

# TECHNICAL SPECIFICATIONS

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## SECTION 01 00 00 – SPECIFICATION FORMAT

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

- A. The purpose of this section is to describe the format in which the Specifications are presented.

#### 1.02 GENERAL FORMAT

- A. The Specifications are presented generally in accordance with the Construction Specifications Institute MasterFormat®.
- B. Most technical and construction related requirements are specified in sections which are grouped by the Construction Specifications Institute major divisions according to trade or type of Work. All major divisions may not be used in this Contract.
- C. Sections are arranged in numerical order, however, section numbers may not be consecutive. Page numbering is subordinate to each section.
- D. Most sections are generally presented in three parts:

PART 1 – GENERAL

PART 2 – PRODUCTS

PART 3 – EXECUTION

All three parts may not be used in all sections and in some cases the title of some parts is other than the three standard titles given above.

- E. Paragraph designations are subordinate to each part.
- F. The format described herein above is general and flexible in nature. There may be overlapping information between various parts of the Specifications. In all cases, the entire requirements of the Contract Documents as a whole shall be apply.

#### 1.03 EXPLANATIONS

- A. Descriptions: Many sections begin with a paragraph entitled “Scope of Work” or similar wording. In such paragraphs, a brief description of the Work generally specified in that Section is presented. These descriptions shall not be construed to be all inclusive and are presented for the purpose of aiding in the location of subject matter in the Specifications.
- B. Related Work Specified Elsewhere: Some sections include a paragraph which lists some of the related Work specified elsewhere in the Contract Documents. Such listings are presented

SECTION 01 00 00 – SPECIFICATION FORMAT

as an aid to the Contractor in locating some of the other Specification sections wherein Work is specified that has a close relationship to the Work specified in that section.

1.04 STANDARD SPECIFICATIONS

- A. The Contractor’s attention is directed to the use of the State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction Form 816, 2004, latest revision and all supplements thereto in the Specifications for this Project.
- B. Only those portions of the Standard Specifications that are referred to in Division II Construction Details and Division III Materials Section shall apply to the Specifications for this Project.
- C. Within the above referenced portions of the Standard Specifications, wherein the following terms are used, they shall mean respectively:

- Owner: Town of Madison, Connecticut
- Engineer: The Town Engineer of the Town of Madison, Connecticut or his agent(s)
- Inspector: Inspector designated by the Owner
- Laboratory: Laboratory designated by the Owner

PART 2 - PRODUCTS

NONE

PART 3 - EXECUTION

NONE

END OF SECTION

## SECTION 01 11 00 – SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.01 SECTION INCLUDES

- A. Work in general.
- B. Work by others.
- C. Contractors use of site.
- D. Owner occupancy.

#### 1.02 WORK IN GENERAL

- A. The Work to be performed consists generally of maintenance and protection of traffic, erosion and sediment control, demolition, utility, storm drainage, irrigation, curbing, sidewalk, crosswalk, median, street lighting, landscape, signage and pavement markings construction. The foregoing is a general description only, and shall not be construed as a complete description of the Work to be performed for the Project.

#### 1.03 WORK BY OTHERS

- A. The Owner may perform such Work as may be shown on the Drawings.

#### 1.04 CONTRACTORS USE OF SITE

- A. Utility interruptions must receive prior written authorization from the respective utility company (ies).
- B. Staging and laydown areas shall be arranged by the Contractor with the approval of the Engineer.

#### 1.05 OWNER OCCUPANCY

- A. The Owner may occupy all or a portion of the site during the progress of the Work.
- B. Cooperate with Owner to minimize conflict and to facilitate owners operations.

### PART 2 - PRODUCTS

NONE

SECTION 01 11 00 – SUMMARY OF WORK

PART 3 - EXECUTION

NONE

END OF SECTION

## SECTION 01 55 26 – MAINTENANCE AND PROTECTION OF TRAFFIC

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this section of the Specifications shall consist of providing, erecting, moving, re-erecting, and maintaining signs and barricades, and adequately safeguarding, protecting, maintaining, and directing vehicular and pedestrian traffic in the Project area for the full length of the Project in accordance with the requirements and regulations of local regulatory authorities and these Specifications.
- B. The Contractor shall maintain and protect the vehicular and pedestrian traffic while construction is underway and shall provide a sufficient number of travel lanes and pedestrian passways to move the traffic ordinarily using the traveled ways. The Contractor shall provide sufficient flag persons to ensure the smooth flow of traffic.
- C. It shall be the sole responsibility of the Contractor to contact the local regulatory authorities at least seventy-two (72) hours in advance of changes in traffic patterns due to proposed construction operations.
- D. The Contractor shall observe and obey all local and State laws, ordinances, regulations, and permits in relation to the obstruction of streets and highways, keeping pedestrian passways open and protecting traffic when there may be danger from construction operations.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

NONE

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Signs, barricades, warning lights and other devices shall be in good working condition and of sufficient size and standard colorization so as to adequately inform the public of possible traffic hazards or unusual conditions within the Project area.
- B. All signs, barricades, warning lights and other devices shall be approved by the local regulatory authorities having jurisdiction over the Project.

## SECTION 01 55 26 – MAINTENANCE AND PROTECTION OF TRAFFIC

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. Travel lanes and pedestrian passways shall be drained and kept reasonably smooth and in suitable condition at all times in order to provide minimum interference to public traffic consistent with the proper prosecution of the Work.
- B. Suitable ingress and egress shall be provided at all times where required, for all intersecting roads, and all abutting properties.
- C. The Contractor shall erect, maintain, keep legible, move, adjust, repair, relocate, re-erect, and store all temporary construction signs, sign mountings, portable barricades, barriers, traffic cones, delineators, and other warning devices as directed by the Engineer.
- D. Where barricades are permitted to remain on the street, the Contractor shall provide precautionary items such as lanterns and/or flashers, which will be in operation during all hours between sunset and sunrise, and during periods of low visibility.
- E. The Contractor shall keep all signs, barricades, and other protective devices in proper position, clean and legible at all times. Care shall be taken so that weeds, shrubbery, construction materials and equipment and spoil materials are not allowed to obscure any sign, light, or barricade. Signs that do not apply to existing conditions shall be promptly removed or adjusted so that the legend is not visible to approaching traffic. All signs and markers shall indicate actual conditions existing and shall be moved, removed, or changed immediately, as conditions require. When construction is not in progress, all unnecessary signs shall be adequately covered.
- F. The Contractor shall be responsible for maintaining all necessary traffic control devices on a 24-hour per day basis. The Contractor shall supply the Engineer, with a telephone number for round-the-clock maintenance of these control devices.
- G. When so directed by the Engineer, the Contractor shall remove or sand snow and ice on temporary, new, and existing sidewalks, within the limits of the project. If the Contractor's operations interfere with the removal or sanding of snow or ice by the State or local regulatory agency or adjoining property owners, in an ordinary manner with normal equipment, the Contractor shall be required to perform such services for the public authorities and/or adjoining property owners without charge. If the Contractor fails to do so, he shall reimburse said authorities or adjoining property owners or the Owner for any additional cost to them for doing such work occasioned by conditions arising from the Contractor's operations.
- H. Detours shall be provided wherever stoppage of traffic for a period in excess of five (5) minutes will occur, but then only with the approval of the Engineer. In the event that temporary detours become necessary, the Contractor shall submit a written request for

SECTION 01 55 26 – MAINTENANCE AND PROTECTION OF TRAFFIC  
approval and a detour route plan to the applicable State and/or local regulatory authority at least five (5) days in advance.

### 3.02 TRAFFIC POLICE AND FLAGPERSONS

- A. Whenever and wherever, in the opinion of the Engineer, traffic is sufficiently congested or public safety is endangered, the Contractor, as required, shall furnish uniformed police officers to direct traffic and to keep traffic away from the area affected by his construction operations.
- B. Where such conditions exist at the close of the working day, such watchpersons and/or flag persons and/or police officers shall be provided at the Contractor's sole expense, to direct traffic at night. The Work must be planned to avoid such situations, whenever possible.
- C. Where uniformed police officers are not required by the Engineer, the Contractor shall provide sufficient flag persons to ensure smooth flow of traffic on all streets. The Contractor shall consult with all agencies involved to determine requirements prior to submission of Bid. All costs of flag persons, whether required during normal working hours or required beyond normal working hours shall be borne by the Contractor.

### 3.03 FAILURE TO COMPLY

- A. In the event that, in the opinion of the Engineer, traffic protective devices are either insufficient or not maintained adequately and/or safely on any part of the project, or the Contractor does not move or relocate traffic control devices to meet construction requirements or the safety of the public when directed to do so by the Engineer, the Engineer immediately without notice may furnish, install, and maintain such traffic protective devices necessary. The cost thereof shall be borne by the Contractor and may be deducted from any amount due or to become due the Contractor under this contract.

### 3.04 CONTRACTOR'S LIABILITY

- A. The use of warning devices and the employment of or presence of traffic flag persons and/or police officers shall in no way relieve the Contractor of any responsibility or liability under the terms of the Contract.

END OF SECTION



## SECTION 01 57 26 – DUST CONTROL

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications shall consist of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection with providing calcium chloride and/or water for dust control purposes over the areas of the Work and at the times and at the rates of application as directed by the Engineer, in accordance with the Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

NONE

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

- A. Calcium chloride shall meet the requirements of the Standard Specifications, Section 9.42.
- B. Water shall be fresh water obtained from a source approved by the Engineer.

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. The Contractor shall exercise every precaution and means to prevent and control dust created as a result of all construction operations from becoming a nuisance to abutting properties, surrounding neighborhoods, and/or the traveling public.
- B. Pavement areas adjoining the work that are open to vehicular traffic shall be kept clean of excess earth materials as directed by the Engineer.
- C. When in the opinion of the Engineer, conditions require additional dust control measures to supplement those required to be provided by the Contractor in Paragraphs A and B above, the Engineer may direct the Contractor to furnish and spread calcium chloride and/or water over certain areas of the site, at certain times, and at certain rates of application.

#### 3.02 EQUIPMENT

- A. Calcium chloride shall be spread in a manner and by devices approved by the Engineer that

SECTION 01 57 26 – DUST CONTROL

will insure uniform application over the area on which it is to be placed.

- B. Watering equipment shall consist of pipelines, tanks, tank trucks, distributors, pumps, meters, hoses, or other devices, approved by the Engineer, which are capable of applying a uniform spread of water over the surface of the area on which it is to be placed. Suitable devices for positive shut-off and regulation of flow shall be provided to insure operator control.

END OF SECTION

SECTION 01 71 13 – MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Work required by this section of the Specifications shall consist of all Work necessary for the movement of the Contractor's plant, equipment, material, and personnel to and from the Project site within this Contract, and for the establishment, maintenance, and ultimate removal of any temporary field offices, buildings, storage areas, sanitary and other facilities necessary to the performance of the Work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

NONE

PART 2 - PRODUCTS

NONE

PART 3 - EXECUTION

NONE

END OF SECTION

## SECTION 01 71 23 – FIELD ENGINEERING

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications shall consist of providing sufficient additional horizontal and vertical reference points in the project area, and all detailed layout, staking, and grade control necessary for the control of the accuracy of all lines, grades, and measurements used in the execution of all Work to be performed under this Contract.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

NONE

### PART 2 - PRODUCTS

NONE

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. The Owner will furnish all boundary surveys and establish permanent horizontal and vertical reference points in the Project area to enable the Contractor to proceed with the Work required under this Section.
- B. The Contractor shall cause to have the layout of all Work performed by a Land Surveyor licensed in the State of Connecticut.
- C. The Contractor shall carefully protect and preserve all permanent reference points, monuments, stakes, benchmarks, and other survey markers furnished by the Owner. Where located in the line of Work, such points, monuments, markers and/or benchmarks shall be tied to fixed points and/or transferred and replaced upon completion of the Work unless otherwise specified by the Engineer.
- D. The Contractor shall record the tie-in or transfer of all points and/or benchmarks and shall submit copies of all notes, sketches or other records of the tie-in and/or transfer to the Engineer.
- E. The Contractor shall insure that adequate reference points, stakes, and/or benchmarks are in place at all times to allow the Engineer to check the Work in progress.

SECTION 01 71 23 – FIELD ENGINEERING

3.02 LINES AND GRADES

- A. The Contractor shall layout all Work and set all necessary grades as required to insure that all Work is installed in conformance with the lines and grades shown on the Drawings or as directed by the Engineer.

END OF SECTION

## SECTION 02 41 00 – SITE PREPARATION

### SECTION 02100 – SITE PREPARATION

#### PART 1 – GENERAL

##### 1.01 SCOPE OF WORK

- A. The Work required by this section of the Specifications shall consist of the furnishing of all labor, plant, equipment, tools and materials and the performing of all operations in connection with all Work necessary to prepare the site for the Work to be performed under this Contract in accordance with the Contract Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Dust Control - Section 01 57 26.
- B. Earthwork - Section 31 00 00.
- C. Clearing and Grubbing – Section 31 11 00.

##### 1.03 SUBMITTALS

- A. Submit the following:
  - 1. Certificates of discontinuance of utility services, if required.

##### 1.04 PROTECTION

- A. Do not interfere with the use of adjacent buildings. Maintain free and safe ingress and egress from adjacent buildings during the construction period.
- B. Take precautions to properly support structures. Cease operations and notify the Engineer immediately if safety of adjacent structures appears to be endangered.
- C. Take precautions to prevent damage to existing conditions including trees and vegetation to remain. Promptly repair any damage identified by the Engineer.

##### 1.05 EXISTING UTILITY SERVICES

- A. The Contractor shall arrange and pay for disconnecting, removing, capping, and plugging utility services as indicated on the Drawings. The Contractor shall notify the affected utility companies in advance and obtain approval before starting work.

## SECTION 02 41 00 – SITE PREPARATION

- B. The Contractor shall place markers to indicate the location of disconnected services.

### PART 2 – PRODUCTS

#### 2.01 SAFETY AND CONSTRUCTION FENCING

- A. Safety and Construction Fencing: if required, shall consist of six (6) foot height galvanized steel chain link fencing with 1 7/8” line posts, spaced 10 feet on center and 2 5/8” corner posts. Gates shall be twelve (12) feet wide and arranged for locking.

### PART 3 – EXECUTION

#### 3.01 CLEARING AND GRUBBING

This part shall supplement Section 31 11 00 - Clearing and Grubbing as follows:

- A. Trees, shrubs, and other vegetation not indicated on the Drawings or designated in the field by the Engineer to remain, and required to be cleared for execution of the Work shall be cleared and grubbed.
- B. The Contractor shall remove stumps to their full depth. Roots three (3) inches and larger shall be removed to a depth of two (2) feet below finished grade. Stumps and debris shall be legally disposed of off-site by the Contractor.

#### 3.02 PROTECTION OF EXISTING TREES

- A. Existing trees and shrubs which are indicated on the Drawings to remain shall be suitably protected by the Contractor during the Contract period. Such trees which are injured due to the Contractor’s operation to such a degree that, in the opinion of the Engineer, their usefulness or appearance are significantly impaired, shall be replaced with equivalent plant materials at the Contractor’s expense.
- B. Materials and equipment shall not be stored or operated under the branches of existing trees which are to remain, except as actually required to construct the proposed work in those areas.
- C. Suitable barricade, fences, or other barriers shall be provided at the drip line to protect existing trees from damage during construction.
- D. Existing trees indicated to remain and which may, in the Engineer’s opinion, be damaged by the Contractor’s equipment and operation shall be protected as directed by the Engineer.

## SECTION 02 41 00 – SITE PREPARATION

### 3.03 POLLUTION CONTROLS

- A. Comply with the requirements of Section 01 57 26 – Dust Control to limit dust and dirt rising and scattering in air. Comply with governing regulations pertaining to environmental protection.
- B. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding or pollution.
- C. Clean adjacent structures and improvements of dust, dirt and debris caused by site preparation operations. Return adjacent areas to condition existing prior to start of work.

### 3.04 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. Existing structures and utilities shall be suitably protected from damage, including but not limited to existing buildings, fencing, and utilities.
- B. The Contractor shall prevent damage to pipes, conduits, wires, cable or structures above or below ground, indicated on drawings to remain. No land monuments, property markers, or benchmarks shall be damaged or removed until an authorized agent has witnessed or otherwise referenced their location and approved their removal. The Contractor shall so control his operations as to prevent damage to trees and shrubs which are to be preserved. Protection may include fences and boards lashed to trees to prevent damage from blasting or machine operations. Fresh scars and wounds shall be painted with an approved paint.
- C. Provide protections necessary to prevent damage to adjoining properties. Restore damaged items to their original condition, at no additional cost to the Owner, and as acceptable to the Engineer.
- D. Remove existing above-grade and below-grade improvements and utilities as indicated.
- E. Repair any damaged utilities as acceptable to the Engineer, at no additional cost to the Owner.

### 3.05 SIDEWALK AND CURBING REMOVAL

- A. Where indicated on the Drawings and as directed by the Engineer, existing sidewalks and curbing shall be removed and properly disposed of.

### 3.06 REMOVAL OF NON-REUSABLE SOILS

- A. The Contractor shall be responsible to remove all non-useable soils from the project site.



## SECTION 02 41 00 – SITE PREPARATION

### 3.07 REMOVALS AND RELOCATION

- A. Materials indicated on the Drawings or designated by the Engineer in the field to be removed shall be dismantled, removed, and legally disposed of off-site or stockpiled as indicated on the Drawings.
- B. Materials designated to be salvaged shall be removed intact, protected, and delivered to the Owner at an Owner identified location.
- C. Materials indicated on the Drawings or designated by the Engineer in the field to be relocated shall be dismantled, removed, and relocated as indicated on the Drawings.

### 3.08 DISPOSAL OF MATERIALS

- A. Material resulting from the site preparation and demolition work and not scheduled to be salvaged and which is unsuitable for reuse on the project, shall become the property of the Contractor and shall be legally disposed of off-site.
- B. Debris, rubbish, and other material shall be disposed of promptly and shall not be left until final cleanup of site.

### 3.09 PAVEMENT REMOVAL

- A. Unstable pavement shall be removed over cave-outs and over breaks and the subgrade shall be treated as the main trench.
- B. Where previous cuts have been made adjacent to the new trench or excavation extra care shall be taken to prevent the opening of existing joints and the settling of the pavements. Any and all damage to the existing pavement adjacent to the excavation including existing patches, shall be repaired by the Contractor.
- C. Pavement edges shall be trimmed to a vertical face and neatly aligned with the center line of the trench.
- D. The cutting of the bituminous surface ahead of excavation is required to confine pavement damage to the limits of the trench. Excavation shall not commence until the Contractor has marked out the proposed limits of excavation in white paint, the underground facilities marked in their respective color, and protection provided for users of the highway.
- E. The initial cutting of the pavement shall be restricted to the area directly over the sidewalks of the proposed trench to be excavated. The pavement surface shall be removed to the limits of excavation with all edges cut to a vertical line and neatly aligned with the center of the trench. Cut-out outside of the trench line must be normal or parallel to the trench.

SECTION 02 41 00 – SITE PREPARATION

- F. The trimming shall be accomplished with either a spaded pavement breaker or cut with a concrete saw. Under no circumstances shall pavement be subjected to blows from a hammer or dropped weight. The use of hydrohammers or heavy duty pavement breakers is prohibited.
- G. Sections of sidewalk within the excavation limits shall be saw cut and removed to the nearest score line or expansion joints.

END OF SECTION

## SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications shall consist of furnishing and installing all reinforced and non-reinforced cast-in-place concrete work, including but not limited to cast-in-place concrete for field perimeter curbing and concrete pavement and all other reinforced and non-reinforced concrete as shown on the Contract Drawings, in accordance with these Specifications or as directed by the Engineer.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Earthwork - Section 31 00 00.

#### 1.03 SUBMITTALS

- A. Submit shop drawings for reinforcement steel, including schedules and details, to the Engineer for approval.
- B. Submit certified test reports of the reinforcement steel to the Engineer for approval. Reports shall be furnished for each steel shipment and shall be identified with specific lots. The steel shall be tested as the Engineer may consider necessary to establish its quality and particularly to fulfill the requirements of bending and elongation.
- C. Certified manufacturer's test reports shall be provided for premolded expansion-joint filler strips, joint sealants, and waterstops to verify compliance with the applicable specification.
- D. A concrete design mix will be prepared by a testing laboratory selected and paid for by the Engineer.
- E. Submit samples of aggregate for laboratory testing and trial mixes. Samples shall be in the quantity (and volume) as ordered by the Owner and shall be delivered in watertight containers with contents fully identified. Testing will be paid by the Owner.

#### 1.04 STANDARDS

- A. The following American Concrete Institute (ACI) publications, latest revisions, are hereby made part of this Section:
  - 1. Building Code Requirements for Reinforced Concrete ACI 318
  - 2. Concrete Sanitary Engineering Structures ACI 350
  - 3. Specifications for Structural Concrete for Building ACI 301

## SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

4. Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete	ACI 304
5. Recommended Practice for Concrete Formwork	ACI 347
6. Recommended Practice for Hot Weather Concreting	ACI 305
7. Recommended Practice for Cold Weather Concreting	ACI 306
8. Recommended Practice for Curing Concrete	ACI 308
9. Manual of Standard Practice for Detailing Reinforced Concrete Structures	ACI 315

### 1.05 TESTING

- A. Cylinders for testing will be taken by the Owner's personnel. An average of four (4) cylinders shall be cast for each fifty (50) cubic yard of concrete placed.
- B. Slump tests shall be performed by the Owner's representative.
- C. The Contractor shall notify the designated testing laboratory at least forty-eight (48) hours before every pouring operation so that arrangements may be made for taking samples and inspection. Contractor take note: Placement of concrete will not be allowed if sufficient notice is not given to the Owner to make arrangements for the taking of samples and inspection.
- D. Where the twenty-eight (28) day compressive strength of concrete in any test cylinder is below the strength specified for the class of concrete tested, the proportion of water content or temperature conditions shall be changed to secure the required strength. The Contractor shall be held responsible for the additional tests and removal and replacement of unacceptable work at no additional cost to the Owner.
- E. If laboratory test of concrete from any part of the structure indicates understrength concrete, the Engineer may order load tests or other tests on the portion of the structure affected to determine its adequacy to sustain the loads for which it is designed. Tests, if required, shall be made at the Contractor's expense and shall conform to the requirements of ACI-318, Chapter 20. If the structure, or any part of the structure, cannot pass the load tests, it shall be removed and replaced at the Contractor's expense.

## PART 2 - PRODUCTS

### 2.01 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, latest revision, Type I or II. Cement shall be the product of one manufacturer.

## SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

- B. Fine Aggregate: ASTM C 33, latest revision. Fineness modulus shall be two point eight (2.80), plus or minus zero point two zero (0.20), and shall not contain more than three (3%) percent, by weight, of material passing a number one hundred (100) sieve (2% when dry). Particles shall be free of alkali and other surface coatings determined by ASTM C 40, latest revision color test. Test aggregate for soundness by five alterations by the accelerated soundness test using magnesium sulphate in accordance with ASTM C 88, latest revision, except that loss of weight shall not exceed five (5%) percent.
- C. Coarse Aggregate: ASTM C 33, latest revision. No more than one (1%) percent, by weight, of the matter shall be removed by decantation. No more than five (5%) percent, by weight, shall consist of structurally weak particles. Materials shall be tested for soundness as given above for fine aggregate.
- D. Water: Clean and potable.

### 2.02 ADMIXTURES

- A. The following admixtures are approved for use in accordance with the recommendations of ACI Committee 350, Title No. R-83:
  - 1. Air Entraining Agent: ASTM C 260. For concrete with 1 1/2" aggregate, provide air content of 5%, +1/2%; for concrete with 3/4" aggregate, 6%, +1/2%. Air content to be determined in accordance with ASTM C 231 or C 173.
  - 2. Water-Reducing Agent: ASTM C 494, Type A.

### 2.03 REINFORCING

- A. Bars: ASTM A 615, grade 60.
- B. Welded Wire Fabric: ASTM A 185.
- C. Bar Supports: ACI 315. Supports for formed surfaces shall be plastic protected wire or stainless steel.
- D. Wire Ties: 16-gauge (min.) black, annealed wire.

### 2.04 FORMS

- A. The design and construction of forms shall be the responsibility of the Contractor. The formwork shall be designed in accordance with Chapter 1 of ACI Standard 347. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of concrete and remain within required tolerances.
- B. Forms for other cast-in-place concrete shall be made of wood, metal, or other approved

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

material. Wood forms shall be constructed of sound lumber or plywood of suitable dimensions, free from knotholes and loose knots; where used for exposed surfaces, boards shall be dressed and matched. Plywood shall be sanded smooth and fitted with tight joints between panels. Metal forms shall be an approved type for the class of work involved and of the thickness and design required for rigid construction.

- C. Form coating shall be a commercial formulation of satisfactory and proven performance that will not bond with, stain, or adversely affect concrete surfaces and will not impair bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

2.05 JOINT MATERIALS

- A. Expansion Joint Filler Strips: ASTM D 1752, Type III; self-expanding cork.

PART 3 - EXECUTION

3.01 MIX DESIGN

- A. All concrete shall be normal weight and consist of a proportioned mixture of Portland Cement, fine and coarse aggregate, admixtures and water.
- B. All concrete mixes shall be proportioned on the basis of field experience and/or trial mixtures in accordance with ACI 318-89 to achieve the following properties:

Class	Comp. Strength @ 28 Days (psi)	Maximum Water/Cement Ratio	Minimum Cement Content (lb/cy)
A	4,000	0.49	611
B	3,000	0.53	517
C	1,500	0.69	423

- C. Class A and B shall be proportioned for a slump range of 2” minimum to 4” maximum. Class C shall not exceed 6”maximum.
- D. Class A and B concrete shall be air entrained with an air content of 6% + 1%. Class C shall not be air entrained.
- E. A low range water reducing admixture shall be utilized in all concrete.
- F. Admixtures to retard or accelerate setting, plasticize or prevent freezing shall not be used without prior approval from the Engineer. No admixtures containing calcium chloride will be permitted.
- G. All admixtures shall be mixed at the batch plant.

## SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

H. Utilize the following maximum aggregate sizes which shall not exceed the tolerance in oversize specified in ASTM C-33:

Class A	3/4"
Class B	1"
Class C	1-1/2"

I. Aggregates shall be well graded from coarse to fine within limits established in ASTM C 33. Maximum size of aggregate in concrete for base mat slabs (mud slabs), walls and footing shall be 1 1/2"; for roof and intermediate slabs, thin wall and densely reinforced sections, 3/4". In no case shall aggregate size exceed 1/5th of the least dimension of the concrete between re-bars and forms. In columns, aggregate size shall be not greater than 2/3 the minimum clear distance between bars.

### 3.02 GENERAL CRITERIA

- A. Concrete measuring, mixing and placing shall conform to ACI 304 requirements and as further required by this Section. Concrete batching shall be at all times under the control of competent and experienced men. The stiffest concrete mixes that can be handles will be required. In no case will concrete having a slump of less than 2" or more than 4" be permitted, except with the expressed permission of the Owner. Slump material shall enter the mixing drum until all of the preceding batch is discharged. No retempering will be allowed and concrete which has attained its initial set before placing shall be discarded at once.
- B. Concrete shall be of uniform consistency, free from segregation and lumps. If at any time segregation occurs, the Owner may require that the materials by satisfactorily remixed at the point of deposit. If concrete ingredients are dry batched at a point distant from the work, the batches shall be kept dry during transportation. Unless the cement is kept separate from the aggregates, all batched concrete so transported shall be controlled by the provisions of ACI 304 Section 5.2.3. Admixtures shall be carefully measure and dispensed with the mixing water and uniformly mixed into the concrete mass.

### 3.03 TRANSIT-MIX CONCRETE

- A. Use truck mixers of approved revolving-drum type, equipped with calibrated tanks for measuring water and carrying the manufacturer's seal of the rated capacity of the truck. Trucks, before loading, shall reverse drums to discharge water and/or materials that may remain in the drum in full view of the Owner. Inspection slops shall be issued to each truck complying with the following requirements and no load will be accepted at the jobsite without such slip. The maximum size of batch shall not exceed the manufacturer's rated capacity. The charge in the mixer shall be reduced if, in the opinion of the Owner, such reduction is required to attain the specified quality and uniformity of concrete.
- B. Mixing shall begin within 30 minutes after the cement has been added to the batch and shall continue until there is uniform consistency. Mixing shall begin immediately after admixtures

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are added and shall continue for at least 30 revolutions to insure complete dispersion, followed by slow agitation during transport and final mixing at the jobsite for a suitable number of revolutions. Concrete shall be completely discharged from the mixer into its final location within two hours after cement has been added, except as otherwise directed or approved. In hot weather, reduce this initial time limit. However, all concrete that has attained its initial set or has exceeded the mixing limit before placing shall be discarded at once. Trucks shall conform to the latest edition of the Specification of the National Ready Mix Concrete Association.

### 3.04 FORMS

- A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting allowable surface requirements. Forms shall not be reused if there are any defects. Surfaces of forms and embedded materials shall be cleaned of any mortar from pervious concreting and of all other foreign material before concrete is placed.
- B. Edges of form panels in contact with concrete shall be flush within 1/32 inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16 inch in 4 ft. Forms shall prevent the passage of mortar, water and grout.
- C. Forms for walls have removable panels at the bottom for cleaning, inspection and scrubbing-in of bonding paste. Forms for walls of considerable height shall be fitted with tremies and hoppers for placing concrete to prevent segregation and accumulation of hardened concrete on forms or reinforcement above the pour line.
- D. Form ties shall be break-back type that will not leave any metal within 1 1/2" of finished surfaces after removal. Removable portions of such ties shall be 1/2" diameter, minimum or shall be furnished with a wood or metal cone at least 1/2" in diameter by 1" long. Thru-bolts or wire ties will not be allowed.
- E. Exposed joints, edges and external corners shall be chamfered by molding placed in the forms unless shown or stated otherwise. Chamfered joints will not be permitted where earth or rock fill is placed in contact with concrete surfaces. Chamfered joints shall be terminated a sufficient distance above earth or rock fill so that the ends of the joints will be visible.
- F. Forms shall be coated with form oil or form-release agent before the form or reinforcement is placed in final position. The coating shall be used as recommended by the manufacturer. Forms for unexposed surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather form oil is mandatory. Surplus coating of form surfaces, reinforcing steel construction points shall be removed before placing concrete.
- G. Directions as to the time of removing forms shall be strictly followed. This work shall be done with care so as to avoid injury to the concrete or damage to any details. In general removal of formwork shall be as specified in Section 3.6 of ACI 347 with the following exceptions:



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1. Forms shall not be removed until the concrete has attained sufficient strength to support its own weight plus construction live loads.
  2. Forms for the vertical faces of walls, beams and columns may be removed 3 days after concrete placement provided the concrete is sufficiently hard to not be damaged by the form removal and that curing, cold weather protection and other protective measures are maintained.
  3. Forms for the bottom of slabs, pan joints and beams shall not be removed until the concrete has gained a minimum of 75% of the required 28 day compressive strength, but in no case shall they be removed before 10 days after concrete placement.
  4. Forms for any portion of the structure shall not be removed until the concrete has gained adequate strength. Forms and form supports shall be removed such that the stresses due to the concrete's own weight can be absorbed by the concrete in a gradual and uniform manner.
  5. No superimposed load will be allowed on any structure until it has attained its 28-day strength.
- H. When reshoring is permitted or required, the work shall be planned in advance and will be subject to approval.
- I. Reshoring for the purpose of early form removal shall be performed so that at no time will large areas of new construction be required to support its own weight. While reshoring is underway, no live loads shall be permitted on the new construction. Reshores shall be tightened to carry their required loads but shall not be overtightened so that the new construction is overstressed. Reshores shall remain in place until the concrete has reached 75% of its specified 28-day strength, unless otherwise specified or permitted.
- J. Floors supporting shores under wet concrete shall be reshored or shall have their original shores left in place. The reshores shall have at least one half the load capacity of the shores above and shall be distributed in approximately the same pattern as those above. These reshores shall remain in place until the freshly-placed concrete has reached 75 percent of its specified 28-day strength, unless otherwise specified or permitted.

### 3.05 REINFORCING

- A. Reinforcing shall be fabricated to the lengths, sizes and shapes as shown on the approved shop drawings, or as otherwise ordered. All bends shall be made cold and in such a manner that there shall be no damage to the bars, nor shall bending exceed the limits given in ASTM A 615.
- B. Identification of bars shall be in accordance with ASTM A 615. Bundles bars shall be clearly identified by the numbers used on the approved Schedules.

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- C. Reinforcement steel and accessories shall be installed or placed as specified and as shown on the Contract and approved shop drawings. Placement details of reinforcement and accessories not specified or shown on the Drawings shall be in accordance with ACI 315 or ACI 318. Reinforcement shall be fabricated to shapes and dimensions shown , placed where indicated within specified tolerances and adequately supported during concrete placement. At the time of concrete placement, all reinforcement shall be free from loose flaky rust, scale (except tight mill scale), mud, oil, grease, or any other coating that might reduce that bond with the concrete.
- D. Bars shall not be bent or straightened in the field unless approval is granted. Bars with bends or kinks not indicated on the approved shop drawings shall not be used. Welding of bars will only be permitted where shown on the drawings, or as permitted or directed by the Owner. Welding shall be in accordance with AWS D12.1 or as directed.
- E. Bars shall be spaced as indicated on the Drawings or as otherwise directed. The spacing between adjacent bars and the distance between layers may not vary from the indicated position by more than one bar diameter nor more than one (1") inch.
- F. Concrete coverage shall be as indicated on the drawings with tolerances as follows:

<u>Minimum Cover</u>	<u>Variation</u>
3"	+3/8"
2"	+1/4"
1 1/2"	+1/4"
1"	+1/8"
3/4"	+1/8"

- G. Splices in reinforcement steel shall be as specified, shown on the Drawings, or as directed by the owner. Bars may be spliced at alternate or additional locations at no additional cost to the Owner, subject to the approval of the Owner. Except as provided herein , all splicing shall be in accordance with approved splicing procedures and the requirements of ACI 318.
- H. Lapped spliced shall be used only for bars smaller than Size #14. Bar laps may be placed in contact and securely ties or may be spaced transversely apart to permit the embedment of the entire surface of each bar in concrete, but shall not be spaced farther apart than one-fifth the required length of lap or 6 inches. Lengths of laps for bars or welded wire fabric shall conform to the requirements of ACI 318, except when otherwise shown on the Drawings.

3.06 CONCRETE PLACEMENT

- A. The method of placement of concrete shall be selected by the Contractor. The Owner shall be advised as to the method of placement, whether by chute, bucket, pumping or other means, in order that the design mix be compatible.
- B. Concrete shall be moved from the mixer to the place of final deposit as rapidly as possible by methods that will prevent separation or loss of ingredients. When concrete is conveyed by

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chuting, the chute shall be of such size and design as to insure a practically continuous flow. The slope of the chute shall be such that concrete flows without separation of ingredients. The chute shall be flushed with water before and after each run; the water discharged outside the forms. Chutes shall be U-shaped, designed for this function and in general, shall have slope varying from 25 to 45. The maximum drop shall be 5 feet and unless mechanical conveyors are used, the maximum horizontal distance shall be 5 feet. Do not use aluminum chutes or pipes for conveying concrete.

- C. In general, concrete placement shall produce compact, dense, homogeneous and impervious concrete, completely filling the space being concreted. Concrete adjacent to forms shall be continuously and sufficiently worked, spaded and vibrated. Acceptable types of high speed electrical or air-operated immersion-type vibrating equipment shall be used. Stones shall be spaced away from faces to be exposed. Concrete shall be spread in horizontal layers not to exceed 18" to 24" thick to the extent practicable. Consolidation shall be thorough for each layer and shall extend into the previously placed concrete to insure an integral mass.
- D. The minimum number of vibrators shall be as follows: 1 per 10 CY per hour for walls; 2 per 20 CY per hour for slabs; 1 spare in proper working condition at all times. The rating capacities of the vibrators shall be 10,000 RPM minimum. The vibrators shall be inserted in the freshly placed concrete at approximately 18 to 30 inch intervals and shall operate in each insertion for a period of 5 to 15 seconds, or as otherwise ordered.
- E. No concrete shall be placed against the surface of sheet piling, rock or concrete until water entering the space to be filled has been cut off by caulking or has been diverted outside the space by means of pans, pipes, gravel drains, sumps or other suitable means.
- F. Methods and materials used for concreting in cold or freezing weather shall be subject to the prior approval of the Engineer. Cold weather shall mean any time that the air temperature in the shade and away from artificial heat may be expected to reach 50oF or lower at any time during the 24 hours following the placing of the concrete. Chill factor shall be taken into consideration in determining proper protection of the concreting operations.
- G. Remove ice and frost from foundations, previously placed concrete, forms and form materials. Heat the water, sand and aggregate. Concrete shall have a temperature of not less than 60F when placed in the forms and shall be maintained at a temperature of at least 50F for not less than 72 hours after placing. Salt, chemicals or other foreign materials shall not be mixed with the concrete to prevent freezing. Recommended methods for hot or cold weather concreting are set forth in ACI 305 and ACI 306.
- H. Where new concrete is to be placed against existing, the latter shall be thoroughly cleaned of all laitance, mortar and other substances which would prevent complete adhesion. The joint shall be clean and free of standing water but the surface shall be moist. A thick layer of mortar of the same consistency as the concrete shall be broomed into the surface, or the Contractor may use one of the specified bonding agents. Bonding agent shall be applied in accordance with the manufacturer's specification.

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- I. Concrete fill shall be placed where shown. The coarse aggregate used in concrete fill shall be sized to permit forming to the details indicated or as directed. Concrete fill shall conform to the requirements specified herein for concrete.
- J. Building into forms, set or attach sleeves, castings, metal frames, ladders, ladder rungs, bolts, pipes, waterstops or other items shown or specified. Provide holes, recesses or projections as needed.

### 3.07 CURING

- A. Every precaution shall be taken to prevent concrete from drying out until thoroughly hardened. To this end, sprinkling may be required as early as three hours after placement. Thereafter it shall be kept continuously moist for fourteen days. Wooden forms shall be wetted immediately before concrete is placed and shall be kept wet until removed. Curing compounds shall not be used on surfaces receiving monolithic or epoxy finishes, resilient tile, ceramic tile, construction joints or surfaces to be bonded to future concrete. Curing methods shall, in general, be in accordance with ACI 308.

### 3.08 PATCHING AND REPAIR

- A. Immediately after forms are stripped, remove fins and projections from flat surfaces and fill recesses left by form ties and repair surface defects. Clean exposed concrete that has been stained by leakage.
- B. Wet holes and other recesses to be filled and apply a 1/16" thick brush coat of neat cement slurry mixed to the consistency of heavy paste. Immediately plug the hole with a 1:1.5 moisture of cement and sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spider web. Trowel smooth with heavy pressure. Avoid burnishing.
- C. When patching or repairing exposed surface use the same source of cement and sand as used in the parent concrete. Adjust color if necessary by additional of proper amounts of white cement. Rub slightly with a fine carborundum stone at an age of 1 to 5 days if necessary to bring the surface down to the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove subbed matter.
- D. Defective concrete and honeycombed areas shall be chipped down reasonably square and at least 1" deep to sound concrete with hand chiseled or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8" wide all around the steel. For areas less than 1 1/2" deep, the patch may be made in the same manner as described above, care being exercised to use dry (non-trowelable) mixtures to avoid sagging. Thicker repairs will require build-up in successive 1 1/2" layers on successive days, each layer being applied (with slurry, etc.) as described above. To aid strength and bonding of multiple layers, use an approved metallic aggregate additive as follows:

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<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Aggregate	0.15	0.25
Sand	1.5	1.5

- E. For every heavy (generally formed) patches, add pea gravel to the mixture and proportion as follows:

<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Aggregate	0.2	0.33
Sand	1.0	1.0
Pea Gravel	1.5	1.5

- F. In cases where metallic aggregate is used in multiple patches and a rusty finish is not desired on the surface, the final layer (or at least the final 1/2") shall be composed of the 1:1.5 grout without the aggregate. After hardening, rub lightly as described above for form tie holes.
- G. Costs of patching and repairs shall be included in the Contract Sum and will not be considered as an addition to the Sum. If required, anchor bolts shall be set in drilled holes, and to these reinforcing steel, wire mesh, or other suitable devices embedded in the patch.

3.09 FINISHING

- A. Formed Surfaces: Grout finish the exposed face of the roof edge beam and parapet. Interior exposed concrete surfaces shall be similarly treated. Use 1:1.5 cement, sand grout mixed with sufficient water produce a consistency of thick paint. The surface of the concrete shall be wetted thoroughly and the grout shall be applied immediately to the wetted surfaces by brush or spray.
- B. Immediately after applying the grout, the surfaces shall be scoured vigorously with clean burlap or rubber sponge float to fill pits completely. While the grout in the pits is still plastic, a dry mix of the specified grout shall be rubbed over the surface with clean dry burlap until no materials remain on the surface except that within the pits. The operation for any area shall be completed the day it is started. After the work has been grouted, any remaining dark spots and streaks shall be rubbed lightly with a fine abrasive stone; rubbing shall not change the texture of the concrete.
- C. Unformed Surfaces: Floor slabs shall be true planes, including slabs pitched to drains, within a tolerance of 1/8" in 10 ft. Dusting with dry concrete or the addition of toppings will not be allowed.
1. Wood Float Finish: Exterior concrete platforms shall be finished by tamping to force coarse aggregate away from the surface and screening and floating to bring the surface to the required finish level. While the concrete is face to the required finish level. While the concrete is still green, but sufficiently hardened to bear a man's weight

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without deep imprint, it shall be wood-floated to a true even surface with no coarse aggregate visible.

2. Broomed Finish: Concrete steps and walls, wet wells and slabs to receive fills shall be broom finished. The surfaces shall be first tamped to force aggregate away from the surface then screened and floated to required grade, or pitch, and finally, while still "green" broomed right angle to the normal line of travel.
3. Trowelled Finish: Interior floor slabs not specified to have another finish shall be steel trowel finished. Surfaces shall be tamped, screened and floated as above and then wood floated. While concrete is still "green", steel trowel the surface to provide a smooth, uniform, impervious finish free of trowel marks.

#### 3.10 MISCELLANEOUS

- A. Expansion Joint Filler: Spaces for premolded filler strips shall be formed with oiled wood strips accurately positioned and secured against displacement. The wood strips shall be tapered and of the size required for the filler strips. Material used to secure wood strips to concrete shall not harm the concrete. The wood strips shall not be removed until after the concrete curing period. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete and any dust which shall be blown out with oil-free, compressed air.

END OF SECTION

## SECTION 31 00 00 - EARTHWORK

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications consists of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection with all Work necessary for all earthwork operations in accordance with the Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.
- B. The Work under this Section of the Specifications shall include, but not necessarily be limited to:
1. Stripping and stockpiling of topsoil.
  2. Mass earth and rock excavation.
  3. Earth and rock excavation for structures.
  4. Embankment construction.
  5. Site grading.
  6. Processing on-site materials for use in the items of Work under this Contract.
  7. Providing, placing and compacting all general site fill, all structural fill and all bedding materials.
  8. Providing, placing and compacting all required borrow materials.
  9. Disposal of all excess or unsuitable materials.

#### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Dust Control - Section 01 57 26.

#### 1.03 EXAMINATION OF SITE

- A. By submitting the Bid the Contractor affirms that he has carefully examined the site and all conditions affecting Work under this Section. No claim for additional costs will be allowed because of lack of full knowledge of existing conditions.
- B. Plans, surveys, measurements and dimensions under which the Work is to be performed are

SECTION 31 00 00 - EARTHWORK

believed to be correct, but this trade shall have examined them for himself during the Bidding period, as no additional compensation will be made for errors or inaccuracies that may be found therein.

1.04 DESCRIPTION

A. General Excavation: shall be classified as Earth Excavation, Rock Excavation and Unclassified Excavation in accordance with the following definitions:

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Common Fill: shall be utilized under areas to be grassed and areas of general landscaping, and shall be clean, friable, non-plastic in-organic soil material containing no stone greater than two thirds (2/3) of the required loose lift thickness. The material shall be free from debris, ice, snow, frozen lumps, vegetation, stumps, roots or other organic materials.
- B. Sandy Fill: shall be utilized as structure backfill and as trench backfill where indicated on the Contract Drawings, and shall be clean, friable, non-plastic in-organic soil material free from debris, ice, snow, frozen lumps, vegetation, stumps, roots or other organic materials and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
6"	100
No. 10	30-95
No. 40	10-75
No. 100	5-30
No. 200	0-12

C. Structural Fill: shall be utilized under footings, foundations, slabs and structure bases where indicated on the Contract Drawings or directed by the Engineer, and shall be clean, friable, non-plastic in-organic soil material free from debris, ice, snow, frozen lumps, vegetation, stumps, roots or other organic materials. The material shall consist of sound, tough, hard, durable particles of sand, gravel and crushed rock or a combination of these materials and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
6"	100
3/4"	50-100
1/4"	30-80
No. 40	10-50
No. 100	0-15
No. 200	0-10



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- D. Granular Fill: shall consist of sound, tough, hard, durable particles of crushed or uncrushed gravel, free from soft, thin, elongated or laminated pieces and vegetable or other deleterious substances. It shall conform to Section M.02, Article M.02.01 and Article M.02.06, Grading “B”, of the Standard Specifications.
- E. Rolled Granular Base: conform to Section M.02, Article M.02.03 of the Standard Specifications, for the stone sizes shown on the Drawings or required in the Specifications.
- F. Crushed Stone: conform to Section M.02, Article M.01.01 of the Standard Specifications, for the stone sizes shown on the Drawings or required in the Specifications.
- G. Geotextile Fabric: used for bedding material envelopes shall be Amoco 4504 as indicated on the Contract Drawings or an equal approved by the Engineer.
- H. Bedding Material:
  - 1. Crushed Stone Bedding: See Item F. above.
  - 2. Sand Bedding: shall be clean, friable, non-plastic in-organic soil material free from debris, ice, snow, frozen lumps, vegetation, stumps, roots or other organic materials and shall conform to the following gradation:

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
1/2”	100
3/8”	80-106
No. 10	30-80
No. 40	10-50
No. 200	0-5

PART 3 - EXECUTION

3.01 LOCATIONS, GRADES AND ELEVATIONS

- A. The Contract Drawings indicate the general location and alignment, and the invert and finished grade elevations of all proposed structures and utilities and other Work under this contract. The Engineer reserves the right to make such adjustments in alignment and elevation as are found necessary in order to avoid interference with structures, facilities or other obstacles and to adapt the proposed structures, utilities and other work to other special conditions encountered.

## SECTION 31 00 00 - EARTHWORK

### 3.02 UTILITIES

- A. The Contractor shall obtain information from the applicable utility companies concerning locations of all utilities within the areas of the work. All Rules and Regulations of the respective utility companies shall be observed. The Contractor shall adequately protect from damage all existing active utilities. Inactive or abandoned utilities encountered in earthwork operations shall be plugged, capped, or removed as directed. The Contractor shall restore any utility damaged as a result of his operations without additional compensation.

### 3.03 TEMPORARY PROCESSING FACILITIES

- A. It is intended that the Contractor utilize, to the extent possible, on-site materials that have been generated in the earthwork operations under this Contract. The work under this Section of the Specifications shall include the processing of on-site materials, including obtaining any required permits and/or approvals for, and the set up and operation of any temporary processing facilities required. All processed materials shall meet the specifications for the various materials noted herein under Section 2.01, Paragraphs A through J.
- B. The Contractor shall be responsible for obtaining all required permits and/or approvals from all regulatory authorities that may have jurisdiction in regulating the operation of any temporary materials processing facilities.
- C. The Contractor shall insure that the operation of any temporary processing facility shall be in strict conformance with the conditions of all permits and/or approvals for such facilities throughout the length of the project.
- D. The location of such facilities shall be in conformance with the conditions of all permits and/or approvals and shall be approved by the Engineer.

### 3.04 STRIPPING AND STOCKPILING TOPSOIL

- A. Prior to the commencement of any excavation and/or grading operations all topsoil shall be stripped to a depth equal to the top of the subsoil and from the area(s) to be disturbed and stockpiled in locations approved by the Engineer.
- B. Topsoil stockpiles shall be protected from erosion as specified in Section 31 25 00 – Soil Erosion and Sediment Control, of these Specifications.

### 3.05 STRUCTURE EXCAVATION

- A. Excavation shall be performed to the elevations and dimensions indicated plus adequate space to permit erection of forms, sheeting, shoring, bracing, drains, masonry, and other work and the inspection of the Work.

## SECTION 31 00 00 - EARTHWORK

- B. Immediately after excavations for the structure have been completed to the required grades, the exposed surface of the excavation shall be cleaned of all loose or disturbed materials. The surface of the excavation shall then be compacted with at least six (6) passes of an acceptable vibratory plate tamper.
- C. If suitable bearing for foundations is not encountered at the depth indicated on the Drawings, or in the excavation required in these Specifications, The Contractor shall immediately notify the Engineer. The Contractor shall remove any remaining unsuitable material as directed. Unsuitable materials as herein defined are organic material, frozen material, peat, organic silt, or combinations thereof, all having unsuitable in-situ bearing properties and all materials of whatever description which are too loose or saturated to provide satisfactory bearing.
- D. If rock is encountered at the required elevations, the rock shall be over-excavated and replaced with a minimum of twelve (12") inches of compacted gravel or crushed stone fill, by the Engineer.
- E. The bottom of excavations shall be protected from frost from whatever source. Footings or slabs shall not be placed on frozen ground or on saturated materials. No excavation shall be made to the full depth indicated when freezing temperatures may be expected, unless the footings or slabs can be placed immediately. The bottoms so excavated shall be protected from frost and water if placing of concrete is delayed.
- F. The Contractor shall sheet, shore and brace all excavation if necessary to prevent cave-ins as required.
- G. Over excavation below or beyond the indicated or authorized limits shall be refilled with fill material approved by the Engineer compacted to ninety five (95%) percent of the maximum dry density of the material as determined by ASTM D 1557 at no additional expense to the Owner.
- H. The Contractor shall control and pitch all grading to prevent water from running into the excavated areas of structures or to prevent damage to other Work already completed or in progress.
- I. The Contractor shall furnish all pumping and other dewatering equipment necessary to keep excavated areas dry during construction, as required. Refer to Section 02230 - Dewatering, Control and Diversion of Water, of these Specifications.
- J. Any damage resulting from the failure of the dewatering operations and any damage resulting from the failure to maintain the area of all structures and Work in a suitable dry condition shall be repaired as directed by the Engineer at no additional expense to the Owner.

### 3.06 SITE EXCAVATION, FILL AND BACKFILL

#### A. GENERAL

## SECTION 31 00 00 - EARTHWORK

1. All fill materials shall be approved by the Engineer prior to being incorporated into any fill area.
2. The Contractor shall perform all site excavations, fills, re-fills, backfills, and compaction required for all site grading and for the various areas to be paved, utilities, structures, conduits and appurtenances.

### B. BORROW

1. The amount of usable general fill material excavated within the limits of the Work contracted for may not be sufficient to accomplish the grading called for and other features of the Work. Borrow shall include the furnishing, removing and satisfactory placing of additional material necessary to complete all features of the Work.
2. Borrow shall be of satisfactory quality as determined by the Engineer for the purpose intended.
3. Borrow will be permitted only to the extent necessary to complete the Work as shown and only after all acceptable on-site material from excavation has been placed. With the approval of the Engineer, the Contractor may be permitted to place borrow before the excavation is completed; but he will be held responsible for the proper placing of all suitable excavated material.
4. The Contractor shall notify the Engineer at least fifteen (15) calendar days prior to obtaining material from any borrow pits so that an examination may be made of the fitness of the material. The limits of the proposed borrow pit shall be shown to the Engineer. The Contractor shall be required to clear the area of all unsuitable material.

### C. OVER-EXCAVATION

1. Unauthorized excavation of suitable materials beyond the indicated or authorized limits shall be refilled, at no additional expense to the Owner, with gravel fill compacted to ninety-five (95%) percent of the maximum dry density of the material as determined by ASTM D 1557.

### D. SHEETING AND SHORING

1. Excavations shall be adequately sheeted, shored and braced, as necessary, to permit proper execution of the work and to protect all slopes and banks.
2. The Contractor shall be solely responsible for the adequacy of all temporary support systems.
3. The Contractor shall retain a Professional Engineer licensed in the State of Connecticut to design all temporary support systems required for the execution of the Work. The

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installation of sheeting, shoring and bracing shall comply with the safety precautions as outlined in the Associated General Contractors of America "Manual of Accident Prevention in Construction," and all Local and State regulations.

4. Sheeting shall be installed as required to prevent cave-ins or settlement and to protect workmen, adjacent structures and utilities. Shoring and sheeting may be removed as the backfilling progresses, but only when banks are safe against caving. The Engineer may direct that sheeting, shoring and bracing be left in place at any time during the progress of the Work, and direct that the timber and/or steel be used for sheeting and bracing, authorized to be left in place, be cut-off at a specified elevation.
5. Dewatering shall be performed as required, for all excavations below ground water level in conformance with Section 02230 - Dewatering, Control and Diversion of Water, of these Specifications.

### E. BACKFILLING

1. Backfilling shall comply with material, compaction and placing requirements specified elsewhere in this section. In addition comply with the following requirements:
2. Backfilling at Buildings: Remove from spaces to be filled all excessively wet or otherwise unsuitable material, such as rubbish, organic materials, sheeting, bracing, forms and debris. Do not commence backfilling operations until conditions have been inspected and approved by the Engineer. Do not place fill material against foundation walls or structural members unless they are either shored and braced or of sufficient strength to withstand the pressures to be imposed by compaction. Similarly, do not place fill until subgrade dampproofing materials have been in place for at least 48-hours, have been inspected and approved by the Engineer, and are properly protected.
3. Backfilling at Utility Trenches: Do not commence backfilling operations until all piping, conduit, etc. has been installed, tested and approved by the Engineer and the locations of all pipe and appurtenances have been recorded. backfill carefully by hand around pipe to depth of 6" above top of pipe using bedding material and tamping firmly in layers not to exceed 6", compacting by hand rammers or mechanical tampers. When a manufacturer of a utility line material suggests specific backfill materials and methods other than those specified herein, such requirements shall govern, providing the finished work equals or exceeds the result obtained by the materials and methods specified herein as determined by the Engineer.
4. Backfilling at Retaining Structures: Compaction equipment weighing more than 2,000 pounds will not be used adjacent to retaining structures or building walls which function as retaining structures unless specifically authorized by the Engineer.

### 3.07 PLACING FILL

#### A. PREPARATION

## SECTION 31 00 00 - EARTHWORK

1. Foundations for fills, refills and backfills shall be prepared in an approved manner by removing all excess and unsuitable materials. The base or other surfaces of fills, refills, or excavations which have been allowed to weather and which, in the opinion of the Engineer, are unsuitable, shall be removed and replaced with crushed stone or gravel fill or shall be dried, roughened or scarified, and then compacted with at least six (6) passes of a suitable vibratory compactor, as directed, before any additional fills or refills are placed on them.

### B. PLACEMENT

1. Materials placed shall be specially compacted by depositing in approximately horizontal layers not exceeding twelve(12") inches in thickness before compaction, and unless sufficiently moist as spread, shall be wetted to near the optimum moisture content. Each layer shall be compacted by suitable vibratory compactors or tampers.
2. Materials used in refills and backfills shall be carefully placed to avoid damage to structures, conduits and/or pipes.

### C. MOISTURE CONTROL

1. Fill material which does not contain sufficient moisture to be compacted to the specified densities shall be conditioned by adding water uniformly to the surface of each lift before compaction.
2. Fill material containing excess moisture shall be required to dry to optimum moisture content before it is placed and compacted. A tolerance of up to five (5%) percent above optimum may be permitted by the Engineer. However, if a lift of fill displays pronounced elasticity or deformation under the action of earthmoving and compaction equipment, the moisture content shall be reduced to secure stability.

## 3.08 COMPACTION

### A. REQUIREMENTS

1. All fills, refills and backfills shall be compacted in accordance with the following minimum percentage of the maximum dry density for the material as determined by ASTM D 1557:
  - a. All fills under building areas - 95%.
  - b. All bases under slabs on grade and footings - 97%.
  - c. All fills under areas to be paved:
    - (1) To within three (3') feet of finished pavement - 92%.

## SECTION 31 00 00 - EARTHWORK

- (2) To within three (3') feet of finished pavement - 95%.
- d. All foundation and retaining wall backfill - 95%.
- e. All pipe bedding - 95%.
- f. All trench backfill under areas to be paved:
  - (1) To within three (3') feet of finished pavement - 92%.
  - (2) Within three (3') feet of finished pavement - 95%.
- g. All trench backfill under unpaved areas - 90%.
- h. All fills under general landscaped areas - 90%.

### B. TESTING

1. All percentages of compaction specified herein shall be related to the maximum dry density as established by Method D ASTM Designation D 1557, latest revision and verified in the field by ASTM Designation D 1556, latest revision, D 2167, latest revision or an approved Nuclear Density Testing Device. Prior to placing, at least one (1) laboratory test shall be made by the Engineer on a representative sample of each of the fill materials proposed to be furnished for the earthwork operations to determine gradation and moisture-density characteristics.
2. Field density tests to determine the actual in-place densities being attained shall be made at the Owner's expense and insufficient quantity to determine that the required compaction is being attained.

### C. EQUIPMENT

1. Where vibratory compaction equipment is specified herein or is directed to be used by the Engineer, all such equipment, whether plate-type or roller-type, shall be furnished with a vibrating surface at least twenty-four (24") inches in width, and capable of operating at a minimum of two thousand (2,000) blows per minute. Equipment not specifically designed as vibrating compaction equipment shall not be permitted for compaction of either existing in-place materials or of fills, refills and backfills. Plate vibratory tampers specified for compaction of materials shall be commercially manufactured by Jackson Vibrators, Inc., Ludington, MI.; the Wacker Corp., Hartford, WI.; the Jay vibratory plate tamper as manufactured by the Jay Co., Columbus, OH.; or equal.
2. Vibrating rollers and vibrating tampers specified for compaction shall be similar and equal to the Vibrating Rollers as manufactured by Essick Manufacturing Company, Elizabeth, NJ; the Multiple Vibratory Compactor as manufactured by Jackson Vibrators,

## SECTION 31 00 00 - EARTHWORK

Inc., Luddington, MI; or equal. Jack hammers, rubber-tired vehicles, and similar equipment not specifically designed and manufactured for the compaction of granular materials will not be approved for use.

### D. SURFACES TO BE COMPACTED

1. Surfaces to be compacted shall, unless otherwise specified, shall be compacted by a sufficient number of passes with approved vibratory compactors, in order to obtain the percentage of compaction specified in subsection 3.07 A. A complete pass shall consist of the entire coverage of the surface area to be compacted with one trip of the equipment. Each trip of the equipment shall overlap the previous trip by at least one (1') foot.
2. Dumping, spreading, preparing and compacting of several layers of fill materials across the area of work may be performed simultaneously, providing there is sufficient total area to permit these operations to proceed in a systematic manner.
3. No rolling equipment shall be used to compact fill, refill or backfill materials within four (4') feet of the vertical faces of any concrete walls or utility pipes. Plate vibratory tampers shall be used in these restricted areas and in other areas too confined to satisfactorily use rolling equipment.
4. It is the intent of these compaction requirements that the minimum in-place dry density of the compacted materials resulting from the specified minimum number of passes of the compaction equipment will be equal to or greater than the minimum percentages specified herein. Additional passes of the specified equipment shall be required if the minimum percentages of ASTM in-place dry densities as specified are not obtained with the minimum passes indicated.

### 3.09 RESTORATION OF EXISTING SURFACES

- A. Whenever streets, lawns or sidewalks within or outside the Limit of Contract Lines have been excavated in fulfilling the work required under this Contract, the Contractor shall furnish and install all material necessary to bring finish surfaces level with the existing adjacent surfaces. All work shall be installed to match the existing conditions in accordance with the governing authority. The Contractor shall notify the proper authorities prior to restoring surfaces outside the Limit of Contract Line.

### 3.10 OVERLOAD OF STRUCTURES

- A. The Contractor shall be responsible for taking all necessary precautionary measures to assure that compaction equipment used will not overload structures during the compaction of fills and backfills.

END OF SECTION



## SECTION 31 11 00 – CLEARING AND GRUBBING

### SECTION 02110 – CLEARING AND GRUBBING

#### PART 1 - GENERAL

##### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications consists of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection with all Work necessary for clearing and grubbing in accordance with the Contract Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.
- B. The Work under this Section of the Specifications shall include, but not necessarily be limited to:
  - 1. Clearing the ground of trees, stumps, brush, debris and all objectionable material, and miscellaneous structures not specifically covered under other items of Work within the limits shown on the Contract Drawings or as directed by the Engineer.
  - 2. Clearing the ground necessary for grading, the construction and installation of utilities, drainage pipes and structures, pavements, sidewalks, curbing and other site appurtenances.
  - 3. Preservation from injury to or defacement of all vegetation, trees, and other existing features specified on the Contract Drawings or by the Engineer to be protected and retained.
  - 4. Satisfactory disposal of trees, stumps, brush, debris, and other miscellaneous material. Satisfactory disposal shall include all excavation, backfill, compaction, handling, rehandling, storing, hauling and all other Work necessary for the satisfactory disposal of all materials.
  - 5. Satisfactory disposal shall also include removal to an approved off-site disposal area and disposed of in accordance with all applicable laws and regulations.as required or as directed by the Engineer. Satisfactory disposal shall not include burning unless specifically authorized by the Engineer.

##### 1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Dust Control - Section 01 57 26.
- B. Earthwork - Section 31 00 00.

## SECTION 31 11 00 – CLEARING AND GRUBBING

### PART 2 - PRODUCTS

NONE

### PART 3 - EXECUTION

#### 3.01 GENERAL

- A. Clearing and grubbing shall be accomplished in accordance with the Standard Specifications, Section 2.01.
- B. Limbs and branches of trees to be preserved shall be cut back sufficiently, but only to the extent necessary for construction. Trimming shall be done neatly and cleaned so that the remaining parts of the tree will not be damaged and so that healing will be facilitated. Where limbs and branches over one (1) inch in diameter have been cut, the newly cut area of the tree shall be given a thorough application of an approved tree-healing compound.
- C. The Contractor shall not cut or injure any trees or other vegetation outside the limits of the area to be cleared, without first obtaining permission from the Engineer.
- D. All stumps, roots, and foreign matter, topsoil, loam, and unsuitable earth shall be stripped from the ground surface and disposed of as directed by the Engineer. Topsoil and loam shall be stockpiled and re-used on site where possible and approved by the Engineer. Unsuitable earth material shall be disposed of at disposal sites approved by the Engineer.
- E. All tree limbs and brush shall be chipped on site and the chip product shall be disposed of on-site in locations approved by the Engineer or at an off-site location in accordance with all applicable laws and regulations.
- F. All stumps shall be disposed of at an off-site location in accordance with all applicable laws and regulations.

END OF SECTION

## SECTION 321416 - BRICK UNIT PAVING

### 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. Brick Pavers on concrete base set in bituminous setting beds.
  - 2. Aluminum paver edge restraints
- B. Related Requirements:
  - 1. Section 32 16 23 "Concrete Sidewalks" for concrete base under brick unit pavers.
  - 2. Section 32 16 13 "Granite Stone Curbing".
  - 3. Section 31 00 00 "Earthwork"

#### 1.3 REFERENCE STANDARDS

- A. Technical Notes on Brick Construction 14B "Paving Systems Using Clay Pavers on a Bituminous Setting Bed". The Brick Industry Association, Reston, VA, June 2010.
- B. "Flexible Vehicular Brick Paving- A heavy Duty Applications Guide". The Brick Industry Association, Reston, VA, February 2004.

#### 1.4 ACTION SUBMITTALS

- A. Manufacturer's Product Data and Installation Instructions for the following items.
  - 1. Pavers.
  - 2. Bituminous setting materials.
  - 3. Edge restraints.
  - 4. Polymeric sand joint filler mixture.
- B. Test Report of brick pavers and accent brick pavers indicating ASTM C-902 compliance as applicable. Testing shall be done by a qualified independent testing

## SECTION 321416 - BRICK UNIT PAVING

laboratory. Test procedures shall conform to ASTM C-67-03 methods, as applicable. Test report shall indicate, as a minimum, the following.

1. Compressive strength, psi
  2. Absorption, 5 hr. submersion in cold water.
  3. Absorption, 24 hr. submersion in cold water.
  4. Maximum saturation coefficient.
  5. Initial rate of absorption (suction).
  6. Abrasion index.
  7. Freeze-thaw.
  8. Tolerance to saline conditions.
  9. Efflorescence.
- C. Test Report of roadway brick pavers indicating ASTM C-1272 compliance as applicable. Testing shall be done by a qualified independent testing laboratory. Test procedures shall conform to ASTM C-67-03 methods, as applicable. Test report shall indicate, as a minimum, the following.
1. Compressive strength, psi
  2. Absorption, 5 hr. submersion in cold water.
  3. Absorption, 24 hr. submersion in cold water.
  4. Maximum saturation coefficient.
  5. Initial rate of absorption (suction).
  6. Abrasion index.
  7. Freeze-thaw.
  8. Tolerance to saline conditions.
  9. Efflorescence.
- D. Sieve Analysis: for aggregate setting bed materials, according to ASTM C136.
- E. Samples for Verification:
1. Submit sample units of each paver type representative of size, shape, color and finish, indicating color variation and texture range expected in finished installation. Submit minimum of ½ pallet and lay out pavers on site or where directed for the Engineer's approval. Do not order brick for project until Engineer's approval of the sample units.

### 1.5 INFORMATIONAL SUBMITTAL

- A. Qualifications Data: For Brick Paver Installer. Include list of five similar clay brick paver projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, year completed, and include names and address of owners' contact person.

## SECTION 321416 - BRICK UNIT PAVING

### 1.6 QUALITY ASSURANCE

- A. **Installer Qualifications:** Installer shall have not less than three years' experience with at least 75-100,000 square feet installed. Successful completion of five similar clay brick paver installations similar in design which are to be documented. Installer shall include the specified product(s) in their bid and shall have read and understand the contents of ASTM C 902 and C 1272.
- B. **Source Limitations:** Obtain each type of brick unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- C. **Dimensional Uniformity:** The entire order for all material including waste must be ordered and blended at the manufacturer's plant at one time, so that they can be supplied from one production run or sequential production runs to ensure reasonable dimensional uniformity. The manufacturer shall earmark the plant-blended pavers ordered for this Contract.
- D. **Preinstallation Meetings:** Conduct pre-installation meeting one week prior to commencing work of this Section to verify project requirements, substrate condition, coordination with other trades, installation instructions, and warranty requirements. Preinstallation meeting shall include the Contractor, Installer, Engineer, Distributor and/or Manufacturer's Representative, and other interested parties as appropriate.
- E. **Inspections:** Inspect all materials upon delivery. Colors and size within a given shipment may vary slightly due to subtle changes in clay composition and kiln firing temperatures. Brick pavers are sealed with a siloxane-based penetrating sealer/water proofer.
- F. **Mockups:** Construct a mockup of not less than 12' x 12' to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. The Mockup shall include the herringbone "sidewalk" pattern, soldier course banding, brick accent pavers, and granite paver. Use mock-up(s) to determine pre-compaction setting bed level, joint sizes, lines, laying patterns, color and texture range, and workmanship. Do not start work until Engineer has approved mock-up. Remove mock-up and dispose of materials at the completion of the work or as directed by Engineer.

### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store brick pavers 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.

## SECTION 321416 - BRICK UNIT PAVING

- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Store asphalt cement and other bituminous materials in tightly closed containers.

### 1.8 PROJECT CONDITIONS

- A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace brick unit paver work damaged by frost or freezing.
- B. Weather Limitations for Bituminous Setting Bed:
  - 1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
  - 2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

## PART 2 - PRODUCTS

### 2.1 BRICK PAVERS

- A. Brick Pavers: Light-traffic paving brick; ASTM C 902, Class SX, Type I, Application PX . Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
  - 1. Manufacturers: Subject to compliance with requirements, provide pavers by the following :
    - a. Belden Brick Company.
  - 2. Thickness: 2-1/4 inches.
  - 3. Face Size: 4 by 8 inches and 8 by 8 inches as indicated on the drawings.
  - 4. Color: Regimental Full Range Paver A.
- B. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

### 2.2 ROADWAY BRICK PAVERS

## SECTION 321416 - BRICK UNIT PAVING

- A. Roadway Brick Pavers: Heavy vehicular paving brick; ASTM C 1272, Type R, Application PX. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.
  - 1. Manufacturers: Subject to compliance with requirements, provide pavers by the following :
    - a. Belden Brick Company.
  - 2. Thickness: 2-3/4 inches.
  - 3. Face Size: 4 by 8 inches.
  - 4. Color: Regimental Full Range Paver A.
- B. Efflorescence: Brick shall be rated "not effloresced" when tested according to ASTM C 67.

### 2.3 PAVER EDGE RESTRAINTS

- A. Aluminum Edge Restraints: "L" shaped, 1-5/8 inch high with 1-1/4 inch flange, rolled-edge extruded aluminum edging in 8-foot lengths, with splicers to connect individual lengths into an uninterrupted edging system. Base of edging to be provided with holes at 4-inch centers to receive 3/4-inch to 1-inch powder-actuated concrete nails. Aluminum to be alloy 6063 with T-6 hardness. Mill finish.
  - 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. Curv-Rite, Inc.: "Stable Edge". Size: 3/16" x 1-5/8".
    - b. Permaloc Corporation: "StructurEdge". Size: 3/16" x 1-5/8".

### 2.4 ACCESSORIES

- A. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.

### 2.5 BITUMINOUS SETTING-BED MATERIALS

- A. Primer for Base: ASTM D 2028, cutback asphalt, grade as recommended by brick paver manufacturer.
- B. Asphalt cement to be used in the bituminous setting bed shall be Performance Grade binder PG 64-28.

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- C. Fine aggregate to be used in the bituminous setting bed shall be clean, hard sand with durable particles and free from adherent coatings, lumps of clay, alkali salts, and organic matter. Aggregate shall be ASTM D 1073, No. 2 or No. 3.
- D. Fine aggregate shall be dried and shall be combined with hot asphalt cement, and the mix shall be heated to approximately 300 degrees F at the asphalt plant. The approximate proportion of materials shall be 7% asphalt cement and 93% fine aggregate.
- E. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

### 2.6 CONCRETE BASE SLAB

- A. Shall conform to Section 32 13 13 "Concrete Paving".

### 2.7 SAND FOR JOINTS

- A. High Performance Polymeric Jointing Sand for pavers. Color to be selected by Engineer and conform to the ASTM C-144 requirements for joint sand.
  - 1. Mixture of polymer binders and calibrated sand.
  - 2. Water resistant after 90 minutes
  - 3. For surface exposed to heavy foot traffic
  - 4. Applied dry- hardens after being misted
  - 5. Inhibits weed growth
  - 6. Deters ants and other insect infestations
  - 7. Resists erosion – water, frost heaving, wind, power washing, etc.
  - 8. Stabilizes pavers – strengthens interlocking pavers

### 2.8 BITUMINOUS SETTING-BED MIX

- A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F.

### 2.9 PEA STONE

- A. Crushed stone conforming to CDOT Form 816-2004, Article M.01.01, gradation No. 8.



## SECTION 321416 - BRICK UNIT PAVING

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Verify that the concrete base is at the correct elevation, and that the maximum variation of the concrete base is less than plus-or-minus 3/16 of an inch when a 10-foot straightedge is laid on the surface.
- C. Verify that concrete surfaces are free of oil, grease, paint, wax, curing compounds, primer, sealers, form release agents, or any deleterious substances and debris which may prevent or reduce bonding.
- D. Verify that concrete surfaces are cured, free from hydrostatic pressure, and have a moisture content of less than 5 percent.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Core-drill weep holes in concrete substrates at 24-inch centers at lowest elevations, and against curbs, walls, and other permanent structures. Fill holes with washed pea gravel and install temporary plugs to prevent ingress of setting bed material or neoprene adhesive during construction. Remove plugs when paving adjacent to weep holes.
- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

#### 3.3 INSTALLATION, GENERAL

- A. Do not use brick unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Mix brick pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- C. Cut brick unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- D. Joint Pattern: As indicated.

## SECTION 321416 - BRICK UNIT PAVING

- E. Tolerances: Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- F. Expansion Joints: Provide for sealant-filled joints at locations and of widths indicated. Install joint filler before setting pavers. Sealant materials and installation are specified in Section 32 13 73 "Concrete Paving Joint Sealants."
- G. Provide edge restraints as indicated. Install edge restraints before placing brick unit pavers.
  - 1. Install edge restraints to comply with manufacturer's written instructions. Anchor with 3/4-inch to 1-inch powder-actuated concrete nails at 4-inches to 12-inches on center spacing to hold edge restraints in place during and after brick unit paver installation.

### 3.4 BITUMINOUS SETTING-BED APPLICATIONS

- A. Apply primer to concrete slab immediately before placing setting bed.
- B. Prepare for setting-bed placement by locating 3/4-inch- deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of brick paving units to finished grades indicated.
- C. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg F. Strike setting bed smooth, firm, even, and not less than 3/4 inch thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars.
  - 1. Roll setting bed with power roller to a nominal depth of 3/4 inch. Adjust thickness as necessary to allow accurate setting of brick unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F.
  - 2. The compacted setting bed shall be 3/4 of an inch in thickness, plus-or-minus 1/8 of an inch.
- D. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling to a uniform thickness of 1/16 inch. Proceed with setting of brick paving units only after adhesive is tacky and surface is dry to touch.

### 3.5 BRICK PAVERS

## SECTION 321416 - BRICK UNIT PAVING

- A. Do not use brick pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- B. Cut brick pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full brick units without cutting where possible. Hammer cutting is not acceptable.
- C. Place brick pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid brick pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.
- D. Brick pavers shall be set true to the required lines and grades in the pattern detailed on the Drawings. Lay full brick pavers first and adjust brick pavers to form straight bond lines and appropriate joint widths. Provide 1/16" to 3/16" polymeric sand filled joints between brick pavers. Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- E. String lines or chalk lines must be used to keep brick paver bond lines straight and true. The straight and true bond lines shall not deviate more than +/- 1/2" at the end of 50 feet. Establish a center line working outward setting parallel string lines or chalk lines every 2 to 6 feet, depending on the area, to continuously check and adjust paver bond lines.
- F. Roll or compact bituminous-set pavers to achieve full bond with the setting bed, reduce lippage and improve the overall flatness of the surface. Fill the spaces between brick pavers in conformance with the polymeric sand producer's installation instructions and recommendations as soon as possible after the brick pavers have been placed. Clean joints of all debris with power air blowers or vacuums to ensure full penetration of the jointing sand. Sweep dry joint filling sand over surface of paving until all joints are completely filled. Once the initial filling of the joints is completed, roll the surface of the pavers to fully compact the pavers into place. Utilize a light rubber-tired roller with sufficient pressure to achieve a full bond to the setting bed or a 4-5000 LBF plate tamper with a protective mat attached. Do not operate the roller in a vibrating mode, as this may cause cracking of the pavers. Protect the surface with plywood or other suitable materials to prevent damage to the edges of the pavers. Perform rolling at the warmest part of the day, but prior to final set of the adhesive, taking care to ensure that the alignment is not altered. After rolling, add dry sand to the joints as necessary to ensure that the sand has penetrated to the bottom of the joints. Do not vibrate the pavers after they or the sand have been placed on the setting bed. Roll the surface when the sand shows no sign of further settlement. Add additional sand as necessary. Mist and

## SECTION 321416 - BRICK UNIT PAVING

rinse in conformance with the polymeric sand producer's installation instructions and recommendations.

- G. Do not permit traffic, including construction equipment, on pavers before joint filling. Disturbed areas of pavers should be taken up, the setting bed re-rolled and pavers re-laid. Remove cracked or damaged pavers and replace with new units. Protect areas where joints have not been filled with waterproof covering overnight
- H. Completed brick paver areas within the path of travel of any construction equipment shall be protected with steel road plates.
- I. Discontinue laying operations when weather conditions are such that pavement performance may be compromised. On laying operations recommencement, verify acceptable setting bed condition before further pavers are laid.

### 3.6 REPAIRING AND CLEANING

- A. Remove and replace brick unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 14 16

SECTION 32 16 13 – GRANITE STONE CURBING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Work required by this section of the Specifications consists of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection with the installation of granite stone curbing in accordance with the Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Cast-In-Place Concrete - Section 03 30 00.
- B. Earthwork – Section 31 00 00.

1.03 SUBMITTALS

A. Submit 6” width x 13” depth x 12” length and 6” width x 18” depth x 12” length size samples of both straight and curved granite stone curbing to indicate color, dimensions, and conformance to the Drawings.

PART 2 - PRODUCTS

2.01 GRANITE STONE CURBING

A. Granite Stone Curbing shall conform to the requirements of Article M.12.06 of the Standard Specifications, and the following requirements:

Requirement	Minimum Criteria	Testing Method
Bulk Density:	165 lbs/cubic foot	ASTM C-99
Absorption:	.37%	ASTM C-97
Compressive Strength:	23,000 psi	ASTM C-170
Modulus of rupture:	1,700 psi	ASTM C-99

Black vein rejection: Curbs with veins of black through the stone shall be rejected. Curbs with black spots, splotches, or streaks may be accepted if they do not detract from physical appearance of exposed surfaces.

## SECTION 32 16 13 – GRANITE STONE CURBING

Quartz vein tolerance: Curbs with quartz veins may be accepted. However, all stones with quartz veins must be examined very closely to ascertain whether a seam exists along joint between granite and quartz. This is characterized by a discoloration (black, pink, yellow) as fine as 1/16" along the joint. All such stones shall be rejected. Curbs with quartz veins shall be limited to 5% of total delivered and shall be evenly distributed throughout the limits of the Project. All others shall be rejected.

Finishes:

6" x 13" and 6" x 18" straight and curved Granite Stone Curbing:

Top: Thermal

All vertical sides: Sawn

Bottom: Sawn

All curbing installed with a 4" or 6" reveal shall have a buzzed edge (1/4" x 1/4" chamfer) on the traffic side top of the curbing.

- B. Granite shall be tough, dense, sound and durable, of uniform light color, reasonably fine grained and free from seams, cracks or other structural defects.
- C. Furnish curbs with sawed top, split face and ends. Straight pieces shall be a minimum of three (3) feet long. Curb segments on curves with radii of one hundred (100) feet or less shall be shaped to the required curvature, with the ends split on radial lines.
- D. Indicated dimensions for curb segments shall not vary more than two (2) inches for depth and one (1) inch for width.
- E. Top and front surfaces shall be true planes at right angles to each other, as seen with a straight edge. No projection greater than 3/4" or depression greater than 1/2" on the split surfaces will be acceptable. Top surface shall not vary more than 1/8".
- E. Drill holes will not be permitted in exposed curb surfaces.

### 2.02 MORTAR

- A. Mortar shall conform to the requirements of Article M.11.04 of the Standard Specifications.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Set curbs true to line and grade on a compacted granular fill base. Join curb sections

SECTION 32 16 13 – GRANITE STONE CURBING  
together leaving sufficient room for a ½” maximum mortar joint.

B. Place Class “C” concrete at joints as shown on the Drawings.

3.02 PROTECTION

C. Contractor shall maintain curbs at the proper alignment and elevation. Any curbing damaged during construction activities shall be replaced at no cost to the Owner.

END OF SECTION

## SECTION 32 16 23 – CONCRETE SIDEWALKS

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications consists of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection the installation of concrete sidewalks and concrete sidewalk ramps in accordance with the Drawings and these Specifications, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.
- B. The materials and methods specified herein are directly intended for placement of new concrete sidewalks and concrete sidewalk ramps. Where existing sidewalk is removed and replaced during construction, modifications to these Specifications to match existing conditions shall be made as directed by the Engineer.

#### 1.02 QUALITY ASSURANCE

##### A. Reference Standards:

- 1. The latest edition of the following standards, as referenced herein, shall be applicable:

- a. American Society of Testing and Materials (ASTM).
- b. American Concrete Institute (ACI).

- B. Concrete Testing Service: Engage a testing laboratory, to be named by the Engineer, to perform concrete tests and submit to state lab.
- C. Materials and installed Work may require testing and retesting at any time during progress of work. Retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- D. When proprietary items are used, follow manufacturer's recommendations.
- E. Materials, fabrication and erection procedures and concrete operations are subject to inspection and test in mill, shop and field, conducted by the Owner's Testing and Inspection Agency. Such inspections and tests will not relieve Contractor of his responsibility for providing materials and fabrication procedures in compliance with specified requirements. The inspections and tests, which the Owner's Testing and Inspection Agency performs, shall be at the expense of the Owner. Contractor shall provide free access to material stockpiles, facilities and the Work. Contractor shall cooperate with the Owner's Testing and Inspection Agency at all times.



## SECTION 32 16 23 – CONCRETE SIDEWALKS

- F. The Contractor shall notify the Engineer forty-eight (48) hours before placing concrete in order to give the Engineer an opportunity to inspect the formwork, reinforcing, and related items prior to placement of the concrete.

### 1.03 SUBMITTALS

#### A. Concrete:

1. The Contractor shall furnish the name and location of the concrete supplier.
2. Submit the design mix for each class of concrete prior to use in the Work.
3. Product Data: submit manufacturer's catalog cuts, specifications, and installation instructions.

- B. Test Results: The testing laboratory shall submit written reports of all tests, investigations, and recommendations to the Contractor and the Engineer.

## PART 2- PRODUCTS

### A. MATERIALS

#### 1. Concrete:

- a. All cast-in-place concrete shall be ready mixed concrete meeting the following criteria:
- b. 28 day compressive strength – 4000 psi.
- c. Air entrainment – 4% to 8%.
- d. Slump – 2" to 4".

- 2. Premolded Expansion Joint Filler: The premolded expansion joint filler shall be pre-cut to match the concrete sidewalk cross-sectioned dimensions as detailed on the Drawings.

- 3. Fabric Reinforcement: Flat sheets of 6 x 6 – No. 8, ASTM A185, welded wire fabric.

#### 4. Curing and Materials:

- a. Impervious Sheeting: ASTM C171.

## SECTION 32 16 23 – CONCRETE SIDEWALKS

- b. Liquid Membrane Curing Compound: ASTM C309, compound shall be free of paraffin or petroleum, “Kure-N-Seal 0800” by Sonneborn, “Cure & Seal” by Symons, or approved equal.
5. Sealants: Joint Sealers: ASTM D1850.
6. Forms:
- a. Sidewalk forms shall be of wood or steel, straight of sufficient strength to resist springing during depositing and consolidating concrete, and of a height equal to the full depth of the finished sidewalk.
  - b. Wood forms shall be surfaced plank, two (2) inch nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of ten (10) feet, with a minimum of three (3) stakes per form, at maximum spacing of four (4) feet. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Radius bends may be formed with  $\frac{3}{4}$ ” boards, laminated to the required thickness.
  - c. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Form ends shall be interlocked and self-aligning. Forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Forms shall have a nominal length of ten (10) feet, with a minimum of two (2) welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips, designed for use with steel forms.
7. Detectable Warning Tiles: Heavy duty, cast iron, ADA compliant, Neenah Foundry or approved equal.

### PART 3 - EXECUTION

#### 3.01 INSPECTION

- A. The Contractor shall notify the Engineer twenty-four (24) hours before placing concrete in order to give the Engineer an opportunity to inspect the formwork, reinforcing and related items prior to placement of the concrete.
- B. Delivery tickets shall show the amount of cement, brand, and amount of all admixtures, in addition to information required by ASTM C94, Section 14. Water added on the job shall be approved and the amount noted on the delivery ticket and initialed by the Contractor.

## SECTION 32 16 23 – CONCRETE SIDEWALKS

### 3.02 SUBBASE PREPARATION

- A. Concrete sidewalk shall be constructed on a compacted granular subbase as shown on the Drawings.
- B. The completed subbase shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.
- C. The subbase shall be maintained in a smooth, compacted condition in conformity with the required section and established grade, until the concrete is placed.
- D. The subbase shall be in a moist condition when concrete is placed.
- E. The subbase shall be prepared and protected so as to produce a subbase free from frost when the concrete is deposited.

### 3.03 FORMWORK

- A. Earth cuts may not be used as forms for vertical surfaces.
- B. All forms shall be built mortar tight and of materials sufficient in strength to hold concrete without bulging between supports. Forms shall be maintained to eliminate the formation of joints due to shrinkage of the forms. Concrete, misshapen by bulges or deformations caused by inadequate forms, shall be removed or corrected as ordered by the Engineer. All replacements or corrections shall be made at the Contractor's expense.
- C. All surfaces of wooden forms that will be in contact with exposed concrete shall be thoroughly treated with an approved lacquer in the procedure recommended by the manufacturer. Forms so treated shall be protected from being damaged or dirtied prior to placing of the concrete.
- D. Metal forms shall be treated with an approved form lacquer or may be treated with an approved form oil. The metal used for forms shall be of sufficient thickness to remain true to shape. All bolt and rivet heads shall be designed to hold the forms rigidly together and to allow removal, without injury to the concrete. Metal forms which do not have smooth surfaces, correct alignment and clean surfaces shall not be used.
- E. Side forms shall not be removed for twelve (12) hours after finishing has been completed.

### 3.04 CONCRETE PLACEMENT AND FINISHING

- A. Preparation: Set forms true to line and grade and anchor rigidly in position.

## SECTION 32 16 23 – CONCRETE SIDEWALKS

- B. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Longitudinal expansion joints shall be installed between concrete sidewalk and abutting concrete curb, continuously. Transverse expansion joints shall be installed equally at not more than twenty (20) feet on center, unless otherwise directed by the Engineer, or as detailed on the Contract Drawings.
- C. Transverse expansion joints shall be filled with ½” joint filler strips. Joint filler shall be placed with top edge ¼” below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Protect the top edge of the joint filler during concrete placement with a temporary cap and remove after concrete has been placed.
- D. Expansion joints shall be formed about structures and features that project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated. The filler shall be installed in such manner as to form a complete, uniform separation between the structure and sidewalk pavement.
- E. Placement of Fabric Reinforcement:
  - 1. Prior to placement, clean reinforcement thoroughly of mill and rust scale and of coatings which could destroy or reduce bond. Where there is a delay in depositing concrete after the positioning of reinforcement, re-clean reinforcement, if necessary.
  - 2. Place reinforcement midway between top and bottom of the slab and secure against displacement.
  - 3. Lap edges and ends of adjoining sheets of fabric reinforcement at least half the mesh width. Offset end laps in adjacent sheets to prevent continuous joints at ends. Interrupt reinforcement at expansion joints, stopping two (2) inches from edges.
- F. Concrete Placement:
  - 1. Concrete shall be placed in the forms in one (1) layer of such thickness that when compacted and finished the sidewalk will be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted.
  - 2. The concrete shall be tamped and consolidated with a suitable wood or metal tamping bar, and the surface shall be finished to grade with a wood float. Finished surface of the walk shall not vary more than 3/16” from the testing edge of a twenty (20) foot straightedge. Irregularities exceeding the above shall be satisfactorily corrected. The

## SECTION 32 16 23 – CONCRETE SIDEWALKS

surface shall be divided into rectangular areas by means of contraction joints spaced at intervals shown on the drawings.

3. Place concrete in accordance with ACI 301 unless otherwise specified herein.
4. Cold Weather Concreting: Comply with ACI 305 for placement at temperatures of, or expected to be, below 40°F.
5. Hot Weather Concreting: Comply with ACI 306 for placement at temperature of, or expected to be, above 90°F.

### G. Concrete Finishing:

1. After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, or as otherwise shown on the drawings.
2. All slab edges, including those at formed joints, shall be finished carefully with an edger having a radius of  $\frac{1}{8}$ ". Corner and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.
3. The completed surface shall be uniform in color and free of surface blemishes and tool marks.

### 3.05 CURING

#### A. Impervious Sheeting Method:

1. The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light colored side up and overlapped twelve (12) inches when a continuous sheet is not used.
2. The curing medium shall not be less than eighteen (18) inches wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or by placing a bank of moist earth along edges and laps in the sheets.
3. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than seven (7) days.

## SECTION 32 16 23 – CONCRETE SIDEWALKS

### B. Membrane Curing Method:

1. The entire exposed surface shall be cured with a membrane forming curing compound.
2. Curing compound shall be applied in two (2) coats by hand operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats, unless otherwise approved by the Engineer based upon manufacturer's data.
3. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Apply an additional coat to all surfaces showing discontinuity, pinholes or other defects.

C. Concrete surfaces that are subjected to heavy rainfall within three (3) hours after curing compound has been applied shall be re-sprayed by the above method and at the above coverage at no additional cost to the Owner.

D. Expansion-joint openings shall be sealed at the top by inserting moistened paper or fiber rope or covering with strips of waterproof paper prior to application of the curing compound, in a manner to prevent the curing compound entering the joint.

E. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected for seven (7) days from pedestrian and vehicular traffic and from any other action that might disrupt the continuity of the membrane. Any area covered with curing compound and damaged by subsequent construction operations within the seven (7) day curing period shall be re-sprayed as specified above at no additional cost to the Owner.

### 3.06 SEALING JOINTS

A. At the end of the curing period, expansion joints shall be carefully cleaned and filled with joint sealer. Concrete at the joint shall be surface dry, and the atmospheric and pavement temperatures shall be above 50°F, at the time of application of joint sealing materials.

B. Joints shall be filled flush with the concrete surface in such manner as to minimize spilling on the walk surface. Spilled sealing material shall be removed immediately and the surface of the walk cleaned. Dummy groove joints shall not be sealed.

### 3.07 BACKFILLING AND RESTORATION

A. After curing, debris shall be removed, and the area adjoining the concrete shall be backfilled,

SECTION 32 16 23 – CONCRETE SIDEWALKS

graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

- B. All lawns, pavements, driveways, shrubs, or other improvements affected by sidewalk placement shall be restored to their original condition.

END OF SECTION

## SECTION 32 33 00 – SITE FURNISHINGS

### PART 1 - GENERAL

#### 1.01 SCOPE OF WORK

- A. The Work required by this Section of the Specifications consists of the furnishing of all labor, plant, equipment, tools, materials and incidentals, and the performing of all operations in connection with all Work necessary to provide the complete installation of site furnishings in accordance with the Drawings, or as directed by the Engineer, or as necessary for the proper completion of the intended Work.

#### 1.02 SUMMARY

- A. Section includes:

- 1. Bicycle racks.

#### 1.03 RELATED WORK SPECIFIED ELSEWHERE

- D. Earthwork – Section 31 00 00.
- E. Cast-In-Place Concrete - Section 03 30 00.

### PART 2 – PRODUCTS

#### 2.01 BICYCLE RACKS

- A. Bicycle Racks as shown on the Contract Drawings and manufactured by:

Cycle Safe, Inc.  
5211 Cascade Road, SE, Suite 210  
Grand Rapids, MI 49546  
800-950-6531

- B. Concrete: Concrete shall be in accordance with the Contract Drawings details and Section 03 30 00 - Cast-In-Place Concrete.

### PART 3 - EXECUTION

#### A. GENERAL

- 1. Locate all site furnishings in field by staking for approval by the Engineer prior to excavation or installation.
  - 2. Furnish and install all site furnishings in the locations shown on and in accordance with



SECTION 32 33 00 – SITE FURNISHINGS

the Contract Drawing details, Specifications and the manufacturers installation instructions.

3. Do not install site furnishings before final grading is completed, unless otherwise permitted.
4. Clean all site furnishings with water spray or hand scrub to remove dirt and debris. Protect from damage by subsequent construction activities.
5. Execution and installation shall meet or exceed the minimum requirements as depicted on the contract details.
6. Meet or exceed all requirements as outlined by the manufacturers.

END OF SECTION

## SECTION 32 90 00 - PLANTING

### PART 1 - GENERAL

#### 1. RELATED DOCUMENTS

1

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

#### 1. SUMMARY

2

##### A. Section Includes:

- 1. Ground cover
- 2. Plants
- 3. Mulching
- 4. Seeding
- 5. Sodding

##### B. Related sections

- 1. Section 312000 – Earth Moving
- 2. Section 321416 – Brick Sidewalks
- 3. Section 321613 – Cast-In-Place Concrete Curbs
- 4. Section 321613.43 – Stone Curbs

#### 1.3 DEFINITIONS

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- E. Root Protection Zone (RPZ): An area indicated on the plans where construction activities are to be conducted under the supervision of a licensed arborist to help protect existing trees of significance during construction. The RPZ is calculated by providing 2' of radius from the existing tree trunk for every inch of diameter at breast height (DBH). For example a tree with a 12" DBH will require a 24' radius of RPZ.
- F. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- G. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic

SECTION 32 90 00 - PLANTING

matter and soil organisms.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Planting Soil Mix
- C. Topsoil Analysis for Lawn Areas:
  - 1. Furnish soil analysis by a qualified soil-testing laboratory.
  - 2. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
  - 3. Report suitability of topsoil for lawn growth. Provide "textural analysis – percentage of sand, silt and clay". PH and laboratory recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.
  - 4. Topsoil shall meet the following parameters:

<u>Parameters</u>	<u>Range</u>
a. Sand Content	50% – 70% of total weight
b. Organic Matter Content	6% – 10% (dry weight basis)
c. Clay	< 10% (by weight)
d. Silt	10% - 15% (by weight)
e. pH	5.5% - 7%
f. Foreign Matter	< 0.05% (by weight)
- D. Product certificates. For plant material see Connecticut DOT Form 816 Section M.13.07 – Plant Materials
  - 1. Certification of grass seed.
    - a. Certification of each seed mixture for turf grass and sod.
- E. Sod
  - 1. The sod grower shall provide a particle size analysis of the soil on which the sod is grown from a laboratory certified by the American Association for Laboratory Accreditation, results submitted to the Owner prior to the site visit to inspect the sod
  - 2. Certification of the cultivars comprising the sod shall be submitted along with grower’s information. Certification must be submitted to and approved by the Owner before delivery to the site.
- F. Fertilizer: Product Tags
- G. Planting Schedule: Indicating anticipated planting dates for exterior plants.
- H. Maintenance Instructions: See Contract Drawings.
- I. Equipment to install, grade, and fine grade topsoil: Contractor is to submit for approval all equipment he intends to use for this work.
- J. Mulch: One gallon pale.

## SECTION 32 90 00 - PLANTING

- K. Tree Protection - submit the following:
  - 1. Copy of arborist license
  - 2. Recommendations from the licensed arborist for construction within the critical root zones.
- L. Fine grading technique - must be submitted by the Contractor to the Town and to the Landscape Architect for review and approval at least two (2) weeks before fine grading has started.

### 1.5 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.
- B. Protection of existing specimen tree (Sycamore) and other mature shade trees: Excavation and construction within the root protection zone, as shown on the plans, shall be performed under the supervision of a CT licensed arborist.
- C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- D. Form 816 - State of Connecticut Department of Transportation "Standard Specification for Road, Bridges, and Incidental Construction" 2004 edition and latest supplements shall be used for materials compliance and execution of the work in this section.
- E. Pre-installation Conference: Conduct conference at Project site.

### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery and handling.
- B. Handle planting stock by root ball.
- C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.
- D. Sod: Harvest, deliver, store, and handle sod according to requirements in Turf Product Industry's "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

### 1.7 WARRANTY

- A. Special Warranty: Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.

## SECTION 32 90 00 - PLANTING

- B. Failures include, but are not limited to, the following:
  - 1. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.
  - 2. Structural failures including plantings falling or blowing over.
- C. Warranty Periods from Date of Substantial Completion:
  - 1. Trees: One year.
  - 2. Shrubs, Ground Cover and Plants: One year.

### 1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Provide full maintenance by skilled employees of landscape installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings and lawn are acceptably healthy and well established, but for not less than maintenance period below.
  - 1. Maintenance Period for Trees and Shrubs: 12 months from date of planting completion.
  - 2. Maintenance Period for Ground Covers and Plants: 12 months from date of planting completion.
  - 3. Seeded Lawns: 90 days from date of Substantial Completion.
    - a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

## PART 2 - PRODUCTS

### 2.1 GENERAL PLANT MATERIAL REQUIREMENTS

- A. All plant material shall meet the requirements from Connecticut DOT Form 816 Section M.13.07 – Plant Materials and those of which are listed below.

### 2.2 GROUND COVER PLANTS

- A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

### 2.3 PLANTS

- A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

### 2.4 TOPSOIL

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 6 percent and a maximum of 20 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
  - 1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled

## SECTION 32 90 00 - PLANTING

surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

- a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

### 2.5 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

### 2.6 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 7 decisiemens/m.
- B. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.
- C. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
- D. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

### 2.7 FERTILIZER

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 10 percent phosphoric acid.
- B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  1. Composition: 293 lbs. per acre of 10-10-10.
- C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
  1. Composition: 142 lbs. per acre of 20-10-10.

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### 2.8 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.
- C. Bark Mulch: Double ground or shredded bark mulch without dye or colorization from hardwood trees including hemlock, fir, cedar, or pine.

### 2.9 PLANTING SOIL MIX

- A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
  - 1. Ratio of Loose Compost to Topsoil by Volume: 1:4.
  - 2. Ratio of Loose Peat to Topsoil by Volume: 1:4.
  - 3. Ratio of Loose Wood Derivatives to Topsoil by Volume: 1:4.
  - 4. Weight of Lime per 1000 Sq. Ft.: per PH test to achieve 6.0 – 6.5.

### 2.10 SEED

- A. Grass Seed: Seed shall be a blend of certified lawn grasses as specified on the Contract Drawings. Provide fresh, clean, new-crop seed complying with established tolerances for germination and purity in accordance with the U.S. Department of Agriculture Rules and Regulations under the latest edition of the Federal Seed Act. Seed shall be mixed by the dealer and shall be delivered to the site in sealed containers that bear the Dealer's guaranteed analysis.
- B. Seed Species: The seed mixture shall be as shown on the Contract Drawings, or approved equals. Refer to the Contract Drawings for seed types for different grass areas/zones.

### 2.11 TURFGRASS SOD

- A. Turfgrass Sod: Complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.
- B. Turfgrass Species: Sod of grass species as follows:
  - 1. Sod shall be "Black Beauty" composed of a blend of Turftype Tall Fescue cultivars as grown by SODCO, 757 Indian Corner Rd, Slocum, RI 02877, (401) 294-3100, or approved equivalent, cut at a uniform thickness of ¾ inch +/- ¼ inch and shall be free of weeds, disease and other imperfections.
  - 2. The sod shall come from a field in which the sod is grown on a sand or on a loamy sand with greater than 85% sand and shall have been mowed at a mowing height of no greater than 1 ½ inches high (bench setting). The sod shall not be more than 18 months in age. Submit sod source for approval prior to arrival of sod on site. The owner reserves the right to order testing of sod soil prior to delivery on site.

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3. The names of the cultivars comprising the sod shall be submitted and approved by the Owner before delivery to the site. The Owner will inspect the sod field prior to purchase and delivery. The sod shall be planted within 24 hours of the time of harvest using a track installer machine. Owner reserves the right to reject sod pieces that are damaged or show injury. These shall be lifted and replaced with new sod immediately.

### PART 3 - EXECUTION

#### 3.1 GENERAL LANDSCAPING DESCRIPTION

- A. The landscaping associated with this project includes installation of street trees in planting pits with tree grates, structural soil trench for street trees, tree plantings in lawn and plant bed areas, median plantings consisting of shrubs, perennials, groundcovers and ornamental grasses, sod lawn areas, vine planting along a green screen, and associated work.

#### 3.2 TREE ROOT PROTECTION

- A. **Special Instructions** for protection of existing the specimen sycamore tree and other mature trees: Excavation and construction within the root protection zone, as shown on the plans, shall be performed under the supervision of a CT licensed arborist. The contractor shall engage a licensed arborist to evaluate protective measures for work within the root protection zone and within the vicinity of the historical tree. Submit recommendations to the Town for review, approval and coordination with the provisions stated in this tree root protection section.
- B. All tree protection and maintenance work shall be performed in compliance with the National Arborist Association and the American National Standards Institute (ANSI) Publication: ANSI Z 133.1 "Safety Requirements for Pruning, Trimming, Repairing, Maintaining and Removing Trees, and for Cutting Brush."
- C. The Contractor, the Town representative and inspector, and the Landscape Architect shall meet on the site to discuss all aspects of tree protection and maintenance prior to the commencement of any work, including clearing and grubbing operations. This meeting will include the field inspection of the staked limit of grading to review the existing vegetation and to identify any field modifications to the work.
- D. No excavated material or construction materials are to be stockpiled within the drip line of any tree. Tree root systems shall be protected from smothering, flooding, erosion, and excessive wetting resulting from dewatering operations; and from run-off, spillage, and drainage of solutions containing materials which would be deleterious to tree roots. Parking and vehicular traffic will not be permitted within the tree's drip lines. Foot traffic over tree roots shall be restricted to prevent excessive compaction of soil over root systems.
- E. **Root Pruning:** The Contractor shall operate a trenching machine, vibratory knife, or rock saw along the outside limits of grading prior to clearing and grubbing operations. The activity involves clean cutting tree roots to minimize the construction activity shock to the affected trees. Unless otherwise instructed by the Engineer, root pruning shall be performed to a depth of 3.0 feet only in the vicinity of existing trees. When a trenching machine is used, the trench shall be immediately backfilled with soil removed or organic soil. This root pruning operation shall occur prior to protective fencing and clearing and grubbing.



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- F. Care must be taken to cut all roots clean by either hand or mechanical methods in accordance with the best horticultural practice.

### 3.3 TREES AND SHRUBS

- A. Excavation of Pits and Trenches for Shrubs: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
- B. Excavation of Pits and Trenches for Trees: Excavate circular pits with sides sloped inward. Install and compact approved soil mix at bottom of pit as shown on the Contract Drawings leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.
  - 1. Excavate at least two times as wide as root ball diameter.
  - 2. Assure that pit or trench is free draining at a rate of 1.5" per hour or greater. Make necessary improvements so plant does not sit in standing water or in a "bath" condition.
- C. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
- D. Stock with Root Balls: Set trees and shrubs plumb and in center of pit or trench with top of root ball flush with adjacent finish grades.
  - 1. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 2. Container Grown: Carefully remove root ball from container without damaging root ball or plant.
  - 3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
- E. Organic Mulching: Apply 4-inch average thickness of double shredded bark mulch extending 12 inches beyond edge of planting pit or trench. (No dyed mulch) Do not place mulch within 3 inches of trunks or stems.
- F. STAKING
  - 1. Stake trees per Contract Drawings. Ensure guy wires are securely fastened to prevent wind damage to trunk and rootball.
- G. TREE AND SHRUB PRUNING
  - 1. Remove only dead, dying, or broken branches. Do not prune for shape.

### 3.4 GROUND COVER AND PLANT PLANTING

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- A. Set out and space ground cover and plants as indicated on the Contract Drawings.
- B. Dig holes large enough to allow spreading of roots and backfill with planting soil.
- C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
- E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### 3.5 PLANTING BED MULCHING

- A. Mulch backfilled surfaces of planting beds and other areas indicated.
  - 1. Mulch: Apply 4-inch average thickness of double shredded bark mulch, and finish level with adjacent finish grades. No dyed mulch. Do not place mulch against plant stems. Bark may be derived from hardwood species such as pine, hemlock or cedar.

### 3.6 PLANT MAINTENANCE

- A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.
- B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.
- C. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

### 3.7 LAWN PREPARATION

- A. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
  - 1. Test existing topsoil per recommendations above.
  - 2. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
  - 3. Loosen surface soil to a depth of at least 8 inches.
  - 4. Per recommendations of the soil testing agency, apply soil amendments and fertilizers according to standard turf grass management practices and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
    - a. Apply fertilizer directly to surface soil before loosening.
  - 5. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.

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6. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

B. Finish Grading: The topsoil shall be fine graded (micro graded) to the proposed lines and grades as indicated on the Contract Documents. The fine grading shall be conducted with laser grading techniques. Very closely spaced grade staking and string lines will not be accepted. The fine grading technique must be submitted by the Contractor to the Engineer for review and approval at least two (2) weeks before fine grading has started. Fine grading must result in a maximum tolerance from proposed grade of  $\pm \frac{1}{2}$ " with no areas where water may puddle and/or pond. Any additional topsoil needed to produce the required grading will be supplied and placed by the Contractor.

1. All equipment used to install, grade and fine grade topsoil shall be low ground pressure equipment suitable for the installation. Contractor is to submit for approval all equipment he intends to use for this work. Large loaders, bulldozers, and earthmoving equipment will not be allowed on the topsoil during placement or after rototilling. Equipment weighing of 16,000 pounds and equipment with high ground pressure contact will not be allowed on the turf areas after topsoil has been placed or rototilled without the approval of the Engineer.
2. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
3. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

### 3.8 SEEDING

- A. Furnish and apply seed to the topsoil with a mechanical seeder.
- B. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
- C. Sow seed at rates shown on the Contract Drawings. Apply seed evenly in two (2) directions with a mechanical seeder.
- D. Hydroseeding is not acceptable.
- E. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.
  1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

### 3.9 EROSION CONTROL MATTING

- A. Erosion control matting shall be installed in accordance with the manufacturer's recommendations in the locations indicated on the Contract Drawings or as directed by the Engineer.
- B. Where two lengths of matting are joined, the end of the up-grade strip shall overlap the down-

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grade strip.

- C. The Contractor shall maintain and protect the areas with erosion control matting until such time as the turf grass is established. The Contractor shall replace or repair at his own expense any and all erosion control matting areas damaged by fire, water or other causes including the operation of construction equipment. No mowing will be required in the locations where erosion control matting is installed.

### 3.10 SODDING

- A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with topsoil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
  - 1. Lay sod across angle of slopes exceeding 1:3.
  - 2. Retain subparagraph below if required. Steel staple anchors are commonly used.
  - 3. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage
- C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

### 3.11 LAWN MAINTENANCE

- A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation.
- B. Mow lawn as soon as top growth is tall enough to cut (4 inches). Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing.

### 3.12 SATISFACTORY LAWNS

- A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
- B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

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