: -84.4299
Site History	The proposed site is currently developed as part of the parking/drive area for the existing library located to the east. (Google Earth)
Existing Site Ground Cover	Asphalt parking area
Existing Grade/Elevation Changes	± 2 Feet Estimated (992 to 990 MSL), Sloping downward from east to west. (Google Earth Pro).
Existing Site Features	Existing Library Building and associated pavements and parking lots. (Google Earth Pro)
Site Boundaries/Neighboring Development	Residential and commercial properties

2.2 SITE GEOLOGY

Based on the on-line geologic map provided by the Ohio Geological Survey, the proposed site area is in the Central Lowland Province, Till Plains Section, Southern Ohio Loamy Till Plain and Union City-Bloomer Transitional Terrain Regions with Ridge and Ground moraine topography supported by Silurian bedrock as part of the Wisconsinan Glacial Period.

Based on well log data on this proposed site from the Ohio Department of Natural Resources web site, the area's rock formation is located at about 70 feet beneath the existing surface grades. PSI did not encounter rock during field operations.

A review of the ODNR Quaternary Geology of Ohio Map No. 2, the area is noted as "M3" End moraine, occurs as hummocky ridges higher than adjacent terrain. Additionally, based on a review of the ODNR Karst Map program the immediate project site area does not appear to be within known karst areas. However, there are known Karst areas approximately 4 to 5.5 miles to the southeast of the site area.

Additional soil information can be found on the USDA Web Soil Survey Map in the appendix.



2.3 SUBSURFACE CONDITIONS

The scope of PSI's services included a subsurface exploration program consisting of drilling test borings and Standard Penetration Testing (SPT) at three (3) locations including two (2) borings for the building addition and one (1) boring for the pavement. The borings were drilled to depths of 10 to 20 feet below existing surface grades.

The borings were advanced utilizing a 3¼ inch inside diameter, hollow-stem auger drilling methods. Soil samples were routinely obtained during the drilling process. Select soil samples were later tested in the laboratory to obtain soil material properties for the foundation and concrete slab-on-grade recommendations. Drilling, sampling, and laboratory testing was accomplished in general accordance with ASTM procedures.

SURFICIAL MATERIALS: Surficial materials consisted of approximately 3 to 3.5 inches of asphalt underlain by approximately six (6) to thirty (30) inches of aggregate base material. Any surficial material thicknesses are included in this report for informational purposes only and should not be used for bidding or estimating purposes.

COHESIVE SOILS: Underlying the surficial/uncontrolled fill materials, natural cohesive soils consisting of **Lean Clay (CL) and Fat Clay (CH)** with varying amounts of sand, silt, clay and gravel were encountered. The Standard Penetration Test values ("N₆₀"-values) for the cohesive soils generally ranged from ten (10) to thirty-eight (38) blows per foot indicating "stiff" to "hard" consistencies. The moisture contents of the cohesive soil samples ranged from thirteen (13) to twenty-five (25) percent.

GRANULAR SOILS: Underlying the surficial materials, granular soils consisting of **Clayey Sand (SC)** with varying amounts of clay, sand, silt, and gravel were also encountered within the explored depths at test boring locations B-1 and B-2 at the bottom of the borings. The Standard Penetration Test value ("N"-values) for the granular soils ranged from eight (8) to one-hundred thirteen (113) blows per foot indicating "loose" to "extremely dense" consistencies, generally getting stiffer with depth. The granular soil exhibited moisture contents ranging from eight (8) to eighteen (18) percent.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil/rock descriptions, stratifications, penetration resistances, and locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during the field operations is also shown on these boring logs. The samples that were not altered by laboratory testing will be retained for thirty (30) days from the date of this report and then will be discarded.



2.4 GROUNDWATER LEVEL MEASUREMENTS

Groundwater was encountered at test boring locations B-1 and B-2 during drilling operations at 13.5 and 15 feet, respectively, below existing surface grades. Groundwater was also encountered at completion of drilling operations at test boring locations B-1 and B-2 at depths of seven (7) and nine (9) feet, respectively, below existing surface grades. It must be recognized that free groundwater levels can significantly fluctuate (seasonally) and as a function of rainfall and may be present at other locations or at depths shallower than those encountered. It is likely that groundwater is following the bedrock towards the river. During a time of year or weather different from the time of drilling, there may be a considerable change in the water table, or the occurrence of water where not previously encountered. Furthermore, the free groundwater levels in the boreholes often are not representative of the actual groundwater level, because the boreholes remain open for a relatively short time. It is common for groundwater to be present along the soil bedrock interface. To obtain longer-term measurements, it is necessary to install water level observation wells or piezometers. The water level measurements presented in this report are the levels that were measured at the time of PSI's field activities. Therefore, we recommend that the contractor determine the actual groundwater levels at the time of construction to evaluate groundwater impact on the construction procedures.



3 GEOTECHNICAL DISCUSSION

The project field exploration has revealed concerns at this site which may affect the overall performance of foundations, or slabs for the project. The following summarizes these concerns.

3.1 HIGH PLASTIC - FAT CLAY

High plasticity and “Fat” Clays (CH) were noted at soil test boring location B-1 to a depth of approximately 3 feet below the existing surface grade. These higher plasticity and Fat Clays have a larger potential to expand and shrink thereby possibly impacting the proposed construction. Additionally, these higher plasticity “Fat” Clay soils may be present in other areas of the site and in greater quantities than that observed in the soil test borings. Additionally, these fat clays will most likely be present in the on-site borrow soils for the anticipated building fill material. Accordingly, careful selection of borrow soils should be undertaken prior to earthwork operations to verify that these fat clay soils are not being used. Moreover, where these soils exist within 2 feet of floor slabs and footings, or within 1 foot of pavements, removal and replacement is recommended to reduce the shrink/swell potential.

Although it is not possible to prevent soil moisture changes, a number of steps may be taken to aid in the reduction of subsoil moisture content variations. These steps are intended to help reduce the shrink/swell potential, not eliminate it. Some of these measures are:

1. During construction, a positive drainage scheme should be implemented and maintained to prevent ponding of water on subgrades.
2. The building subgrade should not be allowed to dry out; backfill should proceed as soon as possible to minimize changes in the natural moisture regime.
3. Permanent positive drainage should be maintained around the construction, thereby transmitting water away from the foundation perimeter. In addition, site grading should provide rapid drainage of surface water away from foundation areas.
4. Utility trenches should be backfilled with low plasticity clays to reduce the potential of the trenches to act as aqueducts transmitting water beneath the structures due to excess surface water infiltration.
5. Shrubbery, flower beds and sprinkler systems surrounding the structures should be eliminated or at least limited and should be designed so that the bedding soils drain away from the building areas. The planters should have impermeable bases with weep holes discharging into drainage pipes or onto paved surfaces.
6. Trees and/or large bushes should not be planted adjacent to the structures.
7. Since plumbing and other water leaks can cause excessive heaving of high plasticity soils, every effort should be made to maintain the plumbing in good working order and prevent or minimize water leaks and discharges. It is recommended that all water supply lines and wastewater lines be tested for leaks prior to backfilling the utility trenches.

Please refer to the “Site Preparation” section and “Engineering Fill” section of this report for further recommendations.



4 GEOTECHNICAL RECOMMENDATIONS

The following geotechnical related recommendations have been developed based upon the subsurface conditions encountered, our experience with similar soils and site conditions, and PSI's understanding of the proposed development. Should changes in the project criteria occur, a review must be made by PSI to determine if modifications to our recommendations will be required.

4.1 SITE PREPARATION

PSI recommends that any surficial materials, asphalt, gravel, soft/loose, organic materials, frozen, or otherwise objectionable soils in the construction areas be removed and either wasted or stockpiled for later use in non-structural areas. Additionally, PSI recommends that where encountered, high plasticity/fat clays be removed to a minimum depth/distance of 24 inches from footings, walls, and floor slabs and a minimum of 12 inches beneath pavement sections. A representative of the geotechnical engineer should determine and document the depth of removal at the time of construction.

In this region, these otherwise competent sands, silts and lean clays can undergo a significant loss of stability when construction activities are performed during wetter portions of the year. PSI anticipates that the soils in the project area can become easily disturbed if subjected to conventional rubber tire or narrow track-type equipment. Soils that become disturbed would need to be excavated and replaced; however, this remedial excavation may expose progressively wetter soils with depth, thus compounding the situation. Therefore, a normal approach to subgrade preparation may not be possible. Appropriate wide-track equipment selection should aid in minimizing potential disturbance.

After stripping to the proposed subgrade level and replacing unsuitable fill soils and/or objectionable soils if present, with engineered fill, as required, the building and paving areas should be proof-rolled with a loaded tandem-axle dump truck or similar heavy rubber-tired vehicle (typically with an load greater than nine (9) tons per axle). Soils that are observed to rut or deflect excessively (typically greater than one (1) inch) under the moving load should be undercut and replaced with properly compacted low plasticity fill material. The proof-rolling and undercutting activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather. If the earthwork activities take place during wet seasons, lime stabilization of the subgrade could be required prior to engineered fill placement. Care should be taken during construction activities not to allow excessive drying or wetting of exposed soils. The subgrade soils should be scarified and compacted to at least 98% of the materials' standard Proctor maximum dry density, in general accordance with ASTM procedures, to a depth of at least twelve (12) inches below the surface. Additionally, new fill for building structures, asphalt, and concrete should not be placed on soft or frozen ground.



4.2 ENGINEERED FILL

After subgrade preparation and observation have been completed, fill placement required to establish grade may begin. Low plasticity structural fill materials should be free of organic or other deleterious materials and have a maximum particle size of less than three (3) inches. Low-plasticity soils are defined as having a liquid limit less than forty-five (45) and plasticity index between ten (10) and twenty (20). Samples of proposed fill materials should be provided to PSI well in advance of their use to determine if the proposed fill material is suitable for use at the project. Some of the onsite soils may be suitable for reuse; however, organic or contaminated soils will likely not be suitable. Additionally, a representative of PSI should be on-site to observe, test, and document placement of the fill. If the fill is too dry, water should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Close moisture content control will be required to achieve the recommended degree of compaction. If wet or cool season earthwork is necessary, PSI recommends the use of imported fill materials meeting the requirements of Ohio Department of Transportation (ODOT) No. 304 aggregate.

Fill should be placed in maximum loose lifts of eight (8) inches and compacted to at least 98% of the materials' standard Proctor maximum dry density, and within a range of the optimum moisture content as designated in Table 2 below, as determined in general accordance with ASTM procedures. Each lift of compacted-engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts. The edges of compacted fill should extend a minimum of five (5) feet beyond the building footprint, or a distance equal to the depth of fill beneath the footings, whichever is greater. The measurement should be taken from the outside edge of the footing to the toe of the excavation prior to sloping.

In utility trenches, shallow foundation excavations, and other areas where large compaction equipment cannot be used, granular engineered fill should be placed as backfill. PSI recommends the use of material meeting Ohio Department of Transportation (ODOT) No. 304, for use as granular engineered fill. Engineered fill should be placed in accordance with the recommendations stated in this section of the report.

The fill placed should be tested and documented by a geotechnical technician and directed by a geotechnical engineer to evaluate the placement of fill material. It should be noted that the geotechnical engineer of record can only certify the testing that is performed, and the work observed by that engineer or staff in direct report to that engineer. The fill should be evaluated in accordance with the following table.

Table 3

MATERIAL TESTED	PROCTOR TYPE	MIN % DRY DENSITY	PLACEMENT MOISTURE CONTENT RANGE	FREQUENCY OF TESTING *¹
Structural Lean Clay Fill (Cohesive)	Standard	98%	-2 to +2 %	1 per 1000 ft ² of fill placed / lift
Structural Fill (Granular)	Standard	98%	-2 to +2 %	1 per 1000 ft ² of fill placed / lift
Random Fill (non-load bearing)	Standard	90%	-3 to +3 %	1 per 1,500 ft ² of fill placed / lift
Utility Trench Backfill	Standard	98%	-2 to +2 %	1 per 150 lineal foot / lift

*¹ Minimum 2 per lift.



Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures and prior to the placement of additional fill material.

4.3 FOUNDATION RECOMMENDATIONS

PSI has based this report on the columns having maximum loads of 100 kips and walls having a maximum load of 3 kips per lineal foot. Accordingly, after the site preparation portion of the report is complete, the proposed structure can be supported on conventional spread-type footing foundations bearing on either competent naturally deposited soils or properly compacted, tested, and documented engineered fill. If it is desired for the planned foundations to bear on properly compacted and documented fill, the geotechnical engineer should be allowed to review the material to determine its consistency with the recommended bearing pressures. The encountered undocumented fill is not suitable to support building foundations. Spread footings for building columns and continuous footings for bearing walls can be designed using a maximum allowable soil bearing pressure of **3,500 pounds per square foot (psf)** based on dead load plus design live load. These values contain a safety factor of 3 against ultimate soil failure. PSI recommends a minimum dimension of twenty-four (24) inches for square footings and eighteen (18) inches for continuous footings to minimize the possibility of a local bearing capacity failure.

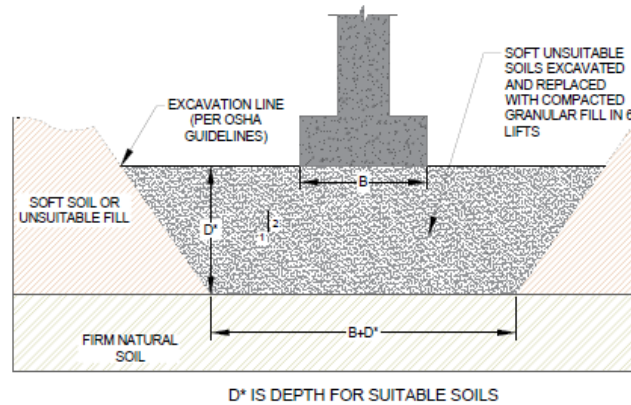
Exterior footings and footings in unheated areas should be located at a depth of forty-two (42) inches or deeper below the final exterior grade to provide adequate frost protection. However, footings should bear as near as possible to the elevations of the existing building foundations, especially for footings constructed adjacent to the existing building. If the structure is to be constructed during the winter months or if footings will likely be subjected to freezing temperatures after foundation construction, then the footings should be protected from freezing. PSI recommends that interior footings be a minimum depth of eighteen (18) inches below the finished floor elevation.

Caution must be exercised if new foundations are to be situated near any existing foundation members to assure that the new foundations do not overstress the soils beneath the existing foundations which could result in excessive settlement of either foundation. It is recommended that the foundations be designed so no footing is within an area extending from the bottom of the footing downward and outward at a 45-degree angle. Footings should also be designed so there is at least 3 footing widths clear space between footings to reduce the potential for excessive settlement due to stress overlap. Care must also be taken during excavation of the new foundation to not undermine any existing foundations, utilities, slabs, or other flatwork.

The foundation excavations should be observed and documented by a representative of PSI prior to steel or concrete placement to determine that the foundation materials are consistent with the materials discussed in this report, and therefore can support the design loads. Soft or loose soil zones encountered at the bottom of the footing excavations should be removed to the level of suitable natural soils and replaced with adequately compacted (granular) structural fill. Fill placed below the foundations where unsuitable materials are removed should extend one half ($\frac{1}{2}$) foot outside the foundation limits for every one (1) foot in thickness between the intended bearing surface and the underlying, suitable natural soils. Alternately, the foundations may be extended through unsuitable soils to bear on the underlying suitable material. Cavities formed because of excavation of soft or loose soil zones should be backfilled with lean concrete or dense graded compacted crushed stone.



Figure 3



After opening, footing excavations should be observed, and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture by placing a relatively thin seal slab of concrete.

Based on the known subsurface conditions and site geology, laboratory testing and past experience, PSI anticipates that properly designed and constructed footings supported on the recommended materials should experience total and differential settlement between adjacent columns of less than one (1) inch and $\frac{3}{4}$ inch, respectively.

Be advised that as a part of the foundation selection process, there is a cost/benefit evaluation. Although PSI is recommending a specific foundation type, we have not accomplished the cost/benefit evaluation.

4.4 EARTHQUAKE AND SEISMIC DESIGN CONSIDERATION

The 2021 International Building Code requires a site class for the calculation of earthquake design forces. This class is a function of soil type (i.e., depth of soil and strata types). Based on the depth to rock and the estimated shear strength of the soil at the test boring locations, Site Class "D" is recommended. The United States Geological Survey National Earthquake Hazard Reduction Program (USGS-NEHRP) probabilistic ground motion values "D" are as follows:

Table 4: For Latitude 40.13242°N / Longitude -84.42987°W

Period (seconds)	Site Coefficients	Max. Spectral Acceleration Parameters	Design Spectral Acceleration Parameters
0.215 (S_s)	$F_a = 1.6$	$S_{ms} = 0.344$	$S_{Ds} = 0.229$
0.075 (S_1)	$F_v = 2.4$	$S_{m1} = 0.179$	$S_{D1} = 0.119$

According to IBC 2021, the Site Coefficients, F_a and F_v were interpolated from ASCE7-16 as a function of the site classifications and the mapped spectral response acceleration at the short (S_s) and 1 second (S_1) periods.



If a **Seismic Design Category B** is selected by the architect or structural engineer for this structure, Section 1802 of the Code does not require an assessment of slope stability, liquefaction potential, and surface rupture due to faulting or lateral spreading.

4.5 FLOOR SLAB RECOMMENDATIONS

The floor slab should be supported on properly placed, compacted, and tested fill or native low plasticity soil. If the owner is willing to accept some risk of excessive settlement, partial removal (3 feet) of the undocumented fill below the floor slabs could be undertaken. However, due to the non-uniform nature of the encountered materials the risk is not able to be quantified. Other options, besides removal and replacement, are available. PSI would be happy to provide additional recommendations upon request of the owner.

Once the site area has been prepared in accordance with the "Site Preparation" section of this report, the floor slab can be grade supported on a minimum 2 feet non-expansive engineered fill. Proof-rolling, as discussed earlier in this report, should be accomplished to identify soft or unstable soils that should be removed from the floor slab area prior to fill placement and/or floor slab construction. These soils should be replaced with properly compacted structural fill as described earlier in this report.

PSI recommends that a minimum six (6) inch thick trimmable, compactable granular material be placed beneath the floor slab to enhance drainage. The soil surface shall be graded to drain away from the building without low spots that can trap water prior to placing the granular drainage layer. Polyethylene sheeting should be placed to act as a vapor retarder where the floor will be in contact with moisture sensitive equipment or products such as tile, wood, carpet, etc., as directed by the design engineer. The decision to locate the vapor retarder in direct contact with the slab or beneath the layer of granular fill should be made by the design engineer after considering the moisture sensitivity of subsequent floor finishes, anticipated project conditions, and the potential effects of slab curling and cracking. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage.

For subgrade prepared as recommended and properly compacted fill, a modulus of subgrade reaction, k value, of **120 pounds per cubic inch (pci)** may be used in the grade slab design based on correlation to values typically resulting from a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value should be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = \left(\frac{k}{B} \right)$ for cohesive soil and

$$k_s = k \left(\frac{B+1}{2B} \right)^2 \text{ for cohesionless soil}$$

where:	k_s	=	coefficient of vertical subgrade reaction for loaded area,
	k	=	coefficient of vertical subgrade reaction for 1 square foot area, and
	B	=	effective width of area loaded, in feet



The precautions listed below should be followed for construction of slab-on-grade pads. These details will not reduce the amount of movement, but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content is inevitable because of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

Cracking of slab-on-grade concrete is normal and should be expected. Cracking can occur not only because of heaving or compression of the supporting soil and/or bedrock material, but also because of concrete curing stresses. The occurrence of concrete shrinkage cracks, and problems associated with concrete curing may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement, finishing, and curing, and by the placement of crack control joints at frequent intervals, particularly where re-entrant slab corners occur. The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. For example, joints are recommended at a maximum spacing of twelve (12) feet based on having a four-inch slab. PSI also recommends that the slab be independent of the foundation walls. Using fiber reinforcement in the concrete can also control shrinkage cracking.

Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.

Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.

4.6 PAVEMENT RECOMMENDATIONS

General Traffic Information

PSI's scope of work did not include performing a CBR analysis or specific pavement design for the proposed project. However, PSI conducted grain-size analysis and index tests and an average California Bearing Ratio (CBR) value of four (4) was estimated based upon the test results and our experience in the area. This value can be utilized for design of the pavement structures if the subgrade materials consist of engineered fill or natural soils and are compacted to the minimum specified degree as recommended. The subgrade soils should be verified by PSI prior to the placement of the aggregate base course.

Anticipated traffic data was not available at the time of this report. PSI has based this report on the following design traffic in order to conduct a pavement section analysis. Traffic data should be provided when available so PSI can review the design recommendations and make any necessary changes.

- ADT of 500 light duty vehicles
- A garbage truck 2 times a week each
- Periodic bus traffic
- 20-year design life
- 2% annual growth rate
- 85% reliability
- 0.45 standard deviation
- serviceability loss of 2.0



Pavement Subgrade Preparation

The subgrade should be prepared per the “*Site Preparation*” section of this report. Additionally, prior to paving, the prepared subgrade should be proof rolled using a loaded tandem axle dump truck or similar type of pneumatic tired equipment with a minimum gross weight of nine (9) tons per single axle. Localized soft areas identified should be repaired prior to paving. Moisture content of the subgrade should be maintained between –2% and +3% of the optimum at the time of paving. It may require rework when the subgrade is either desiccated or wet.

Construction traffic should be minimized to prevent unnecessary disturbance of the pavement subgrade. Disturbed areas, as verified by PSI, should be removed, and replaced with properly compacted material.

The edges of compacted fill should extend a minimum two (2) feet beyond the edges of the pavement, or a distance equal to the depth of fill beneath the pavement, whichever is greater. The measurement should be taken from the outside edge of the pavement to the toe of the excavation prior to sloping.

The aggregate base should comply with the gradation requirements of ODOT No. 304 (or similar) dense-graded aggregate. It should be compacted to 98 percent of the maximum dry density as determined by ASTM D698 (standard Proctor). The granular base course should be built at least 2 feet wider than the pavement on each side to support the tracks of the slip form paver. This extra width is structurally beneficial for wheel loads applied at pavement edge. The asphalt base course should be compacted to a minimum of 92% of the Maximum Theoretical Density as determined by ASTM D2041. Careful attention will be required in fine grading the subgrade surfaces to eliminate undulations and depressions that would tend to collect water.

Flexible Pavement

The recommended **minimum** pavement thickness values based upon the provided and calculated data are shown in the following table.

Table 3: Flexible Pavement Sections

Layer	Standard-Duty
Surface Course (ODOT #448 Type 1)	1.5 inches
Intermediate Course (ODOT #448 Type 2)	2.0 inches
Aggregate Base Course (ODOT #304)	6.0 inches

Subgrade compaction required in the upper 12 inches of subgrade.

For parking stalls that allow free movement through them (i.e. no parking block or curbs), PSI recommends constructing the recommended heavy-duty asphalt section. Allowances for proper drainage and proper material selection of base materials are most important for performance of asphaltic pavements. Ruts and birdbaths in the asphalt pavement will allow for quick deterioration of the pavement primarily due to saturation of the underlying base and subgrade. Proper maintenance will be required.



Rigid Pavement

The use of concrete for paving has become more prevalent in recent years due to the long-term maintenance cost benefits of concrete compared to asphalt concrete pavements. Should concrete pavement be utilized, the concrete should be properly reinforced and jointed, and should have a 28-day flexural strength of no less than 600 psi and should be air entrained. Expansion joints should be sealed with a polyurethane sealant so that moisture infiltration into the subgrade soils and resultant concrete deterioration at the joints is reduced.

Table 4: Rigid Pavement Sections

Rigid (Concrete) Pavement	Standard-Duty*
Plain PCC Concrete	5.0 inches
Thickened Edges	6.5 inches
Aggregate Base Course (ODOT #304)	4.0 inches

Subgrade compaction required in the upper 12 inches of subgrade.

**Automobile traffic and light trucks only.*

Pavement for any dumpster pad areas or areas subject to consistent heavy loads should be constructed of a minimum of 8 inches of Portland cement concrete with load transfer devices installed where construction joints are required. A thickened edge equal to 20 percent of the pavement thickness and a minimum of 2 inches is recommended on the outside of slabs subject to wheel loads. This thickened edge usually takes the form of an integral curb, tied shoulders, or thickened pavement tapered in the outer 4 feet of the pavement. Jointing for crack control should have a maximum spacing of 2 times the slab thickness (inches) in feet or for a 5-inch thickness the joints spacing should be a maximum 10 feet. Fill material should be compacted behind the curb or the edge of the outside slabs should be thickened.

Design for drainage is of the utmost importance to minimize detrimental effects that may shorten the service life of the pavements. The pavement should be crowned or sloped to promote effective surface drainage and reduce the risk of water ponding. In addition, the subgrade should be similarly sloped to promote effective subgrade drainage. We recommend “stub” or “finger” drains be provided around catch-basins and in other low areas of the proposed pavements to limit the accumulation of water on the frost susceptible subgrade soils. Subsurface edge drains should be provided at curbs. Where no curbs are proposed, ditches should be provided, and the pavement base course should be daylighted through the ditch side slope to facilitate drainage of the base course.

All materials used, and field operations required in connection with the contemplated pavement structures should follow recommendations and procedural details as per the Ohio Department of Transportation, Asphalt Institute, and/or American Concrete Institute.

Pavement Drainage & Maintenance

PSI recommends pavements be sloped to provide rapid surface drainage. Water allowed to pond on or adjacent to the pavement could saturate the subgrade and cause premature deterioration of the pavements, and removal and replacement may be required. Consideration should be given to the use of interceptor drains to collect and remove water collecting in the granular base. The interceptor drains could be incorporated with the storm drains of other utilities located in the pavement areas.



Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and by maintaining proper surface drainage to avoid ponding of water on or near the pavement areas. Underdrains, sub-drains and under slab drains presented in this report will not prevent moisture vapor that can cause mold growth.

Design for drainage is of the utmost importance to minimize detrimental effects that may shorten the service life of the pavements. The pavement should be crowned or sloped in order to promote effective surface drainage and reduce the risk of water ponding. We recommend a minimum slope of 1.5 percent. In addition, the subgrade should be similarly sloped to promote effective subgrade drainage. We recommend “stub” or “finger” drains be provided around catch-basins and in other low areas of the proposed pavements to limit the accumulation of water on the frost susceptible subgrade soils. Subsurface edge drains should be provided at curbs. Where no curbs are proposed, ditches should be provided and the pavement base course should be daylighted through the ditch side slope to facilitate drainage of the base course.

Subsurface “stub” or “finger” drains should be perforated corrugated plastic pipe or an equivalent. The pipe should be surrounded by a minimum of 4 inches of free draining aggregate, with the aggregate fully encased in a non-woven geotextile filter fabric.

4.7 UTILITIES TRENCHING

Excavation for utility trenches shall be performed in accordance with OSHA regulations as stated in 29 CFR Part 1926. It should be noted that utility trench excavations have the potential to degrade the properties of the adjacent fill materials. Utility trench walls that can move laterally can lead to reduced bearing capacity and increased settlement of adjacent structural elements and overlying slabs.

Backfill for utility trenches is as important as the original subgrade preparation or structural fill placed to support either a foundation or slab. Therefore, it is imperative that the backfill for utility trenches be placed to meet the project specifications for the structural fill of this project. PSI recommends that flowable fill or lean mix concrete be utilized for utility trench backfill. If on-site soils are placed as trench backfill, the backfill for the utility trenches should be placed in four (4) to six (6) inch loose lifts and compacted according to the parameters detailed in Table 3 in section 3.2 of this report. Up to four (4) inches of bedding material placed directly under the pipes or conduits placed in the utility trench can be compacted to the 90% compaction criteria with respect to the standard Proctor. Compaction testing should be performed for every 150 cubic yards of backfill place or each lift within 150 linear feet of trench, whichever is less. The backfill of utility trenches should not be performed with water standing in the trench. If granular material is used for the backfill of the utility trench, the granular material should have a gradation that will filter protect the backfill material from the adjacent soils. If this gradation is not available, a geosynthetic non-woven filter fabric should be used to reduce the potential for the migration of fines into the backfill material. Granular backfill material shall be compacted to meet the above compaction criteria. The clean granular backfill material should be compacted to achieve a relative density greater than 75% or as specified by the geotechnical engineer for the specific material used.



4.8 SILTATION CONTROL

The Clean Water Act implemented in 1990 includes a federal permit program called the National Pollutant Discharge Elimination System (NPDES). This program requires that projects sites more than one (1) acre or are part of a development which exceeds one (1) acre be covered under a permit. This typically includes the development of a storm water pollution prevention plan (SWPPP) as well as period inspections (typically once a week plus after significant rainfall). PSI is available to assist with these services.



5 CONSTRUCTION CONSIDERATIONS

PSI should be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. PSI cannot accept responsibility for conditions that deviate from those described in this report, nor for the performance of the foundation system if not engaged to also provide construction observation and testing for this project.

5.1 MOISTURE SENSITIVE SOILS/WEATHER RELATED CONCERNS

The upper fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and to changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather.

5.2 DRAINAGE AND GROUNDWATER CONSIDERATIONS

Groundwater was encountered at test boring locations B-1 and B-2 during drilling operations at thirteen and a half (13.5) and fifteen (15) feet, respectively, below existing surface grades. Groundwater was also encountered at completion of drilling operations at test boring locations B-1 and B-2 at depths of seven (7) and nine (9) feet, respectively, below existing surface grades. PSI recommends that the Contractor determine the actual groundwater levels at the site at the time of the construction activities to assess the impact groundwater may have on construction. Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building. Overall site area drainage is to be arranged in a manner such that the possibility of water impounding below slab-on-grade areas and over the structural fill, is prevented at all times during and after construction.

5.3 EXCAVATIONS

In Federal Register, Volume 54, Number 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better enhance the safety of workers entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is PSI's understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

Care must be taken to protect adjacent structure foundations and structures during the foundation excavation process, so no structure or foundation is undermined. All existing foundations must be protected during the installation process. In addition, care must be taken to maintain the groundwater level at least 2 feet below the deepest excavation at the site to reduce the potential for unstable soil conditions.



The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case, should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

PSI is providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations. A trench safety plan was beyond the scope of our services for this project.



6 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding section constitutes PSI's professional estimate of those measures that are necessary for the proposed structure to perform per the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.



7 REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by PSI for the proposed development. If there are any revisions to the plans for the proposed development or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be retained to determine if changes in the recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

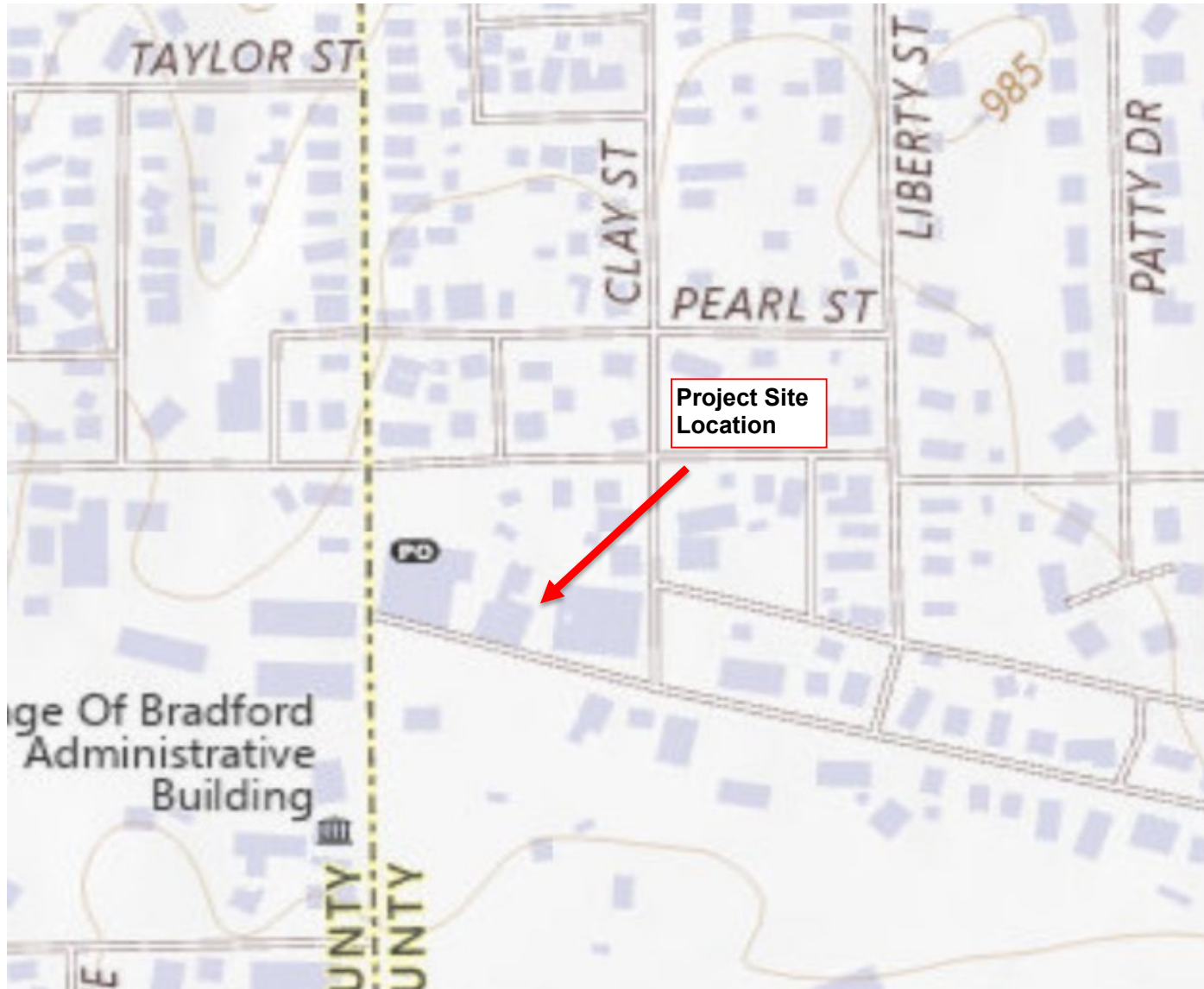
The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of SHP for the specific application of the proposed Addition and Renovation Project for the Bradford Public Library. The project is located at 138 East Main Street Bradford, Miami County, Ohio 45308.



APPENDIX

Site Vicinity Plan
Boring Location Plan
Boring Logs
Laboratory Test Results
U.S. Seismic Design Map
Soil Map
KARST Maps
General Notes
Unified Soil Classification System (USCS)



Site Vicinity Map
Bradford Library
138 East Main Street
Bradford, Miami County, Ohio

Image Taken from USGS website

Project No. 01253857



DATE STARTED: 8/20/26
DATE COMPLETED: 8/20/26
COMPLETION DEPTH: 20.0 ft
BENCHMARK: N/A
ELEVATION: N/A
LATITUDE:
LONGITUDE:
STATION: N/A OFFSET: N/A

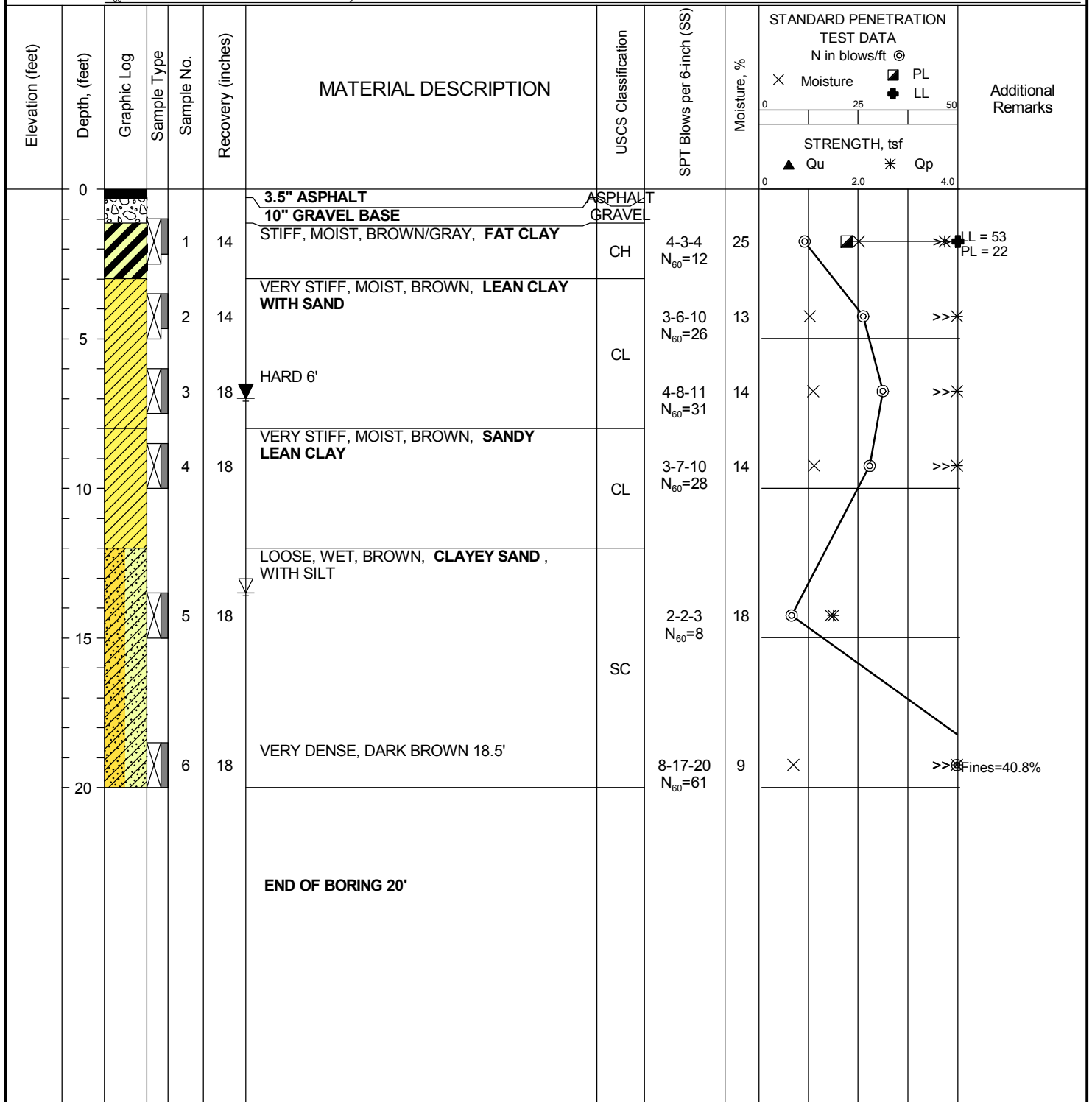
DRILL COMPANY: Envirocore
DRILLER: Andy LOGGED BY:
DRILL RIG: DH103
DRILLING METHOD: Hollow Stem Auger
SAMPLING METHOD: 2-in SSSplit Spoon
HAMMER TYPE: Automatic
EFFICIENCY: 99%
REVIEWED BY: CC/BF

BORING B-1

Water: While Drilling 13.5 feet
Upon Completion 7 feet
Delay N/A

BORING LOCATION:
East side of addition

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.



Professional Service Industries, Inc.
2341 Spencerville Road
Lima, OH 45805
Telephone: (419) 999-5660

PROJECT NO.: 01253857
PROJECT: Bradford Library
LOCATION: 138 East Main Street
Bradford, Ohio

DATE STARTED: 8/20/26
 DATE COMPLETED: 8/20/26
 COMPLETION DEPTH: 20.0 ft
 BENCHMARK: N/A
 ELEVATION: N/A
 LATITUDE:
 LONGITUDE:
 STATION: N/A OFFSET: N/A

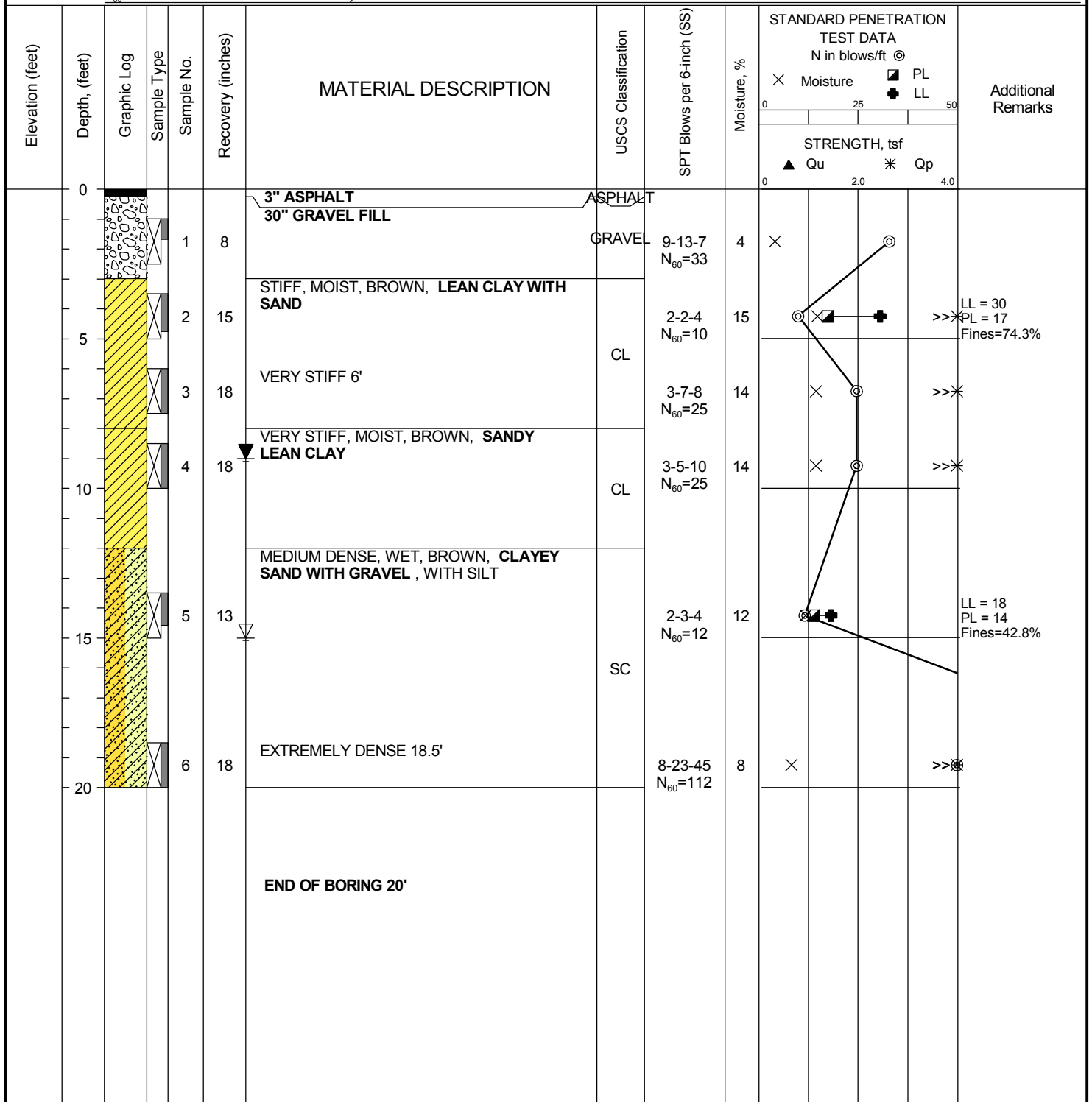
DRILL COMPANY: Envirocore
 DRILLER: Andy LOGGED BY:
 DRILL RIG: DH103
 DRILLING METHOD: Hollow Stem Auger
 SAMPLING METHOD: 2-in SSSplit Spoon
 HAMMER TYPE: Automatic
 EFFICIENCY: 99%
 REVIEWED BY: CC/BF

BORING B-2

Water	While Drilling	15 feet
	Upon Completion	9 feet
	Delay	N/A

BORING LOCATION:
 West side of addition

REMARKS: N_{60} denotes the normalization to 60% efficiency as described in ASTM D4633.



Professional Service Industries, Inc.
 2341 Spencerville Road
 Lima, OH 45805
 Telephone: (419) 999-5660

PROJECT NO.: 01253857
 PROJECT: Bradford Library
 LOCATION: 138 East Main Street
 Bradford, Ohio

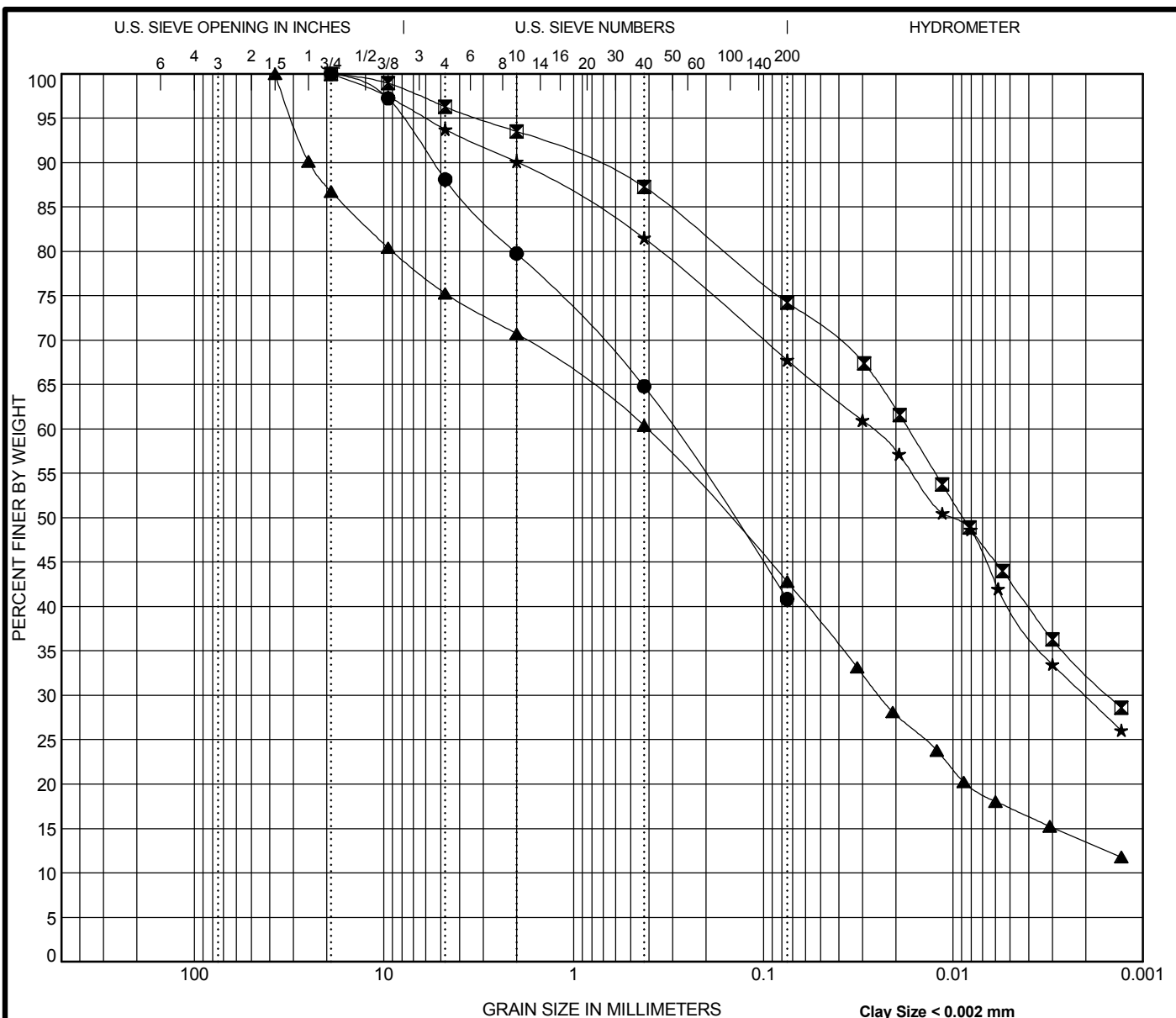
DATE STARTED: 8/20/26 DATE COMPLETED: 8/20/26 COMPLETION DEPTH: 10.0 ft BENCHMARK: N/A ELEVATION: N/A LATITUDE: LONGITUDE: STATION: N/A OFFSET: N/A REMARKS: N ₆₀ denotes the normalization to 60% efficiency as described in ASTM D4633.		DRILL COMPANY: Envircore DRILLER: Andy LOGGED BY: DRILL RIG: DH103 DRILLING METHOD: Hollow Stem Auger SAMPLING METHOD: 2-in SSSplit Spoon HAMMER TYPE: Automatic EFFICIENCY: 99% REVIEWED BY: CC/BF		BORING B-3 Water ∇ While Drilling ▼ Upon Completion ∇ Delay NONE feet NONE feet N/A BORING LOCATION: Pavement	
--	--	---	--	---	--

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft @	Additional Remarks
0						3.5" ASPHALT	ASPHALT				
						6" GRAVEL BASE	GRAVEL				
				1	12	VERY STIFF, MOIST, BROWN/GRAY, LEAN CLAY WITH SAND		4-4-6 N ₆₀ =16	13	X Moisture ▲ Qu □ PL + LL	
				2	18	HARD 3.5'	CL	4-9-14 N ₆₀ =38	15		
5				3	18	HARD, MOIST, BROWN, SANDY LEAN CLAY	CL	5-9-12 N ₆₀ =35	15		LL = 28 PL = 17 Fines=67.8%
				4	18	VERY STIFF 8.5'	CL	3-6-11 N ₆₀ =28	14		
10						END OF BORING 10'					



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PROJECT NO.: 01253857
PROJECT: Bradford Library
LOCATION: 138 East Main Street
 Bradford, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification			LL	PL	PI	Cc	Cu
●	B-1	19.3	CLAYEY SAND (SC)							
☒	B-2	4.3	LEAN CLAY WITH SAND (CL)			30	17	13		
▲	B-2	14.3	CLAYEY SAND WITH GRAVEL (SC)			18	14	4		
★	B-3	6.8	SANDY LEAN CLAY (CL)			28	17	11		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	19.3	19	0.3			11.9	47.3	40.8	
☒	B-2	4.3	19	0.017	0.002		3.7	22.0	41.7	32.6
▲	B-2	14.3	37.5	0.409	0.024		24.7	32.5	29.3	13.5
★	B-3	6.8	19	0.027	0.002		6.2	26.0	37.9	29.9



Professional Service Industries, Inc.
 2341 Spencerville Road
 Lima, OH 45805
 Telephone: (419) 999-5660
 Fax: (419) 999-6029

GRAIN SIZE DISTRIBUTION

Project: Bradford Library
 PSI Job No.: 01253857
 Location: 138 East Main Street
 Bradford, Ohio



PSI Job No.:	01253857
Project:	Bradford Library
Location:	138 East Main Street Bradford, Ohio



Latitude, Longitude: 40.13242, -84.42987



Date	8/31/2026, 11:37:32 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	0.215	MCE_R ground motion. (for 0.2 second period)
S_1	0.075	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.344	Site-modified spectral acceleration value
S_{M1}	0.179	Site-modified spectral acceleration value
S_{DS}	0.229	Numeric seismic design value at 0.2 second SA
S_{D1}	0.119	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.126	MCE_G peak ground acceleration
F_{PGA}	1.548	Site amplification factor at PGA
PGA_M	0.195	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
S_{sRT}	0.215	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	0.227	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.5	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.075	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	0.083	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.6	Factored deterministic acceleration value. (1.0 second)
PGA_d	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.126	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.948	Mapped value of the risk coefficient at short periods
C_{R1}	0.902	Mapped value of the risk coefficient at a period of 1 s

Type	Value	Description
C _v		Vertical coefficient

DISCLAIMER

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Soil Map—Darke County, Ohio, and Miami County, Ohio



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Darke County, Ohio

Survey Area Data: Version 25, Aug 27, 2025

Soil Survey Area: Miami County, Ohio

Survey Area Data: Version 24, Sep 2, 2025

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 18, 2023—Aug 4, 2023

MAP LEGEND

MAP INFORMATION

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CrA	Crosby silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes	0.7	6.5%
Subtotals for Soil Survey Area		0.7	6.5%
Totals for Area of Interest		10.9	100.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
CrA	Crosby silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes	7.1	65.6%
Uf	Udorthents, Sanitary landfill	3.0	27.9%
Subtotals for Soil Survey Area		10.2	93.5%
Totals for Area of Interest		10.9	100.0%

ArcGIS Web Map



8/31/2026, 11:29:43 AM

Karst Points

- Karst - Field Verified
- Karst - Suspect - Field Visited
- Karst - Suspect - Not Visited
- Spring - Field Verified Carbonate

Spring Points

- Spring - Field Verified Carbonate
- Spring - Field Verified Non-Carbonate
- Spring - Suspect Carbonate
- Spring - Suspect Non-Carbonate

Karst Detailed Mapping Completed Areas

Karst Depressions Depth in Feet

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---

9	10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38
39	40	41	42	43	44	45	46	47	48

<all other values>

Counties

Statewide Parcels

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

1.2m Resolution Metadata

Current Township

1:4,776

0 0.04 0.09 0.18 mi

0 0.05 0.1 0.2 km



Source: Esri, Vantor, Earthstar Geographics, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Map Layers & Legend

Click  to toggle the legend on/off.

> ☒ Karst Layers  ...

Karst Points

Custom

-  Karst - Field Verified
-  Karst - Suspect - Field Visited
-  Karst - Suspect - Not Visited
-  Spring - Field Verified Carbonate

Spring Points

Custom

-  Spring - Field Verified Carbonate
-  Spring - Field Verified Non-Carbonate
-  Spring - Suspect Carbonate
-  Spring - Suspect Non-Carbonate

Karst Detailed Mapping Completed Areas

- 

> ☐ Bedrock Geology  ...

☐ Drift Thickness  ...

> ☒ Land Base  ...

Current Township



Measure 

Unit

Miles 

Distance

4.34 mi



Map Layers & Legend

Click  to toggle the legend on/off.

> ☒ Karst Layers ...

Karst Points

Custom

-  Karst - Field Verified
-  Karst - Suspect - Field Visited
-  Karst - Suspect - Not Visited
-  Spring - Field Verified Carbonate

Spring Points

Custom

-  Spring - Field Verified Carbonate
-  Spring - Field Verified Non-Carbonate
-  Spring - Suspect Carbonate
-  Spring - Suspect Non-Carbonate

Karst Detailed Mapping Completed Areas

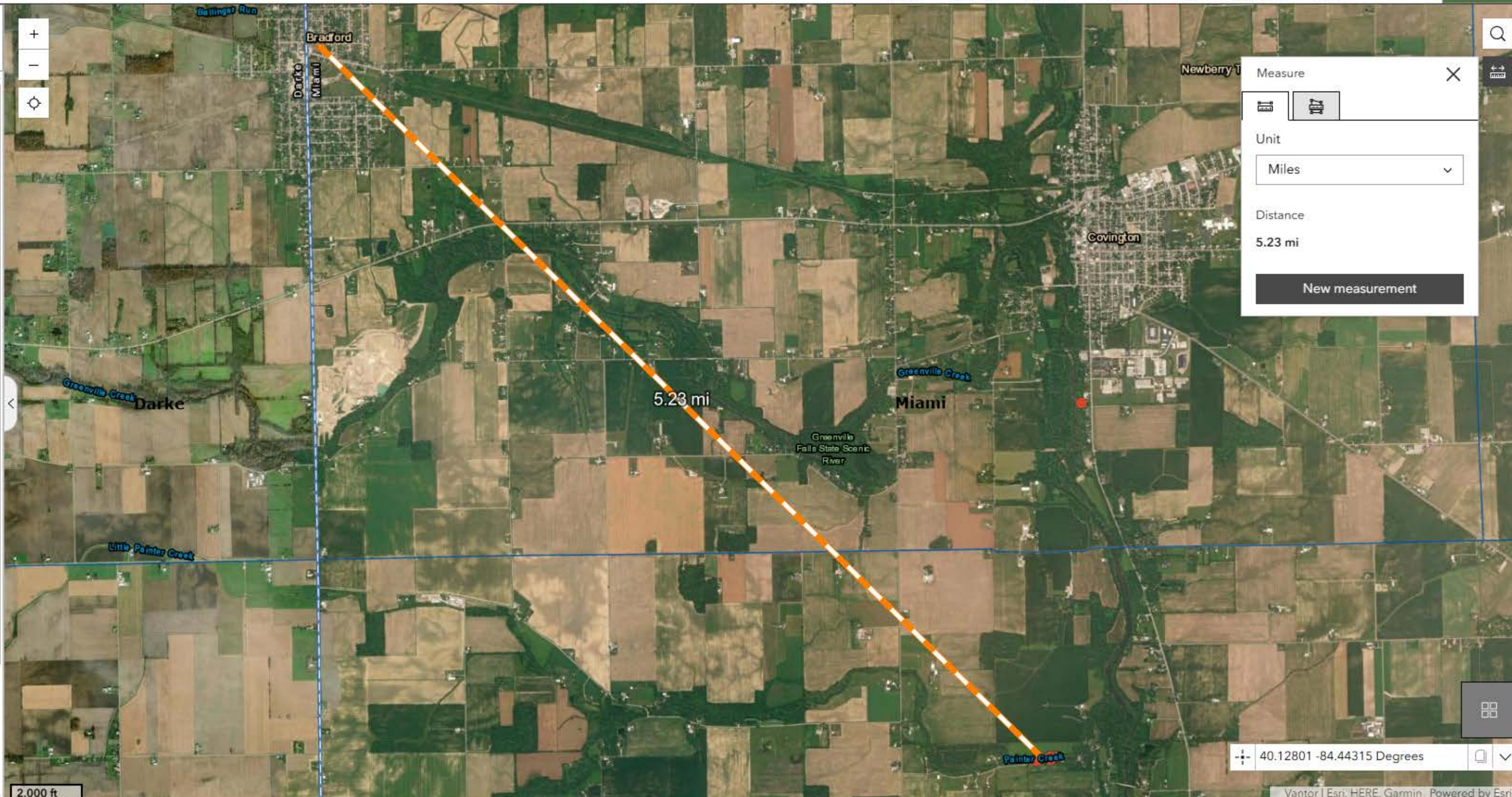


> ☐ Bedrock Geology ...

☐ Drift Thickness ...

> ☒ Land Base ...

Current Township



Measure

Unit

Miles

Distance

5.23 mi

New measurement

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Soil Classification System (USCS), AASHTO 1988 and ASTM designations D2487 and D-2488 are used to identify the encountered materials unless otherwise noted. Coarse-grained soils are defined as having more than 50% of their dry weight retained on a #200 sieve (0.075mm); they are described as: boulders, cobbles, gravel or sand. Fine-grained soils have less than 50% of their dry weight retained on a #200 sieve; they are defined as silts or clay depending on their Atterberg Limit attributes. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size.

DRILLING AND SAMPLING SYMBOLS

SFA: Solid Flight Auger - typically 4" diameter flights, except where noted.	☒ SS: Split-Spoon - 1 3/8" I.D., 2" O.D., except where noted.
HSA: Hollow Stem Auger - typically 3 1/4" or 4 1/4" I.D. openings, except where noted.	■ ST: Shelby Tube - 3" O.D., except where noted.
M.R.: Mud Rotary - Uses a rotary head with Bentonite or Polymer Slurry	▮ RC: Rock Core
R.C.: Diamond Bit Core Sampler	↓ TC: Texas Cone
H.A.: Hand Auger	☞ BS: Bulk Sample
P.A.: Power Auger - Handheld motorized auger	☒ PM: Pressuremeter
	CPT-U: Cone Penetrometer Testing with Pore-Pressure Readings

SOIL PROPERTY SYMBOLS

N: Standard "N" penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split-Spoon.
N ₆₀ : A "N" penetration value corrected to an equivalent 60% hammer energy transfer efficiency (ETR)
Q _u : Unconfined compressive strength, TSF
Q _p : Pocket penetrometer value, unconfined compressive strength, TSF
w%: Moisture/water content, %
LL: Liquid Limit, %
PL: Plastic Limit, %
PI: Plasticity Index = (LL-PL), %
DD: Dry unit weight, pcf
▼, ▼, ▼ Apparent groundwater level at time noted

RELATIVE DENSITY OF COARSE-GRAINED SOILS

Relative Density	N - Blows/foot
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	50 - 80
Extremely Dense	80+

ANGULARITY OF COARSE-GRAINED PARTICLES

Description	Criteria
Angular:	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular:	Particles are similar to angular description, but have rounded edges
Subrounded:	Particles have nearly plane sides, but have well-rounded corners and edges
Rounded:	Particles have smoothly curved sides and no edges

GRAIN-SIZE TERMINOLOGY

Component	Size Range
Boulders:	Over 300 mm (>12 in.)
Cobbles:	75 mm to 300 mm (3 in. to 12 in.)
Coarse-Grained Gravel:	19 mm to 75 mm (3/4 in. to 3 in.)
Fine-Grained Gravel:	4.75 mm to 19 mm (No.4 to 3/4 in.)
Coarse-Grained Sand:	2 mm to 4.75 mm (No.10 to No.4)
Medium-Grained Sand:	0.42 mm to 2 mm (No.40 to No.10)
Fine-Grained Sand:	0.075 mm to 0.42 mm (No. 200 to No.40)
Silt:	0.005 mm to 0.075 mm
Clay:	<0.005 mm

PARTICLE SHAPE

Description	Criteria
Flat:	Particles with width/thickness ratio > 3
Elongated:	Particles with length/width ratio > 3
Flat & Elongated:	Particles meet criteria for both flat and elongated

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% Dry Weight
Trace:	< 5%
With:	5% to 12%
Modifier:	>12%

GENERAL NOTES

(Continued)

CONSISTENCY OF FINE-GRAINED SOILS

<u>Q_u - TSF</u>	<u>N - Blows/foot</u>	<u>Consistency</u>
0 - 0.25	0 - 2	Very Soft
0.25 - 0.50	2 - 4	Soft
0.50 - 1.00	4 - 8	Firm (Medium Stiff)
1.00 - 2.00	8 - 15	Stiff
2.00 - 4.00	15 - 30	Very Stiff
4.00 - 8.00	30 - 50	Hard
8.00+	50+	Very Hard

MOISTURE CONDITION DESCRIPTION

<u>Description</u>	<u>Criteria</u>
Dry:	Absence of moisture, dusty, dry to the touch
Moist:	Damp but no visible water
Wet:	Visible free water, usually soil is below water table

RELATIVE PROPORTIONS OF SAND AND GRAVEL

<u>Descriptive Term</u>	<u>% Dry Weight</u>
Trace:	< 15%
With:	15% to 30%
Modifier:	>30%

STRUCTURE DESCRIPTION

<u>Description</u>	<u>Criteria</u>	<u>Description</u>	<u>Criteria</u>
Stratified:	Alternating layers of varying material or color with layers at least ¼-inch (6 mm) thick	Blocky:	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Laminated:	Alternating layers of varying material or color with layers less than ¼-inch (6 mm) thick	Lensed:	Inclusion of small pockets of different soils
Fissured:	Breaks along definite planes of fracture with little resistance to fracturing	Layer:	Inclusion greater than 3 inches thick (75 mm)
Slickensided:	Fracture planes appear polished or glossy, sometimes striated	Seam:	Inclusion 1/8-inch to 3 inches (3 to 75 mm) thick extending through the sample
		Parting:	Inclusion less than 1/8-inch (3 mm) thick

SCALE OF RELATIVE ROCK HARDNESS

<u>Q_u - TSF</u>	<u>Consistency</u>
2.5 - 10	Extremely Soft
10 - 50	Very Soft
50 - 250	Soft
250 - 525	Medium Hard
525 - 1,050	Moderately Hard
1,050 - 2,600	Hard
>2,600	Very Hard

ROCK BEDDING THICKNESSES

<u>Description</u>	<u>Criteria</u>
Very Thick Bedded	Greater than 3-foot (>1.0 m)
Thick Bedded	1-foot to 3-foot (0.3 m to 1.0 m)
Medium Bedded	4-inch to 1-foot (0.1 m to 0.3 m)
Thin Bedded	1¼-inch to 4-inch (30 mm to 100 mm)
Very Thin Bedded	½-inch to 1¼-inch (10 mm to 30 mm)
Thickly Laminated	1/8-inch to ½-inch (3 mm to 10 mm)
Thinly Laminated	1/8-inch or less "paper thin" (<3 mm)

ROCK VOIDS

<u>Voids</u>	<u>Void Diameter</u>
Pit	<6 mm (<0.25 in)
Vug	6 mm to 50 mm (0.25 in to 2 in)
Cavity	50 mm to 600 mm (2 in to 24 in)
Cave	>600 mm (>24 in)

GRAIN-SIZED TERMINOLOGY

<u>(Typically Sedimentary Rock)</u>	
<u>Component</u>	<u>Size Range</u>
Very Coarse Grained	>4.76 mm
Coarse Grained	2.0 mm - 4.76 mm
Medium Grained	0.42 mm - 2.0 mm
Fine Grained	0.075 mm - 0.42 mm
Very Fine Grained	<0.075 mm

ROCK QUALITY DESCRIPTION

<u>Rock Mass Description</u>	<u>RQD Value</u>
Excellent	90 - 100
Good	75 - 90
Fair	50 - 75
Poor	25 - 50
Very Poor	Less than 25

DEGREE OF WEATHERING

Slightly Weathered:	Rock generally fresh, joints stained and discoloration extends into rock up to 25 mm (1 in), open joints may contain clay, core rings under hammer impact.
Weathered:	Rock mass is decomposed 50% or less, significant portions of the rock show discoloration and weathering effects, cores cannot be broken by hand or scraped by knife.
Highly Weathered:	Rock mass is more than 50% decomposed, complete discoloration of rock fabric, core may be extremely broken and gives clunk sound when struck by hammer, may be shaved with a knife.

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

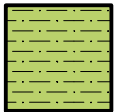
Graphic Symbols for Materials and Rock Deposits



CONCRETE
Portland Cement Concrete



BITUMINOUS CONCRETE



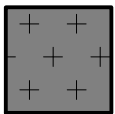
CLAYSTONE



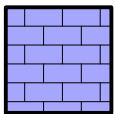
COAL
Coal, Anthracite Coal



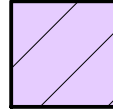
CONGLOMERATE/BRECCIA
Conglomerate, Breccia



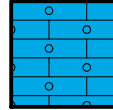
IGNEOUS ROCK
Anorthosite, Basalt, Metabasalt, Diabase (Gabbro), Gabbro, Granite/Granodiorite, Hornfels, Pegmatite, Rhyolite/Metarhyolite



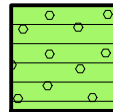
LIMESTONE
Limestone, Dolomite



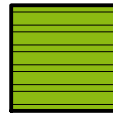
METAMORPHIC ROCK
Amphibolite, Gneiss, Marble, Phyllite, Quartzite, Schist, Serpentine, Slate



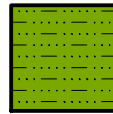
CHERT



SANDSTONE
Sandstone, Orthoquartzite (Sandstone)



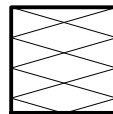
SHALE



SILTSTONE



NO RECOVERY



VOID

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Administrative and procedural requirements for **Substitution requests**.
 - 2. Administrative and procedural requirements for **Comparable Product requests**.
- B. Request Form
 - 1. Form that must be used for initiating a Substitution request or a Comparable Product request is included at the end of this Section; the use of any other form or format or process for considering a product change will be rejected without review.
 - a. **READ AND FOLLOW THE INSTRUCTIONS FOR USE OF THIS FORM!**
- C. Related Requirements:
 - 1. Section 01 60 00 "Product Requirements" for requirements applicable to products to be selected for use on the Project including those listed in individual specification Sections and those proposed by the Contractor as comparable products.

1.2 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. Changes proposed by Contractor that offer Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
 - 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.
- B. **Comparable Product:** Product that is demonstrated and approved, through the substitution 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 a specified product.
- C. Request for Substitution and Comparable Product Request: Written request from the Contractor to the Architect seeking the use of a product, material, equipment, or method of construction that differs from the one indicated in the Construction Documents.

1.3 ACTION SUBMITTALS

- A. Substitution for Cause, Substitutions for Convenience, and Comparable Product Requests.
 - 1. Submit fully executed request form and all substantiation documentation of each request for consideration. Do not combine multiple requests on one form.
- B. Request Form: Use copy of the form provided in Part 4 of this Section only; no other form will be accepted.
- C. Documentation: Type and format required to completely prove equality to specified products, materials and systems. Reference to the proposed product manufacturer's website or catalog will not be considered responsive to this requirement.
- D. Submission of a Substitution for Convenience Request or a Comparable Product Request does not mandate its review or approval. Architect has no obligation to justify or explain acceptance or rejection of any product change request; Contractor shall not protest Architect's decision relative to this project but may discuss the proposed product with the Architect for consideration on future projects.

1.4 QUALITY ASSURANCE

- A. Failure to Procure: The failure of the Contractor to procure a product or material on schedule will not be considered adequate reason for submitting a substitution request or a comparable product request unless the time required for procuring such product or material by reasonable means exceeds the time available at the Contractor's earliest opportunity to order.
 - 1. Contractor's failure to make submittals in a timely manner to attain a favorable review shall not be considered justification to extend Contractor's 'earliest opportunity'.
- B. Compatibility of Substitutions and Comparable Products: Investigate and document compatibility of proposed substitution and comparable product with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.
- C. Product Change after Award of Contracts: Regardless of Architect's review and acceptance, all changes and associated cost or schedule effects required to associated materials caused by a product change after Award of Contract are the responsibility of the contractor initiating the product change. Submitter of product change request after Award of Contracts is responsible for notifying all associated work contractors of the change and for negotiating with them all differences and costs in their work.

1.5 PROCEDURES

- A. Coordination: Revise or adjust all affected Work as necessary to integrate work of the approved substitutions and comparable products.

1.6 SUBSTITUTIONS FOR CAUSE REQUESTS

- A. Substitutions for Cause:
 - 1. Will be considered after Award of Contract but no later than 30 days prior to the time required for preparation and review of related submittals.
 - 2. Will be considered only if submitted by a Prime Contractor.
 - 3. Will be considered only when accompanied by the fully executed form required (see Part 4 of this Section) and with all substantiating documentation provided by the Contractor.
 - a. Reference to the proposed product manufacturer's website or catalog will not be considered responsive to this requirement.
- B. Conditions: Architect will consider Contractor's request for substitution for cause when a preponderance of the following conditions are satisfied. If applicable conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements.
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 2. Equal product available for lesser cost, in which case the savings to Owner shall be indicated.
 - 3. Specified product not available due to discontinuance or other circumstance beyond the Contractor's control.
 - 4. Specified product not recommended or warranted by manufacturer for intended application.
 - 5. Specified product not approved for use by federal, state, or local authorities having jurisdiction; provide documentation or written statement of the authority.
 - 6. None of the products specified meet performance or warranty requirements specified.
 - 7. Requested substitution does not require extensive revisions to the Contract Documents.
 - 8. Requested substitution is consistent with the design intent and the Contract Documents and will produce indicated results.
 - 9. Requested substitution will not adversely affect Project Construction Schedule.
 - 10. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 11. Requested substitution is compatible with other portions of the Work.
 - 12. Requested substitution provides specified performance and warranty.
 - 13. 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.
- C. Documentation: In addition to information requirements stated in the form included in Part 4, provide greater detail about the following:

1. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 2. Coordination information, including a list of changes or revisions needed to other parts of the Work including that of separate Prime Contractors that will be necessary to accommodate proposed substitution.
 - a. Failure to document changes that will be required to other work will result in the cost of such changes being back-charged to the contractor submitting the request.
 3. Detailed side-by-side comparison listing significant qualities of proposed substitution and those of the Work specified as indicated in the Form in Part 4. Provide a separate sheet if the form does not provide enough spaces. 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.
 - a. Attach product data and, if applicable, drawings and descriptions of products and fabrication and installation procedures of the proposed substitution and the same information of at least one of those named in the specifications, for comparison and substantiation of the data listed in the form.
 4. Samples, where applicable or requested.
 5. Certificates and qualification data, where applicable or requested.
 6. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 7. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 8. Research reports evidencing compliance with building code in effect for Project.
 9. Detailed comparison of Project construction schedule using proposed substitution 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.
 10. Cost information, including a proposal of change, if any, in the Contract Sum.
 11. 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.
 12. 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.
- D. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 15 days of receipt of a request for substitution for cause. Architect will notify Contractor 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.
1. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
- E. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
1. Regardless of any conflicting statement elsewhere in the Project Manual, Architect shall not be obligated to justify either a favorable or an unfavorable review decision.
- 1.7 SUBSTITUTION FOR CONVENIENCE REQUESTS
- A. Substitutions for Convenience (see separate paragraph for comparable product requests):
1. Will be considered only prior to Bidding.
 2. Will be considered only if submitted by a Prime Contract Bidder.
 3. Will be considered only when received in time for a thorough review by the Architect before deadline for issuance of an addendum is reached.
 4. Will be considered only when accompanied by the form required (see Part 4 of this Section) and with all substantiating documentation provided by the Contractor.
 - a. Reference to the proposed product manufacturer's website or catalog will not be considered responsive to this requirement.
- B. Conditions: Architect may consider Contractor's request for substitution for convenience when one or more of the following conditions are satisfied. If applicable conditions are not satisfied, Architect will take no action or may return requests without action except to record noncompliance with requirements.

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume.
 - a. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the design intent and the Contract Documents and will produce indicated results.
 4. Requested substitution will not adversely affect the Project Construction Schedule.
 5. Requested substitution has received necessary approvals of authorities having jurisdiction.
 6. Requested substitution is compatible with other portions of the Work.
 7. Requested substitution has been coordinated with other portions of the Work.
- C. Documentation: In addition to information requirements stated in the form included in Part 4, provide the following:
1. Statement indicating why specified product or fabrication or installation is being proposed.
 2. Coordination information, including a list of changes or revisions needed to other parts of the Work including that of separate Prime Contractors that will be necessary to accommodate proposed substitution.
 - a. Failure to document changes that will be required to other work will result in the cost of such changes being back-charged to the Contractor submitting the request.
 3. Detailed side-by-side comparison listing significant qualities of proposed substitution and those of the Work specified as indicated in the Form in Part 4. Provide a separate sheet if the form does not provide enough spaces. 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.
 - a. Attach product data and, if applicable, drawings and descriptions of products and fabrication and installation procedures of the proposed substitution and the same information of at least one of those named in the specifications, for comparison and substantiation of the data listed in the form.
 4. 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.
 5. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of substitution to produce indicated results.
- D. Architect's Action:
1. If necessary, Architect will request additional information or documentation for evaluation.
 2. Form of Acceptance: Inclusion of the requested product, material, or method in an addendum issued to all bidders prior to Bidding.
 3. Regardless of any conflicting statement elsewhere in the Project Manual, Architect shall not be obligated to justify either a favorable or an unfavorable review decision.
- E. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
- 1.8 COMPARABLE PRODUCT REQUESTS
- A. Comparable Product Requests:
1. Will be considered only prior to Bidding.
 2. Will be considered only when received in time for a thorough review by the Architect before deadline for issuance of an addendum is reached;
 3. **Will be considered only when accompanied by the fully executed form required** (see Part 4 of this Section) and with all substantiating documentation provided by the Contractor.
 - a. Reference to the proposed product manufacturers website or catalog will not be considered responsive to this requirement.
 4. Submit a separate request package for consideration of each individual comparable product desired.
- B. Conditions: Architect may consider Contractor's request for comparable product when one or more of the following conditions is satisfied. If applicable conditions are not satisfied, Architect will take no action or may return requests without action except to record noncompliance with requirements.

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, including the work of others, 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. Documentation that comparable product will not adversely affect any sustainable design credit being sought for the Project.
 3. Evidence that proposed product provides specified warranties.
- C. Architect's Action:
1. If necessary, Architect will request additional information or documentation for evaluation.
 2. Form of Acceptance: Inclusion of the requested product, material, or method in an addendum issued to all bidders prior to Bidding.
 3. Regardless of any conflicting statement elsewhere in the Project Manual, Architect shall not be obligated to justify either a favorable or an unfavorable review decision.
- D. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

PART 4 - FORMS

- A. Form begins on the next page. Use separate additional pages if necessary to list all performance criteria.
- B. Use a separate form for each individual Product for which consideration of a change is being requested. Any written justifications, reasons, explanations, or statements relative to the request shall be provided on the Contractor's letterhead, dated and signed.
- C. DIRECTIONS for use of Form:
1. Contractor must submit a side-by side comparison of all pertinent specification criteria listing the performance criteria of one of the specified products along side of the same criteria of the product the Contractor would like to use instead. Use the form.
 - a. In the first column, re-state the performance requirements given in the specification. List all performance, strength, size, thickness, material, warranty requirements, sustainable design contribution, selection options, and so forth specified; not just one or two.
 - b. In the second column, select one of the products named in the specification section and list the corresponding performance values of that product.
 - c. In the third column, list the corresponding performance values of the product being submitted for consideration.
 2. Architect will review Requests for Substitution for Cause, Requests for Substitution for Convenience, and for use of Comparable Products only when submitted using this form and with all supporting documentation included.
 3. Regardless of any conflicting statement elsewhere in the Project Manual, Architect shall not be obligated to justify either a favorable or an unfavorable review decision.

continued

SUBSTITUTION REQUEST FORM

Project: _____

SHP Project Number: _____ date _____

NOTE:

This form is to be used for Substitutions and Comparable Product Requests during bidding. Substitution-for-Cause Requests after bidding will be considered only for extreme justification and substantial benefit to the Owner as described elsewhere in the Documents, and with compensation to the Architect for evaluation time.

We hereby request the following be considered as an acceptable product / material / manufacturer for the above referenced project.

Section and Paragraph No.	Specified Manufacturer and Product	Proposed Substitution
_____	_____	_____

DIRECTIONS: List **all** specified performance criteria of one of the products named in the specification and then the corresponding criteria of the proposed substitution product. Include performance criteria, referenced standards, codes, color / texture selection availabilities, sustainable design criteria, and warranty data. Provide a separate form for each product to be considered.

Criteria Description	Specified Product Provides / Meets	Proposed Product Provides / Meets
1 _____	_____	_____
2 _____	_____	_____
3 _____	_____	_____
4 _____	_____	_____
5 _____	_____	_____
6 _____	_____	_____
7 _____	_____	_____
8 _____	_____	_____
9 _____	_____	_____
10 _____	_____	_____
11 _____	_____	_____
12 _____	_____	_____

It is understood and expressly agreed that the submitter has investigated the potential effects of the use of the comparable product / substitution and accepts full responsibility for all consequential affects including but not necessarily limited to the following relative to the use of the proposed item:

Effects on other construction including other Contracts; Effects on the Project Construction Schedule; Fitness for the use intended; Equivalency to that specified; Acceptability by authorities having jurisdiction; Safety when used as indicated.

In submitting this form, Contractor understands and agrees that the Architect has no obligation to justify or explain acceptance or rejection of a substitution or comparable product request.

Substitution Request Form – page 1 of 2

For Requests considered after Award of Contract, the Contractor's responsibility includes but is not necessarily limited to: Cost of adjustments to other Work including modifications to work in place; compensation for construction delays, compensation for evaluations by the Architect, consultants and other contractors. *(Complete entire Substitution Request Form)*

Justification: *For Request **after bidding** list at least three significant reasons and Owner benefits for why the proposed substitution should be considered; Architect may request additional justifications:*

1

2

3

Include with this form all additional product literature and information necessary for the Architect to verify data stated in this form and to properly compare the requested product with the specified product. The Architect will not be responsible for delays caused by lack of information. Architect makes no assurances that proposed comparable product will be evaluated in time to be included in the Project by Addendum; Bid Date will not be extended for comparable product / substitution request consideration.

Submitted by:

Company

Address 1

Address 2

Phone

Fax

E-mail

Name and Signature

SHP ACTION:

☐ Approved ☐ Rejected

By: _____ Date: _____

Note:

Regardless of action indicated, return or non-return of this form to the submitter has no legal bearing on acceptance or rejection of a proposed product, manufacturer, or method. Proposed changes are officially accepted for use in the Project only when included in the Contract during bidding by Addendum or (after award) in the Contract by Change Order.

Substitution Request Form – page 2 of 2

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710-2017, "Architect's Supplemental Instructions," or similar format.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect 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 Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request 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 acceptable to Architect.
- 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 Architect.
 - 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 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use forms acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01 21 00 "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 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

- A. Comply with requirements of Division 00 Section "General Conditions" article 7 as amended by Supplementary General Conditions.
- B. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or similar format.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 or similar format. 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 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 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.

1.3 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 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.
- 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. Owner's name.
 - c. Name of Architect.
 - d. Architect's project number.
 - e. Contractor's name and address.
 - f. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. 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.
 - 4. 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. Include evidence of insurance or bonded warehousing if required.
 - 5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
 - 6. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 7. In addition to the Contractor's construction activities, the Contract Cost Breakdown must include the following line items with the associated percentage of the contract value allocated to that activity.
 - a. Progress Meeting Attendance - 0.5% of the Contract.
 - b. Record Drawing Updates.
 - c. Allowances.

- d. Temporary Facilities.
- e. Correction of punchlist items - 0.5% of the Contract.
- f. Specified Training – 1% of the Contract.
- g. Bonds: Insurance, permits and tests.
- h. Mobilization.
- i. Demobilization.
- j. Submittals in the amount of 2% of the Contract; however, not less than \$1,000.00 nor more than \$10,000.00.
- k. Daily clean up.
- l. Final Cleaning.
- m. Closeout costs in an amount equal to 1% of the Contract amount; however, not less than \$500.00 or more than \$10,000.00.
- 8. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 9. 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.

1.4 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 paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect 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.
- 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 one signed and notarized original copy of each Application for Payment to Architect by e-mail by agreed upon monthly submittal date. 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. Executed contract.
 2. List of subcontractors.
 3. Schedule of values.
 4. Contractor's construction schedule (preliminary if not final).
 5. Products list (preliminary if not final).
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 77 00 "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. 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. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
 6. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
 7. AIA Document G707-1994, "Consent of Surety to Final Payment."
 8. Evidence that claims have been settled.
 9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 10. Final liquidated damages settlement statement.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 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. Project meetings.
- B. Related Requirements:
 - 1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

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

1.3 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 15 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, 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 inbuilt facility. Keep list current at all times.

1.4 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. 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.

- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors 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.

1.5 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 subframing for support of ceiling, raised access floor, 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. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
 6. 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.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.

- c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 9. 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.
 - C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
 1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
 2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
 3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
 4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
 5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
 6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
 7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.
 - D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
 1. File Submittal Format: Submit or post coordination drawing files using PDF format.
 2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of Agreement included in this Project Manual.
- 1.6 REQUESTS FOR INTERPRETATION (RFIs)
- 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 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. Owner name
 3. Name of Architect.
 4. Architect's Project number.
 5. Date.
 6. Name of Contractor.
 7. RFI number, numbered sequentially.
 8. RFI subject.
 9. Specification Section number and title and related paragraphs, as appropriate.
 10. Drawing number and detail references, as appropriate.
 11. Field dimensions and conditions, as appropriate.
 12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

13. Contractor's signature.
 14. 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: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow three 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 01 26 00 "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 5 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Include the following:
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 three days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. 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.
 - m. Unlimited user licenses or unlimited collaborators without paying per-user fees.
- B. 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.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: 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 seven days prior to meeting.
 - 2. Agenda: 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: 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. Use of web-based Project software.
 - h. Procedures for processing field decisions and Change Orders.
 - i. Procedures for RFIs.
 - j. Procedures for testing and inspecting.
 - k. Procedures for processing Applications for Payment.
 - l. Distribution of the Contract Documents.
 - m. Submittal procedures.
 - n. Preparation of Record Documents.
 - o. Use of the premises and existing building.
 - p. Work restrictions.
 - q. Working hours.
 - r. Owner's occupancy requirements.
 - s. Responsibility for temporary facilities and controls.
 - t. Procedures for moisture and mold control.
 - u. Procedures for disruptions and shutdowns.
 - v. Construction waste management and recycling.
 - w. Parking availability.
 - x. Office, work, and storage areas.
 - y. Equipment deliveries and priorities.
 - z. First aid.

- aa. Security.
 - bb. 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 30 days prior to the scheduled date of Substantial Completion.
 - 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 Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.

- j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. 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 regular intervals and at frequency mutually agreed to by Owner and Architect.
 - 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) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) 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.
- F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
 - 1. 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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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.

- b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
- c. Review present and future needs of each contractor present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of RFIs.
 - 14) Proposal Requests.
 - 15) Change Orders.
 - 16) Pending changes.
- 3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 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 the critical path of Project and when activities can be performed.
- 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 belongs to Owner.
 - 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.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF file.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, 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.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.

- G. Site Conditions Reports: Submit at time of discovery of differing conditions.
- H. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, 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.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed 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. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.
 - 3. Procurement Activities: Include procurement process activities for long lead-time 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.
 - 4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 6. Commissioning Time: Include no fewer than 15 days for commissioning. *<delete if not applicable>*
 - 7. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 8. 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 01 10 00 "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 01 10 00 "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 occupancy before Substantial 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. Building flush-out.
 - m. Startup and placement into final use and operation.
 - n. 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. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Final Completion, and the following:
 - 1. Temporary enclosure and space conditioning.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 - 1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.
- G. 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.
- H. 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.
- I. 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.

- J. Distribution: Distribute copies of approved schedule to Architect, 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.

1.6 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. 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 the Notice to Proceed.
 - 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.

1.7 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. Substantial Completions authorized.
- B. 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.
- C. 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 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 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
- B. Related Requirements:
 - 1. Section 02 41 19 "Selective Demolition" for photographic documentation before selective demolition operations commence.
 - 2. Section 31 10 00 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 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. 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 management 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 file metadata tag:
 - a. Name of Project.
 - b. Name of Architect.
 - c. Name of Contractor.
 - d. Date photograph was taken.
 - e. Description of location, vantage point, and direction.
 - f. Unique sequential identifier keyed to accompanying key plan.

1.3 RIGHTS

- A. Ownership and copyright privileges of photographic images belong to the Owner and the Architect. Under penalty of Law, the Contractor shall not provide or transmit in any manner construction photographs to any entities except the Owner and the Architect without written authorization from the Architect.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 16 megapixels, and at an image resolution of not less than 4032 by 3024 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date, Project area, and sequential numbering suffix.

1.5 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 the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag construction limits before taking construction photographs.
2. Take photographs to show existing conditions adjacent to property before starting the Work.
3. Take photographs of existing buildings on property to accurately record physical conditions at start of construction.
4. Take photographs of existing pavements, landscaping, and lawn areas to accurately record physical conditions, especially settlement or cracking, at start of construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Administrative and procedural requirements for submittals.
- B. Related Requirements:
 - 1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
 - 3. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs.
 - 5. Section 01 40 00 "Quality Requirements" for submitting test and inspection reports.
 - 6. Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 7. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 8. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

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

1.3 SUBMITTAL FORMATS

- A. Transmittal: Include the following information on transmittal form:
 - 1. Project name.
 - 2. Date.
 - 3. Name of Architect.
 - 4. Name of Contractor.
 - 5. Name of firm or entity that prepared submittal.
 - 6. Names of subcontractor, manufacturer, and supplier.
 - 7. Unique submittal number, including revision identifier. <Subparagraphs below are SHP specific requirements, do not delete>
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Maintain a single numeric sequence regardless of whether an individual submittal is physical or electronic.
 - 2) Resubmittals shall include an alphanumeric suffix after another decimal point (e.g., 061000.01.R1).
 - 8. Category and type of submittal.
 - 9. Submittal purpose and description.
 - 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 - 11. Drawing number and detail references, as appropriate.
 - 12. Indication of full or partial submittal.
 - 13. Location(s) where product is to be installed, as appropriate.
 - 14. Other necessary identification.
 - 15. Remarks.
 - 16. 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 on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.4 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 Management Software: Prepare submittals in PDF form, and upload to web-based Project management 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. 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 reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received. Processing time starts when 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 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - a. Color selections: For submittals that require a color or texture selection by the Architect, submit physical samples in advance of electronic submission.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 14 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 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Resubmittals: Make resubmittals in same form 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. **Repetitious resubmittals** not complying with previous submittal annotations will result in back-charges against the Contractor for excessive Architect / Consultant review time.
 - a. This applies whenever a resubmittal must be revised and resubmitted due to non-compliance with a previous annotation. If there is any question about an annotation that the submitter feels cannot be followed, the submitter must initiate discussion with the Architect, not simply ignore the annotation.
 - b. Back-charges assessed for these reasons must be paid directly to the reviewing entity in advance of the Contractor's next partial Application for Payment or payment request will not be processed.
- E. Processing Electronic Submittals:

1. Assemble all documents of a submittal, including transmittal, into a single PDF. Do not combine multiple submittals into the same PDF. Before creating PDF, ensure the following:
 - a. Documentation is complete and in compliance with the Contract Documents.
 - b. Product selections and options intended to be provided are *clearly* selected and identified in the submittal.
 - 1) Failure to identify selections may result in rejection of the submittal without further review.
 - c. Where Architect selections are needed, ensure the available selections are clearly identified in the submittal; where color or texture selections by the Architect are needed, Contractor is required to submit actual physical samples; no color will be selected from electronic submissions.
 - d. Contractor has stamped, signed, and dated their confirmation that the submittal is correct, complete, and in compliance with Contract Documents.
 2. Ensure PDF is legible in both electronic (screen) version AND printed version.
 - a. In general, create PDF from an original electronic file rather than from a scanning process.
 - b. Illegible PDFs will be returned to Contractor without review.
 - c. No change in Contract Time will be authorized for Contractor's failure to provide actionable PDF submittals.
 3. Upload PDF to web-based software site and email Architect accordingly. Architect will email Contractor when submittal review is complete and ready for Contractor's download.
 4. Contractor shall retrieve completed submittals from the web-based software site, maintain its own electronic file of all completed submittals, and shall provide paper copies of submittals as may be needed for field installation or its own purposes.
- F. 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.
1. For Construction: Provide paper copies of shop drawings, wiring diagrams, and other submittals containing installation requirements for use on the project site.
 - a. Provide additional sets or partial sets needed by the Contractor's own workers while performing the installation. Do not perform installation without having paper copy of final shop drawings present in the work area.
 - b. Use only final submittals bearing the stamp mark of the Architect indicating that the submittal is acceptable for construction use under the conditions indicated.
 2. For Authorities having Jurisdiction: For Contractor-obtained permits and other Contractor-provided information required by authorities having jurisdiction, assemble complete documentation, drawings, and forms for the submission into a single PDF as required by the authority for electronic submission. Attach a signed transmittal form or cover letter on Contractor's letterhead addressed to the authority; include information on method of payment of fees where applicable. Transmit to authority electronically with copy to Architect unless:
 - a. If Authority requires submission be made by the Architect or engineer of record: Provide to Architect who will review the submittal and then forward it (including Contractor's cover letter) to the Authority under Architect's transmittal form.
 - b. If Authority requires hardcopies: Provide number of physical copies required by the authority and process direct or via Architect as indicated above.
 3. For Operation and Maintenance Manuals: Provide 'clean' paper copies of all electronic submittals required and integrate with documents that were processed originally as physical submittals. Do not provide paper copies that have been damaged or marked-up by construction use.
 - a. Additionally, for all submittals that were processed electronically, include all final submittals on a flash drive, cataloged in the same order as required for the physical O&M manual, and furnish to Owner as part of the Manual.
- 1.5 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 not suitable 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 installation instructions.
 - c. 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.
- 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.
- C. Samples: Submit Samples for review of type, 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. Processing: <SHP specific requirement>
 - a. Submit actual-material Samples, with paper transmittal, to Architect for review and action.
 - b. Upload PDF of transmittal to web-based software site including digital image file illustrating Sample characteristics and identification information for record.
 - c. Architect will transmit review action to Contractor through web-based software site.
 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.
 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 one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect 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 two sets of Samples. Architect will retain one Sample set; remainder will be returned to jobsite.
 - 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 AWS B2.1/B2.1M 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 substrate preparation and primers required.
 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.

- I. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.
 - 1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal to proper entity.

1.6 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, 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.

1.7 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.
 - 1. Do not process submittals that do not comply with requirements.
 - 2. Do not process submittals that are not clearly marked to indicate the specific products and specific product options.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. 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 will not review submittals received from Contractor that do not have Contractor's review and approval.

1.8 ARCHITECT'S REVIEW

- A. Requirements of this Section are intended to supplement requirements of the General Conditions and Supplementary General Conditions. Any reference herein, in the General Conditions, or elsewhere in the Project Manual, to Architect's "Approval" of any submittal shall not be construed as the Architect assuming any responsibility of the Contractor or any other entity, nor acceptance of any product or work not in conformance with the Contract Documents.
- B. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals, including submittals that do not highlight specific product choices or options, are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.
- G. Submittal of un-named products when a Section includes a list of acceptable products will be returned by Architect without review. Comply with Section 01 25 00 "Substitution Procedures" for consideration of substitutions and comparable products.

- H. Architect will not review submittals that do not bear Contractor's approval stamp and will return them 'rejected' without further action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 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 and Inspections: 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 Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
- D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 - 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 - 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 - 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with 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 and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- I. 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.
- J. 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.

1.3 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.
- B. Delegated-Design Services Statement: 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.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification 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.
- C. If differing requirements, quantities, or quality levels are indicated between Drawings or between Drawings and Specifications, comply with the most stringent requirement, quality level, and greater quantity. No increase in the Contract Sum will be considered for Contractor bidding the less stringent requirement, lower quality, and lesser quantity instead of seeking clarification during bidding.

1.5 INFORMATIONAL SUBMITTALS

- A. 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. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. 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.

- D. Reports: Prepare and submit certified written reports and documents as specified.
- E. 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.

1.6 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 and to coordinate Owner's quality-assurance and quality-control activities. 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. 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 the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- E. 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.

1.7 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 of 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.

1.8 QUALITY ASSURANCE

- A. 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 be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and be engaged in the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. 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.

- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. 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's Responsibilities:
 - 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. When testing is complete, remove test specimens and test assemblies; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. 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.
 - a. Construct mockups showing exterior elements in an open, unshaded area with the finish side of the mockup positioned to receive direct sunlight.
 - 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who 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 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. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 - 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 10. Demolish and remove mockups when directed, unless otherwise indicated.

1.9 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 inspecting they are engaged to perform.
 - 2. Payment for these services will be made by the Owner.
 - 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 and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect 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 01 33 00 "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. Contractor's Associated Requirements and 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 inspecting 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.
- 1.10 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated in the Statement of Special Inspections, 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 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 with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, 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. Where tests reveal non-compliant work, Owner's testing agency will perform retesting and reinspection of corrected Work at Contractor's expense.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's and authorities' having jurisdiction reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, 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 01 73 00 "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 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 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.

1.2 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.
 - 1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.
- C. Copies of Standards: Each entity engaged in construction on Project must 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 or to resolve any construction activity uncertainty or dispute, Contractor to immediately obtain copies of the relevant standard directly from publication source and keep on site for reference by all entities.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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. ICC - International Code Council; www.iccsafe.org.
 2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to mean the recognized name of the entities indicated on <https://ucsd.libguides.com/govspeak> website.
- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they are to 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 U.S. Government Publishing Office; www.govinfo.gov.
 2. FED-STD - Federal Standard; (see FS).
 3. FS - Federal Specification; Available from DLA Document Services; www.dsp.dla.mil/Specs-Standards/.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from U.S. General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
 4. USAB - United States Access Board; www.access-board.gov.
 5. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (see USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - 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 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall 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, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: 120 volt electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- D. No other public utilities are provided on the site; all other utilities required for construction shall be provided by the Contractor as temporary facilities.

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. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling,
 - 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 sequencing of work that requires water and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- D. 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.
- E. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:
 - 1. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

- A. General: Contractor is responsible for all temporary facilities needed including but not limited to:
1. Installation, operation, maintenance, and removal of each temporary facility necessary for its own normal construction activity, and costs and use charges associated with each facility, except as otherwise provided for in this Section.
 2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
 3. Hoses for water to location needed.
 4. Storage and fabrication sheds.
 5. All safety devices and precautions necessary for operations and work.
 6. Provide, maintain and perform protection and prevention of fires or fire hazards during the construction period for its construction material and personnel in accordance with Federal, State and Local laws and regulations. This includes but is not limited to fire extinguishers, special signs and removal of combustible materials.
 7. Staging and scaffolding for its own construction activities.
 8. Waste disposal facilities, including collection and legal disposal of its own waste materials. Daily cleanup of Contractor's trash & debris is mandatory for this project and is included in the Contract.
 9. Secure lockup of tools, materials, and equipment.
 10. Construction aids and miscellaneous services and facilities necessary exclusively for construction activities.
 11. Means and methods of construction and jobsite safety.
 12. Contractor is similarly responsible for the activities of its subcontractors.
- B. Common-Use Field Office is contractor option; progress meetings may be held in the existing building in lieu of on-site if scheduled in advance with the Owner; or may be held on site in the open. If provided, office trailer shall be of sufficient size to accommodate needs of construction personnel, inspectors, architect, and contractor's office activities and to accommodate Project meetings. Furnish and equip offices as follows:
1. Location: Parking lot; position as approved by Owner.
 2. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 3. Provide secure location for copy of reviewed submittals, permits, permit drawing sets and other official documents, and for as-built markup drawings and specification sets.
 4. Provide tackboard for posting required documents, project information, telephone lists including emergency numbers for fire, police and life squad, safety posters and the like.
 5. Desks for contractor.
 6. Area of sufficient size to accommodate meetings of 10 individuals.
 7. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 8. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. IF NO field office is provided: Provide weather-tight lockable gang box of sufficient size to accommodate record documents, permit drawings, shop drawings, notice board and other required informational documents.
1. This document gang box shall be a separate dedicated item, not part of contractor's tool and equipment gang box. Furnish with combination padlock and advise owner and architect of combination or provide key padlock with keys issued to owner and architect.
 2. Contractor is responsible to ensure gang box is secured on site against theft and damage.
 3. Document gang box shall be available to all authorized entities during construction hours.
- D. Sanitary Facilities: Provide and maintain temporary toilets, wash 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.

- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Remove trash from site daily or provide dumpster adequate for all waste material and debris at end of each day; service as required.
 - 1. Allow no loose material piles or fenced debris containment areas.
- F. Enclosure Fence: Contractor option to enclose staging area. Use portable chain link fencing that does not penetrate or damage pavement.
- G. Barricades, Warning Signs, and Lights: Provide safety devices and protections as required by work or by authorities having jurisdiction including but not limited to structurally adequate barricades, fences, warning signs and lighting.
- H. Storage and Fabrication Sheds: Contractor may provide sheds sized, furnished, and equipped to accommodate materials and equipment for their construction operations.
 - 1. Store combustible materials apart from building.
 - 2. Locate as directed by Construction Coordinator.
- I. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- J. First Aid: Maintain first aid kit adequate for all common construction needs and injuries. Kit must be unlocked and accessible for quick retrieval at all times construction is underway.

PART 3 - EXECUTION

3.1 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 01 10 00 "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.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
- B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
- C. Sanitary Facilities: Provide temporary toilets, wash 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.
- D. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations if requirements exceed the capacity of Owner's existing 120 volt electric power service. Maintain Owner's existing power equipment in a condition acceptable to Owner.

3.3 SUPPORT FACILITIES INSTALLATION

- A. Temporary Use of Existing Permanent Drives, Walks, and Paved Areas: Photo-document condition of existing driveways, parking lots and sidewalks used for construction purposes and access. Show in particular any condition that may later be interpreted as construction damage.
 - 1. Maintain paved areas in good undamaged condition. Review conditions daily and immediately assess any inadvertent damage and identify cause / responsible contractor.
 - 2. Contractor shall provide protective means they deem necessary to protect against pavement damage from their operations.

- B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- C. Waste Disposal Facilities: 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 01 73 00 "Execution."
- D. 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.
- E. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 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.
- 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.
- C. 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 work day.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- F. 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; manage fire prevention program.
 - 1. Prohibit smoking in construction areas.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to 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.

3.5 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.
- C. 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 Substantial Completion. 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 Contractor. Owner reserves right to take possession of Project identification signs.

2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Administrative and procedural requirements for selection of products for use in Project.
 - 2. Product delivery, storage, and handling.
 - 3. Manufacturers' standard warranties on products.
 - 4. Special warranties.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for requests to submit consideration of **comparable products**.
 - 2. Section 01 25 00 "Substitution Procedures" for requests for **substitutions**.
 - 3. Section 01 42 00 "References" for applicable industry standards for products specified.
 - 4. Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.2 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, which 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. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless otherwise indicated.
 - 3. Comparable Product: Product that is demonstrated and approved through Section 01 25 00 "Substitution Procedures" 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 a specified product.
 - a. Comparable products are allowed only under conditions and processes described in Section 01 25 00 "Substitution Procedures".
- B. Substitutions: Changes proposed by the Contractor in products, materials, equipment, or methods of construction from those required by the Contract Documents.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis-of-design" product, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating equivalent features of products of other manufacturers named in the specification.
 - 1. Designating one product or manufacturer as the "Basis-of-Design" does not either directly or unintentionally establish a proprietary specification. It is fully expected that the other named manufacturers have standard or modified products, with or without accessory and supplementary items or methods of installation that provide equivalent utility, function, properties and design intent to the basis of design.
 - 2. Any Contractor needing clarification about the acceptability of a product or method of installation of one of the other named manufacturers shall seek clarification from Architect during bidding by submitting complete documentation for the intended product and a written statement of intent. Submit full substantiating documents in time for Architect's review and analysis before the cutoff date for issuing an Addendum.
 - 3. If clarification is not requested, as required during bidding, comply with Architect's instructions during Submittals Process that establish other named manufacturer product equivalency to the basis-of-design product; or provide the basis-of-design product.
- D. 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.

1.3 SUBSTITUTIONS / COMPARABLE PRODUCTS

- A. Contractor substitution requests for convenience or for cause; and requests to use comparable products, will be considered only when presented in compliance with Section 01 25 00 "Substitution Procedures".
- B. Failure to process or order in a timely manner:
 - 1. Failure to process product submittals or to order materials, in time to meet construction schedule requirements, is not justification for providing any product or method that differs from the Construction Documents.
 - 2. IF a substitution for cause is acceptable to Architect, any and all costs associated with the substitution – including, but not limited to, providing a superior product to the one specified, expedited deliveries, special production runs, custom modifications or finishes, and adjustments to other Work in place or yet to be installed - to be paid by the Contractor whose failure to process or order in a timely manner has caused the change. In no case is any cost to be passed on to Owner for such failure.

1.4 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. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors. Date of Architect's favorable review is the date used in determining precedence.
 - 2. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products will be used. Provide products determined by Architect with no additional cost to Owner.
- 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 inconspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- 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 equipment identification requirements.

1.5 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 that products are undamaged and properly protected.

- C. Storage:
1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 7. Protect stored products from damage and liquids from freezing.
 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections are to 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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
 3. Warranty initiation date shall be the date indicated in the applicable specification section. Contractor to obtain any additional, supplemental, or extended insurance necessary to cover insurances for the time period indicated if manufacturer-provided insurance does not cover the full timeframe required.
 4. There shall be no delay in the initial start and continuation in effect of any warranty required by the Specifications for any cause, including but not limited to any obligations of performance or payment of fee(s), or other requirement between Contractor and product manufacturer / warranty provider.
 - a. Where a fee is required to initiate and bring into effect or to maintain a Warranty, the Contractor shall pay such fee(s) as part of the Work and shall provide proof of payment of fees and proof of initiation of Warranty before Final Payment request will be processed.
 5. Warranties shall not be suspended, terminated, or revoked due to any failure of the Contractor or their sub-contractor to pay premiums or initiation-of-warranty fees.
 6. For the full duration of the warranty period, an executed warranty as delivered to the Owner shall not be suspended, terminated or revoked by the manufacturer or Contractor without written documentation signed by an officer of the manufacturer and delivered to the Owner by registered mail. Manufacturer Direct Inspections for Warranty Continuance: All fees for the product manufacturer's inspections required to maintain a warranty in full force and effect throughout the warranty period shall be waived or be pre-paid and included as part of the construction Work; this applies whether the manufacturer uses their own forces or contracts with an inspection agency. This does not apply to regular maintenance inspections and service obligations of the Owner.
 7. Contractor is responsible to pay all fees and to obtain any and all additional warranties or warranty extensions necessary to fulfill the requirements of this section and of specific Product Section warranties including but not limited to warranty initiation date, warranty initiation fee payments, periodic inspection costs if required by the warranty, warranty termination date, and warranty work coverage, as part of the Work without additional cost to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified or appended to include project-specific information and requirements, properly executed.
 - a. All parties to the agreement must initial any modifications of the standard form.
 - b. Parties must reference all appended documents through modifications to the standard form; cross-reference both documents by title and date.
 2. Specified Form: When specified forms are included in the Project Manual, 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:

1. Sample Warranty / Form: Un-executed, but with terms clearly indicated, when listed in a specification Section under Part 1 article "Informational Submittals".
 2. Executed Warranty / Form: Comply with requirements in Section 01 77 00 "Closeout Procedures."
- D. Product Warranty Prerequisite: Specified warranties are as much a requirement of products as performance criteria. Do not submit products that cannot be covered by the specified warranty whether or not listed in the specification section; seek clarification from Architect in advance. See Section 01 25 00 "Substitution 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 approved equal," or "or approved," comply with requirements in "Comparable Products" Article in Section 01 25 00 "Substitution Procedures" to obtain approval for use of a particular unnamed product.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
 2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
 3. 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 convenience will not be considered.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
 4. 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.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of 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 may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named.
 - a. Any Contractor needing clarification about the acceptability of a product or method of installation of one of the other named manufacturers shall seek clarification from Architect during bidding by submitting complete documentation for the intended product and a written statement of intent.
 - 1) Submit full substantiating documents in time for Architect's review and analysis before the cutoff date for issuing an addendum.
 - 2) If clarification is not requested, as required during bidding, comply with Architect's instructions during the Submittals Process that establish other named manufacturer

product equivalency to the basis-of-design product; or provide the basis-of-design product.

- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," including to "match an established sample or element of an existing building," provide a product that complies with requirements and also matches Architect's sample or indicated element. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of another product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's 'Standard', 'Full', or 'Industry' range of colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements and the following:
 - 1. Standard Range: Or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items / finishes.
 - 2. Full Range: Or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items / finishes.
 - 3. Industry Range: Or similar phrase, Architect will select a product from the manufacturer indicated and that is a regular offering in the industry even if it may be a special offering by the named manufacturer.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
 - 1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: ONLY as indicated and following the processes stated in Section 01 25 00 "Substitution Procedures."

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 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.
 - 4. Cutting and patching.
 - 5. Coordination of Owner's portion of the Work.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for coordination of Owner-furnished products, and limits on use of Project site.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 3. Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building
 - 4. Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 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.
- C. "Cutting and patching" is performed for coordination of the work, to uncover work for access or inspection, to obtain samples for testing, to permit alterations to be performed, and for other similar purposes.
- D. Cutting and patching performed during the manufacturer of products or during the initial fabrication, erection, or installation processes is not considered to be "cutting and patching" under this definition. Drilling of holes to install fasteners and similar operations are also not considered to be "cutting and patching".

1.3 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. Inform Architect of scheduled meeting. 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.
- B. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of new perimeter and structural column grid(s), review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform

Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:

- a. Contractor's superintendent.
 - b. Professional surveyor responsible for performing Project surveying and layout.
2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
 3. Review requirements for including layouts on Shop Drawings and other submittals.
 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 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.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 4. Dates: Indicate when cutting and patching will be performed.
 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. 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, or when encountering the need for cutting and patching of elements whose structural function is not known, 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.
- C. 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. Comply with requirements specified in other Sections.
- 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. Use materials that are not considered hazardous.
- C. 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 EXAMINATION

- A. Existing site survey, topography, and subsurface conditions: Existing conditions presented in drawing, report or specification form are believed accurate within normal industry tolerances but are not guaranteed. Investigate, survey, confirm and verify all conditions bearing on the Work by any means necessary before starting any Work that changes existing conditions. Report any unacceptable discrepancies to the Architect in writing before beginning operations.
 1. Written claims of difference shall be accompanied by all substantiating evidence necessary to document such claim.
 2. Claims of difference shall be resolved, including determination of quantities and costs and methods of contract modification, before work that alters such existing conditions is started.
 3. Initiation of site-clearing, soil-moving operations, demolition or other activity that alters existing conditions shall be evidence that Contractor has made all investigations and evaluations it deems necessary and has accepted all existing conditions present whether or not they conform exactly to the Contract Documents.
 4. Without advance written notification of unacceptable discrepancy, no claim for extra will be considered for a claim of difference between documents and actual conditions after the Contractor has altered existing conditions.
- B. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. 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.
- D. 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, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.
- F. Concealed Conditions: Concealed conditions that the Contractor believes to differ substantially from Contract requirements, that change the product or performance requirements indicated, or that otherwise have a time / cost impact on the Contractor's work, shall be brought to the attention of the Architect immediately upon discovery.
1. Verbal or written claims of difference shall be accompanied by all substantiating evidence necessary to document such claim. Verbal claims shall be documented in writing by the Contractor following discussions including full description of claim and points of understanding.
 2. Claims of difference shall be resolved in writing, including determination of quantities and costs and methods of contract modification, before work that alters such existing conditions is started.
 - a. When actual quantities remain concealed at time of discovery, the unknown quantities shall be estimated and a unit price agreed upon; as work progresses, Contractor shall track and document actual quantities to the Architect daily and shall not exceed estimated quantities without specific notification and further discussion.
 3. Without such written agreement, no claim for extra cost or time will be considered for a claim of difference between documents and actual conditions after the Contractor has altered existing 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, submit a request for information to Architect in accordance with requirements in Section 01 31 00 "Project Management and Coordination."

- E. Drawings:
1. Although Drawings are grouped and identified by classification of the Work, Contractors are responsible for their Work as it may be indicated on any and all of the Drawings regardless of drawing number prefix.
 2. Although the majority of the Drawings are "to scale," Contractors are directed to use indicated written dimensions along with their own field measurements and verifications for determining locations, material quantities and for other reasons.
 - a. Most plan drawings have a one-inch 'reference line' left of the title block box containing the sheet number. Be aware that if this reference line does not measure exactly one inch in length, the sheet has not been reproduced at a correct size.

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 and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 2. Establish limits on use of Project site.
 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 4. Inform installers of lines and levels to which they must comply.
 5. Check the location, level and plumb, of every major element as the Work progresses.
 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 7. 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.

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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect 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. 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 108 inches in occupied spaces and 96 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- 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 of type expected for Project.
- 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: 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 with manufacturer.
 - 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, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. 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 with Owner.
- 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, as judged by Architect. 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, corner to corner of wall and edge to edge of ceiling. 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 PROGRESS CLEANING

- A. 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.

5. Contractors failing to clean their work areas as indicated and directed will be back-charged costs for having the work performed.
 - 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: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
 - G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
 - 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 Substantial Completion.
 - 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 assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- 3.8 STARTING AND ADJUSTING
- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
 - B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
 - C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."
- 3.9 PROTECTION OF INSTALLED CONSTRUCTION
- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 - 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.

3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. List of incomplete items.
 - 4. Submittal of Project warranties.
 - 5. Final cleaning.
- B. Related Requirements:
 - 1. Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. 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 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.

3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
- 1.7 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 in accordance with Section 01 29 00 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

- 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 and proceeding from lowest floor to highest floor, listed by room or space number.
 - 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.
 - d. Name of Contractor.
 - e. Page number.
 - 4. Submit list of incomplete items in the following format:
 - a. PDF Electronic File: Architect will return annotated file.

1.9 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 Substantial Completion, 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 by uploading to web-based project software site.
- E. Provide one paper copy 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.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.

- d. Remove tools, construction equipment, machinery, and surplus material from Project site.
- e. Remove snow and ice to provide safe access to building.
- f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
- g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
- h. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's recommendations.
- i. Vacuum and mop concrete.
- j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- l. Remove labels that are not permanent.
- m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
- q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- r. Clean strainers.
- s. Leave Project clean and ready for occupancy.

3.2 CORRECTION OF THE WORK

- A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 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.

1.3 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 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 by uploading to web-based project software site. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect 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 Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 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, 3-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 the applicable printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. 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 Text: 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.

1.5 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 Architect.
 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 8. 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."

1.6 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.

1.7 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.

1.8 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.

1.9 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.
- 1.10 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 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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.
- B. Related Requirements:
 - 1. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
 - 2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Submit PDF electronic files of scanned Record Prints. Print each drawing, whether or not changes and additional information were recorded.
- 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.

1.3 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 prints 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.

1.4 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.

1.5 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.

1.6 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 reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 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.

1.2 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.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "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, 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.

1.4 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.

1.5 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.

1.6 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 01 78 23 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. 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 Architect, with at least seven days' advance notice.
- C. 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.
- D. 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.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. The Work of this Section Includes:
 - 1. Demolition and removal of selected portions of interior of building.
 - 2. Removal of existing items for reinstallation.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for cutting and patching procedures. Cutting and patching is not the same as Selective Demolition. Cutting and patching includes removal and restoration of walls, floors and similar existing (or in-place new) construction as necessary to install the work shown; and is the responsibility of the trade whose work requires the cutting and removal.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- C. 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 structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.
 - 6. Review and finalize protection requirements.
 - 7. Review procedures for noise control and dust control.
 - 8. Review storage, protection, and accounting for items to be removed for reinstallation.

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.
 - 2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
 - 3. Coordination for shutoff, capping, and continuation of utility services.

- C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, if any, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, which might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

1.7 FIELD CONDITIONS

- A. Owner will not occupy portions of building immediately adjacent to selective demolition area.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 - 1. Before selective demolition, Owner will remove the following items:
 - a. Loose furnishings.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials:
 - 1. Hazardous materials are not expected to be present in buildings and structures to be selectively demolished.
- E. On-site sale of removed items or materials is not permitted.

1.8 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

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. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video. Comply with Section 01 32 33 "Photographic Documentation."
 - 1. Inventory and record the condition of items to be removed for reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
 - 2. 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 reinstallation.

3.2 PREPARATION

- A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
 - 1. Strengthen or add new supports when required during progress of selective demolition.
- B. 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.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
 - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location, cleaned and reinstalled in their original locations after selective demolition operations are complete.

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.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 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.
 - b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.
 - 4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.
 - a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

5. Remove and reinstall existing building systems, equipment, and components indicated on drawings to be removed and reinstalled.
 - a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.

3.4 REINSTALL

- A. Removed and Reinstalled Items:
 1. Clean and repair items to functional condition adequate for intended reuse.
 2. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

3.7 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. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.8 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 02 41 19

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Bar supports.
 - 3. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Material Test Reports: For the following, from a qualified testing agency:
 - 1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar 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 in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

- a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.
- 2.3 FABRICATING REINFORCEMENT
- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. 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.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - 2. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 3. Lace overlaps with wire.

3.3 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION – 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.

1.2 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. Water/Cement Ratio (w/cm):** The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures.
7. Vapor retarders.
8. Floor and slab treatments.
9. Liquid floor treatments.
10. Curing materials.
11. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Slump limit.
6. Air content.
7. Nominal maximum aggregate size.

C. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

D. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

- a. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

- 1. Installer: Include copies of applicable ACI certificates.
- 2. Ready-mixed concrete manufacturer.
- 3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

- 1. Cementitious materials.
- 2. Admixtures.
- 3. Curing compounds.
- 4. Floor and slab treatments.
- 5. Bonding agents.
- 6. Adhesives.
- 7. Vapor retarders.
- 8. Semirigid joint filler.
- 9. Joint-filler strips.
- 10. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

- 1. Portland cement.
- 2. Fly ash.
- 3. Slag cement.
- 4. Silica fume.
- 5. Aggregates.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician.

B. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

C. Ready-Mixed 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.

D. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

- 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94/C94M and ACI 301.

1.7 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. 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.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. 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 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

- A. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I/II.
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

- B. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

- a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
- b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
- c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

2. Maximum Coarse-Aggregate Size: As indicated on Drawings.

3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

- C. Air-Entraining Admixture: ASTM C260/C260M.

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- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete.
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.
- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

2.3 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Minimum 15 mil thickness, ASTM E1745, Class A, except with maximum perm rating of 0.01 after in-service condition testing per ASTM E154 Sections 8, 11, 12, and 13. Include manufacturer's recommended adhesive or pressure-sensitive tape. Plastic vapor retarder is required under all interior slabs-on-grade except for spaces indicated to receive wood flooring.
1. Manufacturers: Subject to compliance with requirements, provide one of the following:
 - a. ISI Building Products, Viper II, 15 mil
 - b. Inteplast Group, Barrier-Bac VB-350
 - c. Poly-America, Husky Yellow Guard, 15 mils
 - d. Reef Industries, Inc., Griffolyn VaporGuard
 - e. Stego Industries, LLC, Stego Wrap, 15 mils
 - f. Viraflex, VaporBlock VB15
 - g. W.R. Meadows, Inc., Perminator 15 mil

2.4 CURING MATERIALS

- A. Unless noted otherwise: Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
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. Dayton Superior.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. SpecChem, LLC.
 - d. W.R. Meadows, Inc.

2.5 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, in accordance with ACI 301.
1. Use a qualified 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 or Other Pozzolans: 25 percent by mass.
 2. Slag Cement: 50 percent by mass.

3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
 4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with 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, for concrete for parking structure slabs, and concrete with a w/cm below 0.50.
- 2.6 CONCRETE MIXTURES
- A. As indicated on Drawings.
- 2.7 CONCRETE MIXING
- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish batch ticket information.
- 2.8 ACCESSORIES
- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 in accordance with ASTM D2240.
1. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant Primers for Porous Substrates: 775 g/L.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. 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 I and II, non-load bearing and Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
1. Before placing concrete, verify that installation of reinforcement, and embedded items is complete and that required inspections have been performed.
 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
 - 4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

- 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.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 2. Face laps away from exposed direction of concrete pour.
 - 3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 - 4. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 - 6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 7. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 - 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 - 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
 - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- E. 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.
 - 1. If a section cannot be placed continuously, provide construction joints as indicated.
 - 2. Deposit concrete to avoid segregation.
 - 3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
 - d. 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.
- F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
 - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 3. Maintain reinforcement in position on chairs during concrete placement.
 - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 5. Level concrete, cut high areas, and fill low areas.
 - 6. Slope surfaces uniformly to drains where required.
 - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 - 8. Do not further disturb slab surfaces before starting finishing operations.

3.6 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

- 1. ACI 301 Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/4 inch.
 - c. Patch tie holes.

- d. Surface Tolerance: ACI 117 Class B.
 - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.
 - B. Related Unformed Surfaces:
 - 1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
 - 2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- 3.7 FINISHING FLOORS AND SLABS
 - A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
 - B. Scratch Finish:
 - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
 - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
 - 3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
 - C. Float Finish:
 - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
 - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
 - 3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
 - D. Trowel Finish:
 - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
 - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
 - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 - 4. Do not add water to concrete surface.
 - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
 - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - 7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Slabs on Ground: as indicated on Drawings.

- 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 perpendicular to main traffic route.
 - 1. Coordinate required final finish with Architect before application.
 - 2. 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 locations indicated on Drawings.
 - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 - 2. Coordinate required final finish with Architect before application.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
 - 1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 - 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 - 3. 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 as indicated on Drawings and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
 - 3. Minimum Compressive Strength: match concrete specified of supporting floor.
 - 4. Install dowel rods to connect concrete base to concrete floor as indicated on Drawings.
 - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 - 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
 - 1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 - 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 - 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
 3. If forms remain during curing period, moist cure after loosening forms.
 4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheetting Materials: Cover exposed concrete surfaces with sheetting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.
 - 2) Maintain continuity of coating and repair damage during curing period.
- C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
 2. Interior Concrete Floors:
 - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 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.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.

- b. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Urethane Flooring:
 - 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- d. Floors to Receive Curing Compound:
 - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period.
 - 4) 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.
- e. Floors to Receive Curing and Sealing Compound:
 - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
 1. Verification of use of required design mixture.
 2. Concrete placement, including conveying and depositing.
 3. Curing procedures and maintenance of curing temperature.
 4. Verification of concrete strength before removal of shores and forms from beams and slabs.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

- a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C143/C143M:
 - a. 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.
 - b. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;
 - a. 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:
 - a. 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. Compressive-Strength Tests: ASTM C39/C39M.
 - a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 7. 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 if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
 8. 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.
 9. Additional Tests:
 - a. 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.
 - b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
 10. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 11. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to Architect.

END OF SECTION 03 30 00

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Standard concrete masonry units (CMU).
 - 2. Architectural CMU.
 - 3. Clay face brick.
 - 4. Mortar and grout.
 - 5. Steel reinforcing bars.
 - 6. Masonry-joint reinforcement.
 - 7. Ties and anchors.
 - 8. Embedded flashing.
 - 9. Miscellaneous masonry accessories.
 - 10. Extruded polystyrene foam-plastic board insulation.
 - a. Perimeter foundation insulation.
- B. Products furnished, but not installed, under this Section:
 - 1. Anchor sections of adjustable masonry anchors for connecting to structural steel frame and steel lintels, installed under Sections 05 12 00 "Structural Steel Framing" and 05 50 00 "Metal Fabrications."
- C. Products installed, but not furnished, under this Section:
 - 1. Steel lintels in unit masonry furnished under Section 05 50 00 "Metal Fabrications."
 - 2. Brake-formed metal angles at top of interior masonry partitions furnished under Section 05 50 00 "Metal Fabrications."
 - 3. Hollow-metal frames in unit masonry openings furnished under Section 08 11 13 "Hollow Metal Doors and Frames."
- D. Related Requirements:
 - 1. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.

1.2 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
 - 2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Initial Selection:
 - 1. Colored mortar.
 - 2. Weep holes/cavity vents.
- D. Samples for Verification subject to final acceptance as part of mock-up review: For each type and color of the following:
 - 1. Clay face brick.
 - 2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
 - 3. Weep holes and cavity vents.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:
 - 1. Masonry units.
 - a. Include data on material properties.
 - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include test report for efflorescence according to ASTM C67.
 - d. For masonry units, include data and calculations establishing average net-area compressive strength of units.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 - 2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.
- D. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- E. Research Reports: For spray-applied polyurethane foam-plastic insulation and thermal barriers, **tested as an assembly** and approved for use as an exposed interior finish, from an agency acceptable to authorities having jurisdiction, showing compliance with UL 1715, UL 1040, FM 4880, or NFPA 286.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

1.7 MOCKUPS

- A. Wall Mockups: Build mockups to verify selections made under Sample submittals to demonstrate aesthetic effects to set quality standards for materials and execution and to set quality standards for installation.
 - 1. Build mockups for typical exterior wall where stack bond patterning occurs in sizes approximately 48 inches (1219 mm) long by 72 inches (1829 mm) high by full thickness, including face and backup wythes and accessories.
 - a. Include a sealant-filled joint at least 16 inches (406 mm) long in exterior wall mockup.
 - b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (305 mm) wide by 16 inches (406 mm) high.
 - c. Include through-wall flashing installed for a 24-inch (610-mm) length in corner of exterior wall mockup approximately 16 inches (406 mm) down from top of mockup, with a 12-inch (305-mm) length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Include air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
 - 2. Clean exposed faces of mockups with masonry cleaner as indicated.
 - 3. Protect accepted mockups from the elements with weather-resistant membrane.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations by Change Order.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- B. At Contractor's option a separate panel mockup, 48 inches long, by 48 inches high, by full wall thickness can be constructed in lieu of an in-place wall mockup.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store packaged cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store masonry sand on protective membrane that separates sand from the ground moisture and contaminants and does not retain water.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.
- F. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- G. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
 - 3. If covering is temporarily removed to perform certain wall operations, restore complete covering as soon as operations are complete and at end of workday; allow NO water intrusion into the masonry or the cavity.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.3 STANDARD CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sills, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 2. Density Classification:
 - a. Lightweight, maximum density not more than 105 lbs. per cubic foot, typical throughout building for interior work.
 - b. Normal weight for below grade work and work exposed to the exterior including mechanical and dumpster screen walls and site signs.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 4. Exposed Faces: Manufacturer's standard color and texture.

2.4 ARCHITECTURAL CONCRETE MASONRY UNITS

- A. Manufacturers; Subject to compliance with requirements, provide the following or a pre-approved equal:
1. Bryce Hill.
 2. Lee Building Products.
 3. Reading Rock.
 4. Oberfields.
 5. Schory Cement Products.
- B. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sills, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners unless otherwise indicated.
- C. CMUs: ASTM C90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
 2. Density Classification:

- a. Normal weight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Pattern and Texture: Standard pattern, ground-face finish.
5. Color: Mortar Color #2 – as selected from manufacturer's full range of not less than 32 colors.

2.5 MASONRY LINTELS

- A. Masonry Lintels: Built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Temporarily support built-in-place lintels until cured.

2.6 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 2. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
 3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 4. For decorative brick recesses and patterning where brick ends or other unfinished brick surfaces may be exposed, provide solid units without cores and with exposed surfaces finished.
- B. Clay Face Brick: Facing brick complying with ASTM C216.
 1. Grade: SW.
 2. Type: FBA.
 3. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3350 psi.
 4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
 5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
 6. Brick shall be a minimum 75 percent solid, unless noted otherwise on Drawings.
 7. Clay Face Brick; **Masonry Veneer Type-A:**
 - a. Product: To Be Determined
 - b. Size – modular - (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
 - c. Mortar Color: Mortar Color #1 - as selected from manufacturer's full range of colored mortars of not less than 32 colors.

2.7 MORTAR FOR UNIT MASONRY

- A. Masonry Cement: ASTM C91/C91M.
 1. Subject to compliance with requirements, provide one of the following:
 - a. Cemex S.A.B. de C.V.; Richmortar Masonry Cement.
 - b. Fairborn Cement Company; MIAMI Masonry Cement.
 - c. LafargeHolcim; Masonry Cement.
 - d. Lehigh Hanson HeidelbergCement Group; Lehigh Masonry Cement.
 2. Aggregate for Mortar: Masonry sand, ASTM C144.
 3. Mortar Mixing: Provide one of the following mortar mixes.
 - a. Add masonry cement to mixer in full bag quantities. Measure dry masonry sand in box with volume of one cubic foot as often as necessary to maintain consistent proportions and at least once daily and every 4 hours of mixing. Add water and mix for 3-5 minutes.
 - b. Add preblended, dry mortar mix to the mixer. Furnish dry mortar ingredients (masonry cement and sand) in form of a preblended mix, ASTM C1714. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site. Add water and mix for 3-5 minutes.
 4. Application: Provide for all standard cmu work and where non-pigmented mortar is required.
- B. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 1. Subject to compliance with requirements, provide one of the following:
 - a. Cemex S.A.B. de C.V.; Richcolor Masonry Cement.
 - b. Fairborn Cement Company; MIAMICOLOR Masonry Cement.
 - c. LafargeHolcim; Custom Color Masonry Cement.
 - d. Lehigh Hanson HeidelbergCement Group; Custom Color Masonry Cement.

2. Formulate blend as required to produce color indicated.
 3. Pigments shall not exceed 5 percent of masonry cement by weight.
 4. Aggregate for Mortar: Masonry sand, ASTM C144.
 5. Mortar Mixing: Provide one of the following mortar mixes.
 - a. Add packaged colored masonry cement blend to mixer in full bag quantities. Measure dry masonry sand in box with volume of one cubic foot as often as necessary to maintain consistent proportions and at least once daily and every 4 hours of mixing. Add water and mix for 3-5 minutes.
 - b. Add preblended, dry mortar mix to the mixer. Furnish dry mortar ingredients (packaged colored masonry cement and sand) in form of a preblended mix, ASTM C1714/C1714M. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site. Add water and mix for 3-5 minutes.
 6. Application: Provide for all clay face brick and for architectural CMU.
- C. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C1384 or water-reducing and accelerating admixture complying with ASTM C494, Type E, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Use of cold-weather admixtures in mortar is not a substitution for compliance with TMS 602/ACI 530.1/ASCE 6 cold weather construction requirements.
 2. Cold-weather admixture (if used) shall be factory blended into the mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
 3. Products: Subject to compliance with requirements, provide one of the following:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. GCP Applied Technologies; Morset.
 - c. Spec Mix, LLC; Spec Mix Non-Chloride Accelerator.
- D. Water: Potable.
- E. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For all masonry unless otherwise noted, use Type S.
 2. For masonry veneer above grade, use Type N.

2.8 GROUT FOR UNIT MASONRY

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in grout.
- B. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout that has been factory pre-blended and delivered to project site.
 - a. On-site field mixing of Portland cement and fine or coarse aggregate will NOT be permitted.
 - b. On-site field mixing of factory pre-blended grout for mixing with water only is acceptable.
 2. Use grout of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - a. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.
 - b. Use coarse grout in grout spaces 2 inches or more in least horizontal dimension, for filling bond beams, and for grouting cores of CMU with reinforcing bars.
 3. Proportion grout in accordance with ASTM C476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2500 psi.
- C. Aggregate for Grout: ASTM C 404.
- D. Water: Potable.

2.9 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars and configurations indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Heckmann Building Products Inc.
 - b. Hohmann & Barnard, Inc.
 - c. Wire-Bond.
- C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: 0.148-inch diameter.
 4. Wire Size for Cross Rods: 0.148-inch diameter.
 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units. Where grouted cells contain reinforcing bars, ladder-type reinforcement works better than truss type.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:
1. For **Masonry Veneer / CMU walls**: 3-wire ladder type with perpendicular cross rods spaced not more than 16 inches on center and with pair of side rods spaced for embedment within each face shell of backup wythe, and one side wire spaced for embedment in the masonry veneer wythe. Size reinforcement to extend at least halfway through masonry veneer wythe but with at least 5/8-inch cover on outside face.
 2. For **Masonry Veneer / CMU cavity walls**: Adjustable (2-piece) type with single pair of side rods, and cross tabs spaced not more than 16 inches o.c. and with separate adjustable ties engaging the cross tabs.
 - a. Adjustable ties and cross tabs shall be rectangular and 0.188-inch diameter minimum. Space side rods for embedment within each face shell of CMU wythe and size adjustable ties to extend at least halfway through masonry veneer wythe but with at least 5/8-inch cover on outside face. Assembly shall provide 100% protection against separation of adjustable ties from cross tabs and shall not allow the adjustable ties to be installed beyond allowable eccentricity.
 - b. Provide with seismic tie, clip, and continuous wire where stack bond is indicated on Drawings.
 - c. Products: Subject to compliance with requirements including size and spacing strength design of the delegated design engineer, provide one of the following:
 - 1) Hohmann and Barnard, Inc.; 270-2X Ladder Eye-Wire.
 - 2) Wire-Bond; Series 800 Ladder Level-Eye

2.10 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
 2. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire. Where column web ties are indicated, provide 0.187-inch-diameter x 12-inches long ties made from hot-dip galvanized steel wire.
- D. Adjustable Masonry-Veneer Anchors for Connecting to Cold-Formed Metal Framing:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick steel sheet, galvanized after fabrication.
 3. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
 4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and insulation and has gasketed washer head that covers hole in insulation.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Heckmann Building Products, Inc.; #75 Original Pos-I-Tie with Triangle Wire Tie.
 - 2) Hohmann & Barnard, Inc.; 2-Seal Tie with 2-Seal Byna-Lok Wire.
 - 3) Wire-Bond; #4520 SureTie, #4590 Thermal Grip Washer, and #4510 SureTie Triangle.
 5. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours according to ASTM B117.
- E. Wire Mesh Ties: 1/2-inch mesh, 16 gage steel wire, hot dip galvanized.

2.11 EMBEDDED FLASHING MATERIALS

- A. Flexible Flashing: Use one of the following:
1. Stainless Steel-Laminated Flashing: 2 mil, Type 304 stainless-steel sheet bonded to a polymeric fabric on one face. Use only where flashing is fully concealed in masonry.
 - a. Product: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hohmann & Barnard, Inc.; Mighty-Flash SS Fabric Flashing.
 - 2) Wire-Bond; Bond-N-Flash.
 - 3) York Flashings; Multi-Flash SS.
 2. Copper-Laminated Flashing: 3-oz./sq. ft. copper sheet bonded to a polymeric fabric on both faces. Use only where flashing is fully concealed in masonry.
 - a. Product: Subject to compliance with requirements, provide products by one of the following:
 - 1) Advanced Building Products Inc., Copper Sealtite 2000.
 - 2) Hohmann & Barnard, Inc.; Copper-Fabric NA Copper Fabric Flashing.
 - 3) Wire-Bond; Copper Seal Flashing.
 - 4) York Flashings; Multi-Flash 500.
 3. Unitized Flashing and Cavity Drainage System: Masonry cavity wall flashing system consisting of a stainless steel- or copper-laminated flashing (meeting requirements for flashings in preceding paragraphs), mortar dropping collection drainage mat, and drainage mesh weep tabs factory-assembled into a single unit in lieu of individual components.
 - a. Product: Subject to compliance with requirements, provide products by one of the following:
 - 1) Mortar Net Solutions; TotalFlash Roll Masonry Cavity Wall Drainage Solution.
 - 2) York Flashings; Flash-Vent.
- B. Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other.
- C. Termination Bars for Flexible Flashing: Aluminum or stainless steel bars 1/8 inch by 1 inch.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

- C. Bond-Breaker Strips: Dense neoprene rubber (ASTM D2000, Grade BC610) bearing pad; 1/8-inch thick. Use at steel wide flange beam and precast concrete / masonry lintel bearing end coinciding with control joint location.
- D. Weep/Cavity Vent Products:
 - 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Advanced Building Products Inc.; Mortar Maze Weep Vents.
 - 2) Heckmann Building Products Inc.; #85 Cell Vent.
 - 3) Hohmann & Barnard, Inc.; QV - Quadro-Vent.
 - 4) Wire-Bond; #3601 Cell Vent.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Advanced Building Products Inc.; Mortar Break.
 - b. CavClear/Archovations Inc.; CavClear Masonry Mat.
 - c. Hohmann & Barnard, Inc.; Mortar Web.
 - d. Keene Building Products; Driwall Mortar Deflection.
 - e. Mortar Net Solutions; MortarNet.
 - f. Wire-Bond; Cavity Net.
 - 2. Configuration: Provide one of the following:
 - a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
 - b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
 - c. Provide thinner strips where required at reduced cavity widths and no thicker than cavity width less 1/4 inch.
- F. Adhesive Anchor: Injectable, two-component epoxy adhesive, complying with ICC-ES AC308 for use in cracked concrete, for installation of reinforcing steel dowels into concrete, ONLY when doweling into footing was not completed per plan or misaligned.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. DeWalt "PURE110+".
 - b. Hilti, Inc. "HIT-RE 500-V3".
 - c. ITW Red Head "G5+ High Strength Epoxy".
 - d. Simpson Strong-Tie Company Inc.; "SET-3G".

2.13 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.14 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. DuPont de Nemours, Inc.
 - c. Kingspan Insulation LLC.
 - d. Owens Corning.

- B. Extruded Polystyrene Board Insulation, Type IV (noted as 'perimeter foundation insulation' on Drawings): ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced. Maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E84.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 2. Verify that foundations are within tolerances specified.
 3. Verify that reinforcing dowels are properly placed.
 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build singlewythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
 1. Exterior Veneer: Standard running bond for modular-sized units.
 2. Interior CMU: Standard running bond.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
 1. Maintain a one-inch joint between partition and penetrating structural framing. Install compressible filler in joint between top of partition and underside of structure above.
 2. Laterally brace partitions with brake-formed metal angles as detailed.
 3. At fire-rated and smoke rated partitions, treat joint between top of partition and underside of structure above and between partitions and penetrating structural framing to comply with Drawings.
- J. Grout solid all cores of CMU below floor line, and grout solid all collar joints in CMU work below floor line, whether or not indicated on drawings.

- K. Ease the exterior corners of all square-edged CMU walls and partitions in occupied rooms and corridors, by rubbing with an abrasive stone, removing sharp corners and providing an approximate 1/4-inch radius.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry and veneer units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush where indicated to cavity wall insulation unless otherwise indicated.

3.6 COMPOSITE MASONRY

- A. Bond wythes of composite masonry together as follows:
1. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
- B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.
1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.
- C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:
1. Provide individual wire mesh ties not more than 16 inches o.c. as detailed on Drawings.

3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to CFMF wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
 2. Embed tie sections in masonry joints.
 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 16 inches vertically, around perimeter.
- B. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at corners by using prefabricated L-shaped units.

D. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL

- A. Anchor masonry to structural steel, where masonry abuts or faces structural steel, to comply with the following:
1. Provide an open space not less than 1 inch wide between masonry and structural steel unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 2. Anchor masonry to each face of structural members.
 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 24 inches o.c. horizontally, whether or not indicated on Drawings.

3.10 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
1. Install preformed control-joint gaskets designed to fit standard sash block.
 2. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
 3. Install sealant and backer rod, specified in Section 07 92 00 "Joint Sealants", at interior face of cavity wall CMU wythe full height from floor slab to underside of deck above, including above-ceiling portions of joints and joints concealed in pipe chases or similar inaccessible spaces.
- C. Form expansion joints in brick as follows:
1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

3.11 LINTELS

- A. Install steel lintels where indicated.
- B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- C. Where lintels occur at masonry control joints, place bond breaker at bearing; hold back bond breaker 1/2-inch from opening and face of wall. Rake out mortar at lintel 1/2 inch for joint sealant application.
- D. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on bed of sealant and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. Allow no penetrations through flashings. Coordinate in advance with all trades to ensure placement of all wall-penetrating work to be above or below flashings. Do not flash and/or seal around such items if discovered when installing flashings; notify Architect and have such work relocated.
 3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches. Where applicable, tuck under water-resistive barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing to sheathing through termination bar.
 4. At lintels, extend flashing full length of lintel bearing into masonry at ends and turn up not less than 2 inches to form end dams.
 5. At sills, where skyward facing joints between units are exposed, install flashing one course below sill and extend through outer wythe, across air space behind veneer, and up face of backup wythe at least 8 inches. Fasten upper edge of flashing to backup wythe through termination bar.
 6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
 7. Special condition for flashing of walls above adjacent roof, roof edges and parapets:
 - a. Extend all through-wall flashings located above roof lines at least 6-inches beyond the roof edge and not less distance than the projection of roof edge metal trim, fascia, coping, or gutter.
 - b. Overlap flashing steps 6-inches minimum.
 - c. Do not terminate through wall flashings or provide a flashing step at inside or outside wall corners; wrap around corners at least 6-inches.
 - d. At abutting parapet walls, step through-wall flashings around and above parapet in a manner that enables proper roof membrane flashing and termination.
- C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
 2. Space weep holes 24 inches o.c. at modular-sized units.
 3. Provide a minimum of two weeps above openings.
- D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- E. Install cavity vents in head joints in exterior wythes at spacing to match weeps. Use specified weep/cavity vent products to form cavity vents.

3.13 REINFORCED UNIT MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
 3. Above windows and doors, limit deflection of formwork and shores to 1/16-inch.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
 2. Limit height of vertical grout pours to not more than 56 inches.

3.14 INSULATION INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.15 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.16 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.17 FIELD QUALITY CONTROL

- A. **Contractor's Performance Testing:** Water-test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe or capping wall.
 - 1. Perform tests in presence of Owners Agent, Architect, and testing agency representative. Representative of general contractor and masonry contractor must be in attendance and perform the test. Provide at least 7 days advance notice of time a scheduled test will be performed.
 - 2. Perform tests at locations selected by the Architect. At least three tests will be required. At least one test will be at an above-roof location. Architect may require an additional unscheduled next-day test at any time, after flashing is placed and veneer above flashing is just starting; regardless of unanticipated interruption of veneer work, comply with test procedures.
 - 3. Test Procedures:
 - a. Extend veneer wythe 8-inches minimum and 12-inch maximum, above flashing to perform test.
 - b. Hold water hose and continuously discharge at standard water pressure force into the cavity at a weep vent so that water can be observed discharging from adjacent weeps for a period of five minutes minimum.
 - c. Continue down the wall to the next cell vent where water has not been observed discharging and repeat the test for the same time period.
 - d. Continue repeating this process until entire flashing length has been tested and passed.
 - e. Photo-document the testing in compliance with Section 01 32 33 "Photographic Documentation". Permit and assist other test observers to photograph test.
 - f. Water observed inside the building, or water outside the building at locations other than at weeps will constitute a test failure.
 - 4. In event of test failure, remove the masonry veneer down to the flashing, inspect and repair or replace the flashing, relay veneer to required test-height and re-perform the water test.
 - 5. Failure of one test location will mandate higher frequency and number of tests to be performed at no additional cost to Owner or others.
- B. **Owner's Testing and Inspecting:** Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- C. Inspections: Level 1 special inspections according to the "Ohio Building Code."
 - 1. Payment for these services will be made by **Owner**.
 - 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

3.18 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 - 3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 - 4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 - 5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
 - 6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.19 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 071100 - DAMPPROOFING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Cold-applied asphalt, emulsified dampproofing.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting Attendees and Procedures:
 - 1. Conduct meeting one month, minimum, before starting Work of this Section.

1.3 ACTION SUBMITTALS

- A. Product Data.

1.4 FIELD CONDITIONS

- A. Ambient Conditions: Perform work within following limitations:
 - 1. Temperature: Do not apply membrane when air or surface temperatures are below 40 degrees F.
 - 2. Precipitation: None occurring and none predicted within 24 hours.
 - 3. Provide adequate ventilation to enclosed spaces during application and after dampproofing has cured.

PART 2 PRODUCTS

2.1 COLD-APPLIED ASPHALT, EMULSIFIED DAMPPROOFING

- A. Manufacturers:
 - 1. BASF.
 - 2. Henry.
 - 3. Karnak.
 - 4. W.R. Meadows.
- B. Application:
 - 1. Trowel Coats: Type II, Class 1; ASTM D1227.
 - 2. Spray and Fibered Brush Coats: Type II, Class 1; ASTM D1227.

2.2 ACCESSORY MATERIALS

- A. Emulsified-Asphalt Primer: Type III, Class 1; ASTM D1227.
- B. Asphalt-Coated Glass Fabric: Type 1; ASTM D1668.
- C. Patching Compound: As recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine substrates for compliance with requirements for installation of dampproofing.
- B. Test for surface moisture per ASTM D4263.

3.2 PREPARATION

- A. Protect adjacent surfaces.
- B. Clean substrates of projections and substances, fill voids, seal joints, and remove bond breakers.

3.3 INSTALLATION OF DAMPPROOFING

- A. Install in accordance with dampproofing manufacturer instructions.
- B. Install dampproofing to uniform thickness and uninterrupted coverage of substrate.
- C. Install flashings and corner protection stripping at change of plane, construction joints, corners, and per Drawings.
- D. Extend dampproofing onto adjacent surfaces as recommended by manufacturer.

3.4 PROTECTION

- A. Protect insulation panels from UV, weather, and physical damage with temporary covering.
- B. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 071100

SECTION 22 10 17 – NATURAL GAS PIPING

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. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.
 - 4. Valves.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
 - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 7 inches water column.

1.4 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pipe and fittings inside the building.
- B. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- B. Conform to National Fuel Gas Code, ANSI B31, NFPA 54, state and local gas codes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes 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.

- B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- C. Protect stored PE pipes and valves from direct sunlight.

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Mechanical Couplings:
 - a. Stainless-steel flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. Stainless-steel bolts, washers, and nuts.
 - d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.3 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: 125 psig.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
 - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: 125 psig.
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BrassCraft Manufacturing Company; a Masco company.
 - b. Conbraco Industries, Inc.; Apollo Div.
 - c. Lyall, R. W. & Company, Inc.
 - d. McDonald, A. Y. Mfg. Co.
 - e. Perfection Corporation; a subsidiary of American Meter Company.
 - 2. Body: Bronze, complying with ASTM B 584.
 - 3. Ball: Chrome-plated bronze.
 - 4. Stem: Bronze; blowout proof.
 - 5. Seats: Reinforced TFE; blowout proof.
 - 6. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flowserve.
 - b. Homestead Valve; a division of Olson Technologies, Inc.

- c. McDonald, A. Y. Mfg. Co.
 - d. Milliken Valve Company.
 - e. Mueller Co.; Gas Products Div.
 - f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
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- 2. Body: Cast iron, complying with ASTM A 126, Class B.
 - 3. Plug: Bronze or nickel-plated cast iron.
 - 4. Seat: Coated with thermoplastic.
 - 5. Stem Seal: Compatible with natural gas.
 - 6. Operator: Square head or lug type with tamperproof feature where indicated.
 - 7. Pressure Class: 125 psig.
 - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

- A. Comply with International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 24 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
 - 3. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.
- F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
- G. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.2 INDOOR PIPING INSTALLATION

- A. Comply with International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install escutcheons at penetrations of interior walls, ceilings, and floors.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- M. Verify final equipment locations for roughing-in.
- N. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- O. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- P. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- Q. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

- a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.
- R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- S. Connect branch piping from top or side of horizontal piping.
- T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- U. Do not use natural-gas piping as grounding electrode.
- V. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

3.3 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. 1/2" and Smaller: 6 feet with 3/8-inch rod.
 - 2. 3/4" to 1": 8 feet with 3/8-inch rod.
 - 3. NPS 1-1/4" and larger: 10 feet with 1/2-inch rod.
- E. Install supports for vertical steel pipe at every floor level.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.6 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.7 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting exterior natural-gas piping.
- B. Paint exposed, exterior metal piping and valves.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel (gloss).
 - d. Color: Gray.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections. Contact the local utility, the owner and the authority having jurisdiction 48 hours prior to test so it can be witnessed.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping 2" and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping 2-1/2" and larger shall be the following:
 - 1. Steel pipe with wrought-steel fittings and welded joints.

3.10 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller shall be one of the following:
 - 1. Two-piece, full-port, bronze ball valves with bronze trim.
 - 2. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger shall be the following:
 - 1. Cast-iron, lubricated plug valve.

- C. Valves in branch piping for single appliance shall be the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
 2. Bronze plug valve.

END OF SECTION 22 10 17

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Product Data: For pipe, tube, fittings and couplings.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Piping applications" Article for application of pipe, tube, fitting and joining material.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Gaskets: ASTM C 564, rubber.

2.3 Hubless Cast-Iron Pipe and Fittings:

- A. Pipe and Fittings: Manufactured from gray cast iron and shall conform to ASTM A 888 and CISPI Standard 301. All pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.
- B. Shielded Couplings: ASTM C 1540 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - 1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - a. Manufacturers
 - 1) ANACO.
 - 2) Ideal Tridon Group.
 - 3) Proflo.
 - 4) Mission Rubber Co.

2.4 Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

- A. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

2.5 Solid-Wall PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.

- A. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
 - 1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
 - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
 - 2. Copper DWV tube, copper drainage fittings, and soldered joints.
 - 3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Underground, soil, waste, and vent piping 6" and smaller shall be any of the following:
 - 1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - a. **NOTE:** PVC is not acceptable for underground piping in the kitchen which receives discharge from 140° F fixtures.

3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. 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. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

- K. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- L. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- M. Terminate vent piping through the roof, a minimum of 12 inches above the roof.
- N. Locations of vents on roof shall be a minimum of 10 feet from any, wall louver outdoor air intake or HVAC rooftop equipment outdoor air intake.

3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 - 2. NPS 3: 60 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 - 4. NPS 6: 60 inches with 3/4-inch rod.
 - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6: 48 inches with 3/4-inch rod.
- H. Install supports for vertical PVC piping every 48 inches.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 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 drainage and vent piping according to 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. 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. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. 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.

3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses. This applies to new pipe installation only.
- B. Protect drains 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.

3.10 PROTECTION

- A. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 13 16

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduit and tubing.
2. Nonmetallic conduit and tubing.
3. Fittings for conduit, tubing, and cable.
4. Electrically conductive corrosion-resistant compounds for threaded conduit.
5. Solvent cements.
6. Metallic outlet boxes, device boxes, rings, and covers.
7. Nonmetallic outlet boxes, device boxes, rings, and covers.
8. Junction boxes and pull boxes.
9. Cover plates for device boxes.
10. Hoods for outlet boxes.
11. Surface metal raceways and fittings.
12. Strut-type channel raceways and fittings.
13. Wireways and auxiliary gutters.
14. Floor service assemblies.
15. Handholes and boxes for exterior underground wiring.
16. Utility structure accessories.

B. Products Installed, but Not Furnished, under This Section:

1. See Section 260553 "Identification for Electrical Systems" for electrical equipment labels.

C. Related Requirements:

1. Section 260010 "Supplemental Requirements for Electrical" for additional abbreviations, definitions, submittals, qualifications, testing agencies, and other Project requirements applicable to Work specified in this Section.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings:

1. Shop drawings for floor boxes.
2. Electric Utility Duct Banks and Structures:

- a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Indicate locations of private property boundaries and utility easements.
 - c. Include information required for approval by electric utility and for obtaining public space utility work permits.
- 3. Precast or Factory-Fabricated Concrete Structures:
 - a. Include plans, elevations, sections, and details, including attachments to other Work.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include reinforcement details.
 - d. Include frame and cover design and manhole chimneys.
 - e. Include ladder details.
 - f. Include grounding details.
 - g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, sumps, and other accessories.
 - h. Include joint details.
- 4. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include cover design.
 - d. Include grounding details.
 - e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and other accessories.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- B. Comply with NFPA 70.
- C. Comply with NECA 1.
- D. Comply with ANSI C2.
- E. Comply with IEEE C2.

1.4 COORDINATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in field. Notify Architect if there is conflict between areas of excavation and existing structures or archaeological sites to remain.

- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain in accordance with Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication in accordance with Section 311000 "Site Clearing."

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Metal Conduit (RMC): ANSI C80.1.
- B. Intermediate Metal Conduit (IMC): ANSI C80.6.
- C. Electrical Metallic Tubing (EMT): ANSI C80.3.
- D. Flexible Metal Conduit (FMC): Zinc-coated steel.
- E. Liquidtight Flexible Metal Conduit (LFMC): Flexible steel conduit with PVC jacket. UL 360.
- F. Fittings: NEMA FB 1, compatible with conduit/tubing used.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT:
 - a. Type: Set Screw – indoors; compression - outdoors.
 - b. Material: Steel
 - 3. Fittings for MC Cable:
 - a. Type: Clamp Screw.
 - b. Material: Steel.
 - c. Clip- and Snap-Style connectors are not acceptable.
- G. Joint Compound for IMC or RMC Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Type EPC-40-PVC, UL 651.
- B. Fittings: Compatible with conduit/tubing used by same manufacturer as the conduit.
 - 1. RNC: NEMA TC 3 and UL 514B.

2.3 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Sheet Metal Boxes: NEMA OS 1.

C. Cast-Metal Boxes: NEMA FB 1, Type FS or FD, with threaded hubs and gasketed cover.

D. Nonmetallic Boxes: NEMA OS 2.

2.4 JUNCTION AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Sheet Metal Boxes: NEMA OS 1.

C. Cast-Metal Boxes: NEMA FB 1, Type FS with threaded hubs and gasketed cover.

2.5 CONDUIT BODIES

A. Conduit Bodies: UL 514B, with threaded hubs and gasketed cover.

2.6 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: Continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, manufacturer's standard finish.
2. Nonmetallic Enclosures: Plastic.

B. Cabinets: Galvanized-steel box with removable interior panel and removable front, with manufacturer's standard finish.

1. Hinged door in front cover with flush latch and concealed hinge.
2. Key latch to match panelboards.
3. Metal barriers to separate wiring of different systems and voltage.
4. Accessory feet where required for freestanding equipment.

2.7 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Options:
 - a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.

2.8 RACEWAY SLEEVES

- A. Steel Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: 24-gage galvanized sheet steel of length to suit application.

2.9 SURFACE RACEWAYS AND FITTINGS

- A. Performance Criteria:
 1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
- B. Surface Metallic Raceways
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Wiremold
 - b. Hubbell Wiring Device-Kellems.
 - c. Mono-Systems.
 - d. Thomas & Betts Corporation.
 2. Standard Features:
 - a. Galvanized Steel base with snap-on covers.
 - b. Prime coated, ready for field painting.
 - c. Wiring Channels: Single.
 - d. Provide fittings as required for complete operational system.

2.10 METAL WIREWAYS & AUXILIARY GUTTERS

- A. Description: Sheet metal sized and shaped as required, hinged or screw cover type, NEMA rating shall be suitable for location and environment, manufacturer's standard finish. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings as required for complete system.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

- C. Wireway Covers: Screw-cover type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.11 FLOOR SERVICE ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiremold Evolution Series.
 - 2. Wiremold CRFB
 - 3. Hubbell SystemOne Recessed.
 - 4. Engineer approved equals.
- B. Floor Box Assemblies:
 - 1. Material: Sheet metal, 11 gauge.
 - 2. Flange Requirements: Refer to Drawings
 - 3. Provide pour pan accessory for on grade installations.
 - 4. Shape: Rectangular.
 - 5. Service Outlet Assembly: Refer to Drawings
 - 6. Comply with UL 514 scrub water exclusion requirements.
 - 7. Comply with UL 514A.

2.12 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND RACEWAYS

- A. Description: Comply with SCTE 77, for flush burial and have integral open bottom. Weatherproof cover, secured by tamper-resistant locking devices, rated for structural load consistent with enclosure, nonskid finish with minimum coefficient of friction of 0.50. Conduit-terminating fittings shall mate with entering raceways for secure, fixed installation in enclosure wall. Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armorcast Products.
 - b. Hubbell-Quazite.
 - c. NewBasis.
 - d. Highline Products.
 - 2. Structural Load Ratings and Materials:
 - a. Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer-concrete, Tier 15.
 - b. Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete, Tier 8.
 - c. Light-Duty Pedestrian Traffic Only: HDPE plastic, 3000-lbf vertical loading.
 - 3. Color: Gray where located within pavement, Green where located within landscaping or grass.

4. Cover Legend: Molded lettering, as indicated for each service.

2.13 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

2.14 DUCT SEALING

- A. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Compound must be capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals. Duct sealing compound must be removable without damaging ducts or cables.
- B. Inflatable Duct-Sealing System: Wraparound inflatable bladder that seals ducts that are empty or containing conductors against air and water infiltration. System is suitable for use in steel, plastic, or concrete ducts and penetrations.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation.
 1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 1. Minimum conduit/duct size for underground installations shall be 1 inch.
 2. Exposed and Subject to Physical Damage: IMC or RMC.
 3. Exposed and Not Subject to Physical Damage: IMC, RMC, or RNC.
 4. Concealed Aboveground: IMC, RMC, or RNC.
 5. Direct Buried: RNC, PVC-40.
 6. Concrete Encased Not in Trench: RNC, PVC-40.
 7. Concrete Encased in Trench: RNC, PVC-40.

8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
9. Underground for utility primaries: Confirm with utility provider. Basis of Design: PVC 40

C. Indoors:

1. Hazardous Classified Locations: IMC.
2. Exposed and Subject to Severe Physical Damage: RMC. Locations include the following:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
3. Exposed and Subject to Physical Damage: EMT. Locations include the following:
 - a. Locations less than 2.5 m (8 ft) above finished floor.
 - b. Stub-ups to above suspended ceilings.
4. Exposed and Not Subject to Physical Damage:
 - a. Unfinished Spaces (shall include mechanical, technology, and electrical rooms): EMT
 - b. Finished Spaces (all other spaces): Surface Raceway
5. Concealed in Metal Stud Interior Walls and Partitions: EMT or MC Cable.
6. Concealed Buried in Block Walls: EMT.
7. Concealed Above Suspended Ceilings: EMT. Unless noted otherwise. Locations include the following:
 - a. Branch circuit wiring from light fixture to light fixture: MC Cable
8. Damp or Wet Locations: IMC, RMC.
9. In concrete slabs: PVC-40
10. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
11. Fire Alarm Power and Control Wiring: EMT.

D. Minimum Raceway Sizes:

1. 3/4-inch
2. 1-inch for exterior applications.
3. 1-inch when embedded in slab.

E. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. RMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.3 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations Exposed to Hosedown: Type 4.
 - c. Locations Subject to Potential Flooding: Type 6P.
 - d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
 - e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - 2. Indoors:
 - a. Type 1 unless otherwise indicated.
 - b. Damp or Dusty Locations: Type 12.
 - c. Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 4X.
 - d. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4.
 - e. Locations Exposed to Hosedown: Type 4.
 - f. Locations Exposed to Prolonged Submersion: Type 6P.
 - g. Locations Exposed to Corrosive Agents: Type 4X.
 - h. Locations Exposed to Spraying Oil or Coolants: Type 13.

3.4 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Comply with NFPA 70 and NECA for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Install raceways, boxes, enclosures, and cabinets to form a continuous electrical conductor.
- D. Do not install raceways under slab or embed within the slab, unless otherwise indicated on Drawings.
- E. Complete duct raceway installation before starting conductor installation.
- F. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor. Protect stub-ups from finished floors from damage.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

- H. Install no more than equivalent of three 90-degree bends in conduit run except for control wiring conduits, for which no more than equivalent of two 90-degree fewer bends are permitted. Support within 12 inch of changes in direction.
- I. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
- J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inch of enclosures to which attached.
- L. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
- M. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service duct raceway enters a building or structure.
 - 3. Conduit extending from interior to exterior of building.
 - 4. Where otherwise required by NFPA 70.
- N. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
- O. Keep duct raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
- P. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
- Q. All suspension systems must be hung independently from structure and not from other systems including their suspension systems.
- R. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.
- S. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
 - 1. Termination fittings with shoulders do not require two locknuts.
- T. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and

insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

U. Separate Raceway Systems: Provide separate raceways for the following:

1. Emergency circuits.
2. Conductors operating at different voltages
3. AC and DC/analog control wiring

3.5 Type IMC:

- A. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

3.6 Types FMC and LFMC:

- A. Provide a maximum of 36 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

3.7 Expansion-Joint Fittings:

- A. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F (17 deg C) and that have straight-run length that exceeds 25 ft (7.6 m).
- B. Install expansion fittings at locations where conduits cross building or structure expansion joints.
- C. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
1. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 2. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 3. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
- D. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

3.8 INSTALLATION OF DUCTS AND DUCT BANKS

- A. Where indicated on Drawings, install duct, spacers, and accessories into duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Steel raceway, bends, and fittings in single duct run or duct bank must be of same type.

- C. Slope: Pitch duct minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope duct from high point between two handholes to drain in both directions.
- D. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor. Provide adapters for change in raceway material as required.
- E. For stub-ups at equipment, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation.
- F. Curves and Bends:
 - 1. Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with minimum radius of 48 inches (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.
 - 2. Field bending must be in accordance with NFPA 70 minimum radii requirements, except bends over 45 degrees must be made with minimum radius of 48 inches (1200 mm). Use only equipment specifically designed for material and size involved. Use PVC heating bender for bending PVC conduit.
- G. Joints: Use solvent-cemented joints in nonmetallic duct and fittings and make watertight in accordance with manufacturer's published instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
 - 1. Install insulated grounding bushings on steel raceway terminations that are less than 12 inches (300 mm) below grade or floor level and do not terminate in hubs.
- H. Building Wall Penetrations: Make transition from underground duct to steel raceway at least 10 ft (3 m) outside building wall, without reducing duct line slope away from building and without forming trap in line. Use fittings manufactured for transition to steel raceway type installed. Install steel raceway penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- I. Install manufactured steel raceway elbows for stub-ups at poles unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
- J. Concrete-Encased Ducts and Duct Bank:
 - 1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes 6 inch (150 mm) or less in nominal diameter.
 - 2. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Concrete Sections.
 - 3. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
 - 4. Depth: Install so top of duct envelope is at least 36 inch (600 mm) below finished grade. Install so top of duct envelope is below local frost line.
 - 5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - 6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 ft (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting.

- Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Minimum Space between Ducts: 3 inches (75 mm) between edge of duct and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and communications ducts.
 8. Maintain minimum distance from underground utility services per respective utility company standards.
 9. Elbows:
 - a. Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 10. Stub-ups to Indoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - a. Stub-ups must terminate in coupling installed flush with finished floor and no less than 3 inches (75 mm) from conduit side to edge of slab.
 11. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
 12. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at other, allowing for expansion and contraction of duct as its temperature changes during and after pour. Use expansion fittings installed in accordance with manufacturer's published instructions, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in vertical plane and install 3/4 inch (15 mm) reinforcing-rod dowels extending minimum of 18 inch (450 mm) into concrete on both sides of joint near corners of envelope.
 14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

K. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 312000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 3 inches (75 mm) wider than duct on each side.
3. Depth: Install top of duct at least 36 inches (900 mm) below finished grade unless otherwise indicated.
4. Set elevation of top of duct bank below frost line.
5. Place minimum 3 inches (75 mm) of sand as bed for duct. Place sand to minimum of 6 inches (150 mm) above top level of duct.
6. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 ft (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 8. Install duct with minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and communications duct. Maintain minimum distance from underground utility services per respective utility company standards.
 9. Elbows: Use manufactured steel elbows for stub-ups, at building entrances, and at changes of direction in duct run.
 10. Stub-ups to Outdoor Equipment: Extend concrete-encased steel raceway horizontally minimum of 60 inches (1500 mm) from edge of equipment base.
 - a. Stub-ups must terminate in coupling installed flush with finished floor and minimum 3 inches (75 mm) from conduit side to edge of slab.
 11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312000 "Earth Moving" for installation of backfill materials.
 12. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 13. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
- L. Underground-Line Warning Tape: Bury conducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide additional warning tape for each 12 inch (300 mm) increment of duct-bank width over nominal 18 inches (450 mm). Space additional tapes 12 inch (300 mm) apart, horizontally across width of ducts.

3.9 EARTHWORK

- A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restoration: Restore area after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Turf and Grasses" and Section 329300 "Plants."

- E. Cut and patch existing pavement in path of underground duct, duct bank, and underground structures in accordance with "Cutting and Patching" Article in Section 017300 "Execution."

3.10 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

- A. Comply with manufacturer's published instructions.
- B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
 - 1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
- C. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- D. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
- E. Recessed Boxes in Masonry Walls: Saw-cut opening for box and install box flush with surface of wall. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
- F. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
- G. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
- H. Do not install boxes back-to-back in walls. Provide minimum 6-inch separation in non-fire-rated walls. Provide minimum 24-inch horizontal separation in acoustic-rated walls.
- I. Locate boxes so that cover or plate will not span different building finishes.
- J. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- K. Support boxes from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose. Boxes connected to one stud are not permitted.
- L. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- M. Set metal floor boxes level and flush with finished floor surface.
- N. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- O. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

Q. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
2. Provide gaskets for wallplates and covers.

3.11 INSTALLATION OF SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

A. Special Installation Techniques:

1. Install surface raceways only where indicated on Drawings.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inch and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's published instructions. Tape and glue are unacceptable support methods.
3. Identification: Provide labels for surface raceways and associated electrical equipment.

3.12 RACEWAY PENETRATIONS

- A. Concrete Slabs and Walls: Install sleeves during erection of slabs and walls, unless core-drilled holes or formed openings are used.
- B. Fire-Rated Assemblies: Install sleeves and seal with firestop for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Cut sleeves to length for mounting flush with both surfaces of walls or extend sleeves installed in floors 2-inches above finished floor level.
1. Products: Cooper B –Line, 3M, Hilti, Specified Technologies, Inc.
- C. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- D. Roof Penetrations: Utilize roof curbs and internal wireways for equipment where available. Provide flexible, boot-type flashing units applied in coordination with roofing work where individual raceways penetrate the roof.
- E. Aboveground, Exterior-Wall Penetrations: Seal penetrations using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

3.13 ENCLOSURE AND CABINET INSTALLATION

- A. Install hinged-cover enclosures and cabinets and rigid without distortion of box. Support at each corner.

3.14 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.15 INTERFACES WITH OTHER WORK:

- 1. Coordinate with Section 078413 "Penetration Firestopping" for installation of firestopping at penetrations of fire-rated floor and wall assemblies.
- 2. Coordinate with Section 260529 "Hangers and Supports for Electrical Systems" for installation of conduit hangers and supports.

3.16 IDENTIFICATION

- A. Where conduit is exposed in public or finished areas, the conduits shall be painted to match the adjacent wall or ceiling color. Associated junction boxes and covers shall be painted inside to match conduit color code below.
- B. Junction boxes of different systems shall be identified by colors indicated below. Box and cover shall be painted prior to attaching identification labels.

	<u>Color</u>	<u>System</u>
1.	Red	Fire Alarm.
2.	Green	Grounding Systems

3.17 CLEANING

- A. Surface Raceways: Clean exposed surfaces as recommended by manufacturer.
- B. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- C. Clean internal surfaces of manholes, including sump. Remove foreign material.

- D. Remove construction dust and debris from boxes before installing wallplates, covers, and hoods.
- E. Remove construction dust and debris from surface raceways before installing covers.

3.18 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide minimum 12 inch (300 mm) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Field Quality-Control Reports: Collect, assemble, and submit test and inspection reports.

3.19 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.
- B. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.
- C. After installation, protect surface raceways from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 260533

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees, shrubs, groundcovers, plants, and grass, to remain.
 - 2. Removing existing trees, shrubs, groundcovers, plants, and grass as indicated on drawings.
 - 3. Clearing and grubbing.
 - 4. Removing above- and below-grade site improvements.
 - 5. Disconnecting, capping or sealing, and removing site utilities.
 - 6. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

- A. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT 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 traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. 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 requirements of authorities having jurisdiction and in accordance with sediment and erosion control Drawings.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.
 - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.

3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. 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 Construction Manager not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Construction Manager's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.

2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Grind stumps and remove roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.

4. Use only hand methods for grubbing within tree protection zone.

5. 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.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as 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 length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.7 DISPOSAL

- A. Disposal: 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.

END OF SECTION 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Aggregate base course for asphalt paving.
6. Excavating and backfilling for utility trenches and pits for buried utility structures.

B. Related Requirements:

1. Section 003132 "Geotechnical Report" for subsurface investigation report information.
2. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

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.

G. Fill: Soil materials used to raise existing grades.

H. 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.

- I. 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.
- J. 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.
- K. 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 GEOTECHNICAL ENGINEERING REPORT

- A. The following report has been completed for this project (see Division 00):
 - 1. Geotechnical Exploration Report for Proposed Addition and Renovation Project Bradford Public Library", prepared by Intertek PSI, dated September 2, 2026.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type product.
 - 1. Geotextile.
 - 2. Controlled low-strength material, including design mixture.

1.6 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.

1.7 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 "Call Before You Dig" 811 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.
- D. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- E. Do not direct vehicle or equipment exhaust towards protection zones.
- F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

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 and satisfactory to the testing agency; 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 and not acceptable to the testing agency.
 - 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; 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 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability:
 - a. As follows:
 - 1) Grab Tensile Strength: 80 lbf; ASTM D4632.
 - 2) Tear Strength: 25 lbf; ASTM D4533.
 - 3) Puncture Strength: 25 lbf; ASTM D4833.
 - b. Apparent Opening Size: ≤0.3mm; ASTM D4751.
 - c. Permittivity: 0.5 per second, minimum; ASTM D4491.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
 - 1. Portland Cement: ASTM C150/C150M, Type I.
 - 2. Fly Ash: ASTM C618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C33/C33M, 3/8-inch nominal maximum aggregate size.
 - 4. Foaming Agent: ASTM C869/C869M.

5. Water: ASTM C94/C94M.
 6. Air-Entraining Admixture: ASTM C260/C260M.
- B. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C495/C495M.

2.4 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 SITE PREPARATION

- #### A.
- Refer to the Geotechnical Exploration Report for site preparation requirements, including removal of high plasticity and “fat” clays, stripping to the proposed subgrade level, proof-rolling of the subgrade, and placement of engineered fill.

3.5 EXCAVATION, GENERAL

- #### A.
- Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.6 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.
2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

- #### B.
- Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

- #### A.
- Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. For sanitary sewer, storm sewer, and water lines, please see the corresponding spec sections. For other site utilities, follow below.
- B. 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.
- C. 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.
- D. Trench Bottoms:
 - 1. Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.
 - a. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- E. Trenches in Tree- and Plant-Protection Zones:
 - 1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

3.9 SUBGRADE INSPECTION

- A. Notify testing agency when excavations have reached required subgrade.
- B. If testing agency determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade Insert locations 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 testing agency, 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 may be used when approved by testing agency.
 - 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by testing agency.

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. For sanitary sewer, storm sewer, and water lines, please see the corresponding spec sections. For other site utility backfill, follow below.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.
- C. 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.
- D. Trenches under Footings: Backfill trenches excavated under footings and within 5 feet on either side of footings with controlled low-strength material (CLSM).
- E. Trenches under Roadways: Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.
- F. Backfill voids with satisfactory soil while removing shoring and bracing.

G. Initial Backfill:

1. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

H. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

- I. 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 or engineered fill.
 2. Under walks and pavements, use satisfactory soil material or engineered fill.
 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 in accordance with the Geotechnical Exploration Report.
 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 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, including 10 feet beyond all such areas, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 100 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 100 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 95 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 100 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 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 1/2 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 SUBSURFACE DRAINAGE

- A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.

3.19 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. Where specified, install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase course and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
 - 5. 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.
 - 6. Compact subbase course and base course to required grades, lines, cross sections, and thickness in accordance with the Geotechnical Exploration Report.
- C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer in accordance with the Geotechnical Exploration Report.

3.20 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 in accordance with the Geotechnical Exploration Report.

3.21 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections. Scheduling of the Geotechnical Testing Agency shall be the responsibility of the Contractor.
- B. 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.

- C. Compaction Testing: 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.
- D. 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.

3.22 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.

3.23 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.
- B. Excavated pavements shall be considered waste material and shall not be incorporated into fills.

END OF SECTION 312000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Hot-mix asphalt patching.
 - 2. Hot-mix asphalt paving.
 - 3. Hot-mix asphalt paving overlay.
 - 4. Asphalt surface treatments.
 - 5. Pavement-marking paint.
 - 6. Wheel Stops.
- B. Related Sections:
 - 1. Division 02 Section "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
 - 2. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
 - 3. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
 - 4. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

- A. Material Certificates: For each paving material, from manufacturer.

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 according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Ohio Department of Transportation for asphalt paving work.

1. Measurement and payment provisions and safety program submittals included in standard DOT specifications do not apply to this section.

D. 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 condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT 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: Comply with weather limitations as per the Ohio Department of Transportation Construction and Material Specifications.
 2. Tack Coat: Comply with weather limitations as per the Ohio Department of Transportation Construction and Material Specifications.
 3. Asphalt Base Course: Comply with weather limitations as per the Ohio Department of Transportation Construction and Material Specifications.
 4. Asphalt Surface Course: Comply with weather limitations as per the Ohio Department of Transportation Construction and Material Specifications.
- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials complying with the Ohio Department of Transportation Construction and Material Specifications as indicated on the plans.

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Use materials complying with the Ohio Department of Transportation Construction and Material Specifications as indicated on the plans.
- B. Asphalt Cement: Use materials complying with the Ohio Department of Transportation Construction and Material Specifications as indicated on the plans.
- C. Prime Coat: Use materials complying with the Ohio Department of Transportation Construction and Material Specifications.
- D. Tack Coat: Use materials complying with the Ohio Department of Transportation Construction and Material Specifications as indicated on the plans.
- E. Water: Potable.

2.3 AUXILIARY MATERIALS

- A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.
- B. Paving Geotextile: As specified on plans.
- C. Joint Sealant: ASTM D 6690 or AASHTO M 324, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- D. Pavement-Marking Paint: ODOT Item 642.
 - 1. Color: White, Yellow, & Blue.
- E. Wheel Stops: Precast, air-entrained concrete, 3500-psi minimum compressive strength, see drawings for dimensions. Provide chamfered corners, drainage slots on underside, and holes for anchoring to substrate.
 - 1. Dowels: 2 - Galvanized steel, minimum 1/2-inch diameter.

2.4 MIXES

- A. Hot-Mix Asphalt: Use plant-mixed, hot-laid asphalt aggregate mixtures complying with the Ohio Department of Transportation Construction and Materials Specifications as indicated on the plans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- 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. Proof rolling to be performed in presence of Architect or Construction Manager.

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, Construction Manager, or Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of asphalt.

3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove all soft or unsatisfactory material. Recompact subgrade and any existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting against new, hot-mix asphalt paving 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.
- C. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/2 inch.
 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

- B. Herbicide Treatment: Apply herbicide according to 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. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. 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 PAVING GEOTEXTILE INSTALLATION

- A. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.
 - 1. Protect paving geotextile from traffic and other damage and place next portion of the pavement section the same day.

3.6 HOT-MIX ASPHALT PLACING

- A. Asphalt shall be placed in accordance with the Ohio Department of Transportation Construction and Material Specifications and as indicated on the plans.
- B. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to 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 in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperatures as per the Ohio Department of Transportation Construction and Material Specifications.
 - 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.
- C. 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. Complete a section of asphalt base course before placing asphalt surface course.
- D. 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.

3.7 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 Per ODOT standards.
 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.

3.8 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 within temperature specifications as set in the Ohio Department of Transportation Construction and Materials Specifications.
- 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: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 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.

3.9 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch (total of all combined base courses).
 - 2. Surface Course: Plus 1/4 inch, no minus.
 - 3. Total Thickness: Where total thickness is of asphalt material is 3" or less, total pavement thickness is to be plus or minus 1/4 inch.
- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base 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.

3.10 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age per manufacturers recommendations 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 per ODOT 642 Specifications to a minimum wet film thickness of 20 mils.

3.11 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels a minimum of 7 inches into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner is to engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

- 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 according to ASTM D 979.
 - 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 according to ASTM D 2041, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- 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.

3.13 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
 - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.4 SUBMITTALS

- A. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- C. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Curing compounds.

4. Applied finish materials.

D. Jointing Plan

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who 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."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications:
 1. Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
 2. Comply with ACI 330, "Guide for Design and Construction of Concrete Parking Lot" unless modified by requirements in the Contract Documents.
 3. Comply with ACI 325, "Design of Jointed Concrete Pavements for Streets and Local Roads" unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
 1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
- C. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I., gray. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 4S coarse aggregate, uniformly graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar pavement applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1 inch nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Provide 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 when steel reinforcement is called out in exterior installations.
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.

2.5 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. Dry, delivered pre-wetted and soaked.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM 1752 Vinyl full depth, with joint sealant.

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
1. Compressive Strength (28 Days): 4,500 psi, unless otherwise indicated on the drawings.
 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 3. Slump Limit: 4 inches, or up to 5 inches with the use of a water-reducing chemical admixture.

- 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: 6 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing 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.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements and as follows:
 - 1. Fly Ash or Pozzolan: 25 percent.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.
 - 1. When air temperature is between 85 deg F 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.

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 pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades
 - 1. Proof rolling to be performed in presence of Architect or Construction Manager.
 - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, Construction Manager, or Geotechnical Engineer, and replace with compacted backfill or fill as directed.
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

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 for pavement 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 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain 2" minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings 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 pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
 - 1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, or through locations of intended contraction or isolation joints, unless otherwise indicated.
 - 2. 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. Dowels to be epoxy coated and sized per ACI 330.
- C. Isolation (expansion) Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of not more than 30 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. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 6. Apply joint sealant / caulk.
 7. 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. Dowels to be epoxy coated and sized per ACI 330.
- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. For thickness 5 inches or less construct contraction joints for a depth equal to at least one-third of the concrete thickness, for thickness greater than 5 inches construct contraction joints for a depth equal to at least one-quarter of the concrete thickness, as follows or match jointing of existing adjacent concrete pavement:
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 groover marks on concrete surfaces.
 2. Sawed Joints: (*Not permitted on sidewalks*). 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.
 3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated, or when construction joint will experience heavy truck traffic . Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint. Dowels to be epoxy coated and sized per ACI 330.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- D. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- E. Comply with ACI 301 and ASTM C94, requirements for measuring, mixing, transporting, and placing concrete.
- F. A one time add of water to concrete during delivery or at Project site is permitted but the water to cementitious material ratio must not be violated.
- G. Do not add water to fresh concrete after testing.

- H. 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.
- I. 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, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.
- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- O. 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 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 mix designs.
- P. Hot-Weather 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 to 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.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water 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. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 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 moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 - 1. Moist 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 prior to placement 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. Immediately repair any holes or tears during 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.

3.9 TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 - 1. Elevation: 1/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
4. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
5. Joint Spacing: 3 inches.
6. Contraction Joint Depth: Plus 1/4 inch, no minus.
7. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted 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 mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 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 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.
- 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 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.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 334100 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. Drains, Catch Basins, Inlets, & Headwalls.
 - 3. Precast concrete & Cast-in-place concrete manholes.

1.3 DEFINITIONS

- A. PE: Polyethylene plastic.
- B. PVC: Polyvinyl chloride plastic.
- C. ODOT: Ohio Department of Transportation

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe.
 - 2. Cleanouts.
 - 3. Trench Drains.
- B. Shop Drawings: For the following:
 - 1. Manholes: Include plans, sections, details, and frames and covers.
 - 2. Catch Basins, Headwalls and Stormwater Inlets. Include plans, sections, details, and frames, covers, and grates.
 - 3. Stormwater Detention Structures: Include plans, sections, details, frames, grates, and covers.

- C. Coordination Drawings: Show pipe sizes, and locations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- D. Profile Drawings (as necessary): Show system piping in elevation view. 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 locations of other utilities crossing system piping.

1.6 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 according to manufacturer's written rigging instructions.
- D. Handle catch basins, headwalls, and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage 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 according to requirements indicated:
 - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Construction Manager 's permission.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Public Roadway Culverts: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type A Conduits.
- B. Conduit Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type B Conduits.
- C. Conduit Not Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type C Conduits.
- D. Private Drive Pipes and Bikeways: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type B Conduits.

2.2 ALUMINIZED CORRUGATED METAL PIPE AND FITTINGS

- A. Per the latest version of the ODOT Construction and Material Specifications and as noted on the Drawings.

2.3 PE PIPE AND FITTINGS

- A. Per the latest version of the ODOT Construction and Material Specifications and as noted on the Drawings.

2.4 PVC PIPE AND FITTINGS

- A. Per the latest version of the ODOT Construction and Material Specifications and as noted on the Drawings.
- B. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.
- C. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.5 REINFORCED CONCRETE PIPE AND FITTINGS

- A. Per the latest version of the ODOT Construction and Material Specifications and as noted on the Drawings.

2.6 DUCTILE IRON PIPE

- A. Per ODOT 748.01 conforming to ANSI/AWWA C151/A21.51, service and extra-heavy classes, for gasketed joints.
- B. Gaskets: ANSI/AWWA C111/A21.11, rubber, compression type, thickness to match class of pipe.

2.7 CLEANOUTS

- A. PVC with cast iron adaptor: Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping. Include cast iron adaptor and threaded brass closure plug.

2.8 DRAINS

- A. Yard Drains: As noted on the Drawings.
- B. Trench Drains: As noted on the Drawings.

2.9 MANHOLES

- A. Per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.
 - 1. Diameter: 48 inches minimum, unless otherwise indicated on the drawings.
 - 2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.

3. Riser Sections: 4-inch minimum thickness, and of length 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. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; Ductile Iron; or Cast Aluminum. Steps shall be wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Steps shall be equally spaced. Whenever possible steps shall not be placed directly above manhole flow channel. Omit steps if total depth from floor of manhole to finished grade is less than 48 inches.
5. Manhole Frames and Covers: Include lettering cast into cover, using wording equivalent to "STORM SEWER."
 - a. Frames and Covers must be heavy duty

2.10 CONCRETE

- A. General: Cast-in-place concrete according to the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings

2.11 CATCH BASINS

- A. Per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.
 1. See drawings for schedule of specific types of catch basins
 2. Frames and Grates:
 - a. Are to be heavy duty.
 - b. Are to be ADA compliant.
 - c. Are to be Bicycle safe.

2.12 STORMWATER DETENTION STRUCTURES

- A. As indicated on the Drawings and Per the jurisdiction having authority.

2.13 PIPE INLETS AND OUTLETS

- A. Headwalls: Per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.
- B. Rock Channel Protection (Riprap): Per the latest version of the ODOT Construction and Material Specifications and as indicated on the Drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. General:
 1. Conduit Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type B Conduits.
 2. Conduit Not Under Pavement: Refer to The Ohio Department of Transportation Construction and Material Specifications Item 603.02, Type C Conduits.

- B. Excavation For Utility Trenches:
1. Excavate trenches to indicated slopes, lines, depths, and invert elevations.
 2. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit.
 3. Excavate trench walls per ODOT Item 603.05 and geotechnical report as identified on the Drawings.
 4. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.
- C. Utility Trench Backfill:
1. Place and compact bedding course as required by ODOT specifications Item 603.06 and geotechnical report. Type 2 bedding consists of structural backfill extending at least 3 inches (75 mm) for all ODOT Item 706 rigid pipe conduits and 6 inches (150 mm) for all other conduits below the bottom of the conduit for the full width of the trench. Extend the bedding up around the pipe for a depth of not less than 30 percent of the rise of the conduit. Shape the bedding to fit the conduit with recesses shaped to receive the bell of bell-and-spigot pipe. Leave the bedding below the middle one-third of the pipe span uncompacted. Compact the remaining bedding according to ODOT Item 603.11.
 2. Use Type 2 bedding for Types A, B, C, and D conduits except for long span structures and for conduits that require Type 3 bedding.
 3. Type 3 bedding consists of a natural foundation with recesses shaped to receive the bell of bell-and-spigot pipe. Scarify and loosen the middle one-third of the pipe span.
 4. Use Type 3 bedding for Type C and Type D conduits of the following materials: ODOT Items 706.01, 706.02, or 706.03.
 5. Structural backfill for ODOT Item 603 bedding and backfill shall consist of limestone, gravel, natural sand, sand manufactured from stone, or foundry sand. Provide Type I or Type II structural backfill per the requirements of ODOT Item 703.11
 6. Non-structural backfill should consist of clean, inorganic soil free of any miscellaneous materials, cobbles, and boulders. The fill should be placed in uniform, thin lifts and carefully compacted to a unit dry weight equal to 100 percent in structure areas and at least 98 percent of the maximum dry weight below pavement areas. The moisture content of the fill should be maintained at -2 to +1 percent of the optimum moisture content as determined in the laboratory by the Standard Test Methods for Moisture-Density Relations of Soils (ASTM D 698). Fill should not be placed in a frozen condition or upon a frozen subgrade.
 7. Place backfill to the limits described and according to the compaction requirements of ODOT Item 603.11. Place the backfill in the trench and embankment outside the trench uniformly on both sides of the conduit for all conduit installations.
 - a. Type A and B. Backfill Types A and B conduits except for long span structures as follows
 - 1) In a cut situation, place and compact structural backfill above the bedding for the full depth of the trench. Within the trench and more than 4 feet (1.2 m) above the top of the conduit, if the trench can accommodate compaction equipment, the Contractor may construct Item 203 Embankment. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - 2) In a fill situation, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and to a depth of 2 feet (0.6 m) above the top of the conduit. Construct the embankment outside the limits of the backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
 - b. Type C and D. Backfill Type C and D conduits as follows:
 - 1) In a cut situation, for plastic pipe, place and compact structural backfill above the bedding and to 12 inches (300 mm) over the top of the pipe. All

- other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
- 2) In a fill situation, for plastic pipe, place and compact structural backfill above the bedding for the full depth of the trench specified in 603.05.B. Above these limits, uniformly place the lesser of one pipe span or 4 feet (1.2 m) of structural backfill on each side of the conduit and vertically to the top of the conduit. Then place for a depth of 12 inches (300 mm) structural backfill over the top of the pipe equal to the trench width centered on the pipe center line. Construct the embankment outside the limits of the backfill. All other conduit material types place and compact backfill. For plastic pipe with an ID 8 inch (200 mm) or less, place and compact structural backfill above the bedding for the full depth of the trench.
8. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.
 9. All fill soils shall be placed in accordance with the article "Compaction of Soil Backfills and Fills" from the Earth Moving Specification Section 312000.
 10. Coordinate backfilling with utilities testing.
 11. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.
 12. Place and compact final backfill of satisfactory soil material to final subgrade.

3.2 PIPING INSTALLATION

- A. All installation shall be per the latest version of the ODOT Construction and Material Specifications item 603 and the latest version of the ODOT Standard Construction Drawings.
- B. 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 design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, contact architect.
- C. 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 according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- E. 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.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
 2. Install piping with 12 inches minimum cover, unless otherwise indicated on the drawings. Notify architect if less than 12 inches of cover will exist.
 3. During construction protect installed piping from damage. Maintain manufacturers recommended minimum cover.

3.3 PIPE JOINT CONSTRUCTION

- A. All joint construction shall be per the latest version of the ODOT Construction and Material Specifications item 603 and the latest version of the ODOT Standard Construction Drawings.
- B. Join dissimilar pipe materials with pressure-type couplings, or concrete collar.

3.4 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 - 1. Use medium-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
 - 2. Use heavy-duty, top-loading classification cleanouts in paved foot-traffic, vehicle-traffic, roads, and service areas.
- B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in asphalt or concrete pavement with tops flush with pavement surface.

3.5 DRAIN INSTALLATION

- A. Install type of drains in locations indicated.
 - 1. Use medium-duty, top-loading classification drains in earth or unpaved foot-traffic areas.
 - 2. Use heavy-duty, top-loading classification drains in paved foot-traffic, vehicle-traffic, roads, and service areas.
- B. Install per manufacturer's written recommendations.

3.6 MANHOLE INSTALLATION

- A. General: Installation shall be per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.
- B. 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.

3.7 CATCH BASIN INSTALLATION

- A. General: Installation shall be per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.
- B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

- A. General: Installation of Headwalls and Rock Channel Protection shall be per the latest version of the ODOT Construction and Material Specifications and the latest version of the ODOT Standard Construction Drawings.

3.9 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.10 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

3.11 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. 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. Crushed, broken, cracked, or otherwise damaged piping.
 - 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 - 3. 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 according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
- C. Replace defective piping using new materials, and repeat testing until defect is within allowances specified.

3.12 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION 334100