Town of Westwood

Westwood High School Practice Field

Contract No. DPW-22-C-023

January 2022

Technical Specifications

_____

Professional Registration No.:

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MARCH 2022

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PART V

TECHNICAL SPECIFICATIONS

MARCH 2022

TECHNICAL SPECIFICATIONS
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SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this Section shall consist of the installation of temporary fence, erosion control, plant protection devises noted on the plans and Contract Documents.

1. Temporary fence: Contractor shall erect as necessary to secure the site for the purpose of public safety. The work shall include furnishing, installing, maintaining, removing, resetting, and final removal of chain-link fence in a location directed by the Engineer. The fence shall be used to close off the construction area from adjacent sidewalks and public ways whose use conflicts with the construction activities.
2. Compost filter tubes: Where indicated on the drawings or where directed by the Engineer, the Contractor shall install and maintain compost filter tubes in designated areas of the limit of work. The purpose is for filtering suspended sediments from storm water flow. All tubes shall be tamped to ensure good contact with soil.
3. Silt Sacks shall conform to the relevant provisions of Section 670 of the Standard Specifications and consist of the furnishing, installing, maintaining, and removing silt sacks from all catch basins, drop inlets, and gutter inlets within the limit of work, or otherwise required.

B. Work under this Section shall consist of:

1. BASE BID
   a. The careful removal and disposal of the existing synthetic turf field.
2. ADD ALTERNATE #1
   a. The careful removal and disposal of the existing synthetic turf within the existing lacrosse court.
3. ADD ALTERNATE #2
   a. The careful removal and disposal of the top course of bituminous paving around the synthetic turf field.
4. ADD ALTERNATE #3
   a. The careful removal and disposal of damaged portions of the existing chain link fencing at the practice field.
5. ADD ALTERNATE #4
   a. The careful removal and disposal of existing natural turf at the locations shown for proposed concrete pads for bleachers.
6. ADD ALTERNATE #5
   a. The careful removal and disposal of the existing backboards and hoop systems at the existing basketball court.

C. Work shall be done in accordance with the contract drawings, these specifications, and Engineer's requirements. Provide all labor, equipment, materials and transportation necessary to complete the work.

D. Related Sections

1. Section 02300 – Earthwork
2. Section 02745 – Bituminous Pavement

3. Section 02790 – Synthetic Turf
4. Section 02880 – Play Field Equipment
5. Section 02920 – Loam and Seed
6. Section 03300 – Cast-in-Place Concrete

1.02 DEFINITIONS

A. Clearing: Removal of trash, vegetation, or organic matter alive or dead.

B. Grubbing: Removal of vegetation including stumps, buried logs and roots.

C. Scalping: Removal of grass turf to a depth of 3 inches.

D. Stripping: Removal of topsoil.

1.03 QUALITY ASSURANCE

A. Obtain Engineer's approval of staked work limits prior to starting site preparation Work.

1.04 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Install erosion and sediment controls prior to starting the Work.

B. Existing Conditions: Temporarily remove property improvements, to the minimum extent necessary, to complete the work and restore improvements to condition which existed prior to construction.

PART 2 - MATERIALS

2.01 TEMPORARY FENCE

A. Fencing shall conform to the relevant provisions of Section 644 of the Standard Specifications. The Contractor will be responsible for providing the Engineer with an acceptable method for the installation of the temporary fence that will provide for pedestrian and worker safety and security for which it is intended.

B. All posts, including but not limited to, end, corner, and intermediate brace posts, and all gates and gate posts, shall be provided by the Contractor. Materials shall be in good condition, shall not be deteriorated, nor in a condition which in any way may jeopardize the safety and security purposes intended.

C. All materials shall meet the approval of the Engineer.

2.02 COMPOST FILTER TUBE

A. Material for the filter tubes shall be compost meeting M1.06.0, except that no manure or bio- solids shall be used. In addition, no kiln-dried wood or construction debris shall be allowed. Particle size analysis: 98% shall pass through a 3-inch (75mm) sieve; 30-50% shall pass 3/8 inches (10mm) sieve. Tubes for compost filters shall be 12 inches (300 mm) in diameter. Tube material shall be a knitted mesh with 1/8" - 3/8" (3-10 mm) openings and made of biodegradable (cotton or jute) materials. Photodegradable (HDPE or polypropylene) fabric may be used; however, photodegradable fabric must be removed and

disposed of by the contractor, at his expense, at the end of the contract. Additional tubes shall be used at the direction of the Engineer. Stakes for anchors, if required, shall be nominal 2 x 2 stakes. Compost Filter Tubes shall be removed and disposed at the end of the Contract.

B. Submit product data for Designer approval.

2.03 DRIPLINE PROTECTION

A. Provide a minimum 48-inch-tall barrier that remains vertical and effective (not sagging) for the duration of period required. Fence shall be orange plastic safety fence (recommended where high visibility is necessary), wooden snow fencing, or other material as noted on the plans or directed by CLIENT.

B. Dripline Protection shall consist of furnishing, installing, removing and resetting, maintaining fence in a vertical and effective position at all times, and final removal. Protection shall be for the duration of the construction activities unless otherwise directed.

2.04 TREE TRUNK PROTECTION

A. Trunk Protector shall be one of the following or approved equal:
1. "ArborGard" AG 9-4 as supplied by Deep Root Partners, L.P. of San Francisco, CA
2. "BarkSavers" corrugated ADS pipe available through Red Hed Supply, North Hatfield, MA
3. Corrugated Tree Guard Model TW48-12 as supplied by Farm Wholesale AG of Salem, OR

2.05 SILT SACK

A. Silt sacks shall be made out of woven polypropylene geotextile fabric and sewn by a double needle machine, using a high strength nylon thread. Devices shall be ACF Environmental (800)-448-3636; Reed & Graham, Inc. Geosynthetics (888)-381-0800; The BMP Store (800)-644-9223; or approved equal.

B. Silt sacks shall be manufactured to fit the opening of the catch basins. Silt sacks shall be manufactured with two dump straps attached at the bottom of the silt sack. Silt sacks shall have a ¼-inch nylon expansion restraint rope with 2-inch flat washers to keep the sides of the silt sacks away from the catch basin walls. Silt sacks shall be manufactured so that they have a certified average wide width strength per ASTM D-4884 standards of 165.0 lb/in for regular flow.

C. Submit product data for approval by Engineer/Designer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Utilities

1. **Notify and coordinate with Algonquin Gas. Gas line runs alongside practice field between parking lot and practice field.**
2. Notify Owner to turn off affected services prior to demolition.
3. Remove utilities to be abandoned as a result of demolition.
4. Seal water, sewer, drainage and gas utilities and services as shown on Contract Drawings or as required or as directed by CLIENT, using plugs, caps or seals as needed.

3.02 PROTECTION

A. Do not cut or injure any trees or other vegetation outside the limits of disturbance and/or permanent easement, as indicated on the drawings.

B. Trees, shrubbery, or planting, along access areas, shall not be removed except with the written approval of the Engineer.

C. Preserve certain vegetation such as trees, shrubs, hedges, and plants within the construction area, as indicated on the drawings to be protected.

D. Work in Improved Property
1. Protect trees, cultivated hedges, lawns, shrubs, and plants that might be damaged by the Contractor's operations.
2. Temporarily replant and care for trees less than 4 inches in diameter that would be damaged by the construction operation. After the construction operations have been substantially completed, replant in their original positions and care for until growth is reestablished. If trees, cultivated hedges, lawns, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced at the Contractor's expense by items of kind and quality existing at the start of the work.
3. Do such handwork as may be required to prevent damage to buildings and improvements.
4. Protect existing pavements, edgings, curbings fences, stone walls and if needed to be removed to facilitate construction or if damaged, upon completion of the work, properly restore or repair to at least as good condition as existed prior to start of the work.

3.03 SITE FEATURES

A. Items referenced on plans, or as indicated by the Engineer to be removed and disposed shall be removed in their entirety, including footing, from the site and properly and legally disposed of by the Contractor.

B. Items referenced on the plans to be removed and reset shall be carefully removed and immediately reset in a manner and location designated by the plans or Engineer or stored on site or transported to a storage facility and unloaded and stacked for reinstallation later as shown on the plans or as indicated by the Engineer.

3.04 TREE TRIMMING AND PRESERVATION

A. Cut back limbs and branches of trees to be preserved only to the extent necessary for construction and as directed by the Engineer.

B. Work will include any incidental pruning of branches and limbs of trees which hinder the healthy growth or that conflict with new improvements or restrict horizontal or vertical clearances. The trees to be trimmed shall be determined by the Engineer and all work shall be done to the satisfaction of the Engineer. The quality and method of work must conform to accepted tree trimming practices. All trees trimming work will be performed by a Massachusetts Certified Arborist. A copy of the Arborist’s current certification will be

provided to the Engineer prior to the start of the work. The method of disposal of cutting shall be the responsibility of the Contractor. No tree shall be removed prior to the approval of the Engineer.

C. Perform preservation work to protect and retain high-value trees to be retained within the project limit as shown on the plans. Work to include root pruning, and excavation by hand digging or excavation for removal of soil within the tree drip line at excavations for installing clean backfill within the project area. Contractor shall hire a Massachusetts Certified Arborist who will prepare a plan and be on-site to direct this work. Tools, machinery, and methods described in the Arborist's plan shall be approved by CLIENT prior to beginning of this work.

3.05 CLEARING

A. Cut or remove all trees, saplings, brush, and vines, windfalls, logs, and trees lying on the ground, dead trees, and stubs more than 1 foot high above the ground surface unless otherwise noted on the plans.

B. Except where clearing is done by uprooting with machinery or where stumps are left longer to facilitate subsequent grubbing operations, trees, stumps, and the stubs to be cleared shall be cut as close to the ground surface as practicable, but no more than 6-inches above the ground surface in the case of small trees, and 12-inches in the case of larger trees. Saplings, brush, and vines shall be cut off close to the ground.

C. Salvaged Wood
1. Logs, timber, and other wood removed in the course of clearing found to be acceptable, as determined solely by the Engineer, shall remain the property of the Owner, unless otherwise directed by the Engineer.
2. Cut logs, timber, and other wood in 4-foot lengths and stack, as directed by the Engineer.
3. Prior to the final completion of the contract, all unclaimed logs, timber, and other wood previously cut and stacked shall be removed from the site and properly disposed of by the Contractor at no additional cost to the Owner.

3.06 GRUBBING

A. Remove to a depth of 12-inches all roots larger than 3-inches in diameter.

B. Remove to a depth of 6-inches all roots larger than 1/2-inches in diameter.

C. Measure depths from the existing ground surface or the proposed finished grade, whichever is the lower.

3.07 STRIPPING

A. Strip topsoil, loam, and unsuitable earth from the ground surface in areas cleared and grubbed for the accessible trail surface.

B. Utilize topsoil and loam, where possible, for finished surfacing at the wetland replication, restoration areas or sides of the trail.

C. All loam to remain on site.

D. Dispose of unsuitable materials off site at authorized disposal location.

3.08 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

A. Dispose of cleared and grubbed materials off site at authorized disposal location.

B. Such disposal shall be carried on as promptly as possible after removal of material in the clearing and grubbing operations and shall not be left until the final period of cleaning up.

3.09 TEMPORARY FENCE

A. The Contractor shall be responsible for maintenance of the temporary fence and for ensuring that the work area remains secure and is inaccessible to the public at all times. Any removing and resetting of Temporary Fence by the Contractor to facilitate his construction operations shall be performed at no additional cost to the CLIENT. The temporary fence shall not be removed until the construction is completed, or until directed by the Engineer.

B. The Contractor shall replace and/or restore sections of fence damaged due to the construction, and/or accidents, vandalism or in any other manner for the duration of the project.

C. All work to furnish, install, relocate, and remove temporary fencing shall be considered incidental to and no separate payment will be made.

3.10 SILT SACK

A. When the expansion restraint rope is covered with sediment, the silt sack shall be emptied, cleaned, and placed back into the catch basin.

All material removed from the silt sacks shall be properly handled and disposed of by the Contractor, and this must be performed in accordance with all DEP regulations, policies, and guidance and at no additional compensation. The responsibility for the proper handling and disposal of this material shall be solely the Contractor's.

Material removed from silt sacks shall be transported immediately to the place of disposal in machines or trucks that will not spill the material along the roadway. Any material falling on the roadway shall be removed at the Contractor's own expense.

Silt sack cleanings are classified as a solid waste by the Massachusetts Department of Environmental Protection (DEP) and may be disposed of at any landfill that is permitted by DEP to accept solid waste. Materials containing free-flowing liquids are prohibited from being accepted at landfills. The DEP encourages the beneficial reuse of this material whenever possible; however, use not in accordance with DEP determination, or disposal or use as fill in an unapproved location is not acceptable.

It is anticipated that most, if not all, of the material will be landfilled, therefore the Contractor should be aware that many landfills may require testing and analysis of the material prior to accepting it for disposal at the facility.

B. The Contractor should be aware that in the event that the test results indicate a hazardous waste that cannot be landfilled, the Contractor shall be responsible for all costs associated with adhering to special regulations regarding disposal of hazardous waste. The Contractor should take this into consideration in preparing the bid.

C. Silt sacks shall remain in place until the placement of the pavement overlay or top course and the graded areas have become permanently stabilized by vegetative growth. All

materials used for the filter fabric will become the property of the Contractor and shall be removed from the site.

D. The Contractor shall inspect the condition of silt sacks after each rainstorm and during major rain events. Silt sacks shall be cleaned periodically to remove and disposed of accumulated debris as required. Silt sacks, which become damaged during construction operations, shall be repaired, or replaced immediately at no additional cost.

E. When emptying the silt sack, the contractor shall take all due care to prevent sediment from entering the structure. Any silt or other debris found in the drainage system at the end of construction shall be removed at the Contractor's expense. The silt and sediment from the silt sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site and used in construction.

F. All curb openings shall be blocked to prevent stormwater from bypassing the device.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

A. SITE PREPARATION shall be measured and paid for at the contract unit price per LUMP SUM and shall include all miscellaneous site preparation including the removal of site elements noted on the drawings including but not limited to play area surfacing, footings, tree removal and canopy pruning for construction clearances and all work items noted in the section that are not paid for under other pay items.

B. TEMPORARY FENCE shall be measured and paid for at the contract unit price per LINEAR FOOT, complete in place a specified herein, including all installation materials, removing and re-setting fence as many times as necessary to protect active work zones and all other incidentals required.

C. COMPOST FILTER TUBE shall be measured and paid for at the contract unit price per LINEAR FOOT consisting of staked compost filter sock installed and maintained in place and removed when no longer required.

D. DRIPLINE PROTECTION shall be measured and paid for at the contract unit price per LINEAR FOOT as specified herein.

E. TREE TRUNK PROTECTION shall be measured and paid for at the contract unit price per EACH as specified herein.

F. SILT SACK shall be measured and paid at the Contract Unit Price bid per EACH, complete in place, which price shall include all labor, materials, equipment, and incidental costs required to complete the work. No separate payment will be made for testing, inspections, maintenance, removal, and disposal of the sediment from the insert or for the final removal and disposal of the silt sack, but all costs in connection therewith shall be included in the Contract unit price bid.

4.03 PAYMENT ITEMS

ITEM	DESCRIPTION	UNIT
02200-1	Site Preparation	LS

02200-2	Temporary Fence	LF
02200-3	Compost Filter Tube	LF
02200-4	Dripline Protection	LF
02200-5	Tree Trunk Protection	EA
02200-6	Silt Sack	EA

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

B. Requirements for; excavating in earth for trenches, pavements and structures; backfilling excavations; furnishing necessary material; compaction; constructing embankments and fills; miscellaneous earth excavations and miscellaneous grading.

C. Related Sections

1. Section 02200 – Site Preparation
2. Section 02745 – Bituminous Pavement
3. Section 02790 – Synthetic Turf
4. Section 02920 – Loaming & Seeding
5. Section 03300 – Cast-In-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM).

D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

1.03 MEASUREMENT AND PAYMENT PROCEDURES

A. Test Pits

1. Where determination of the exact location of pipe or other underground structures or utilities is necessary for doing the work properly, the Contractor may be required to excavate test pits to determine such locations. When such test pits may be properly considered as incidental to other excavation, the Contractor shall receive no additional compensation, the work being understood to be included as part of the excavation.

1.04 SCHEDULING

A. The Contractor shall submit to the Engineer, for approval by the Owner, a progress schedule as specified herein.

1.05 DEFINITIONS

A. The following related items are included herein and shall mean:

1. Standard Specifications: The Commonwealth of Massachusetts, Department of Public Works, Standard Specifications for Highways and Bridges, latest edition.
2. ASTM: American Society for Testing and Materials.
3. AASHTO: American Society of State Highway and Transportation Officials.

1.06 EXAMINATION OF CONDITIONS

A. The Contractor shall fully inform himself of existing conditions of the site before submitting his bid and shall be fully responsible for carrying out all site work required to execute the work of the Contract fully and properly, regardless of the conditions encountered in the actual work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed.

B. Plans, surveys, measurements, and dimensions under which the work is to be performed are believed to be correct to the best of the Engineer's knowledge, but the Contractor shall have examined them for himself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.

1.07 BENCHMARKS, SURVEY AND LAYOUT WORK

A. The Contractor shall maintain and/or re-establish benchmarks and survey monuments shown on the Drawings or found to exist on the site to provide, as needed, a base reference for the construction. Replace any which may become destroyed or disturbed.

1.08 PROTECTION

A. All rules and regulations governing the respective utilities shall be observed by the Contractor in executing all work under this Section. All work shall be executed in such a manner as to prevent any damage to existing buildings, streets, sidewalks, curbs, paving, service utility lines, structures and adjoining property.

B. Locate and mark underground utilities to remain in service before beginning the work. Protect all existing utilities to remain during operations. Do not interrupt existing utilities except as authorized in writing by authorities having jurisdiction.

C. When an active utility line is exposed during construction, its location and elevation shall be plotted on the record Drawing by the Contractor, and both the Engineer and the Utility Owner notified in writing.

D. Conduct earthwork operations to ensure minimum interference with streets, walks, and other adjacent facilities. Do not close or obstruct streets, walks, etc. without written permission from authorities having jurisdiction. Provide barricades, fences, signs, and all other safety devices required for the protection of the public.

1.09 SAMPLES AND TESTING

A. All operations under the Section of the Specifications will be subject to the continuous observation of the Owner's Representative, and of a soil testing laboratory, engaged and paid directly by the Contractor. The Engineer shall direct testing to determine conformance of materials and workmanship, particularly compaction, to the requirements of this Specification.

1. The laboratory shall make such tests of materials and compaction. Costs of the tests shall be borne by the Contractor. Test copies shall be submitted to the Engineer directly from the approved independent testing company.

2. Contractor shall provide a five (5) gallon pail sample of each fill material from each proposed source including on-site. Additional samples shall be provided if a change in material type occurs at the borrow source. Allow minimum of three working days for testing evaluation before materials needed. Do not deliver proposed fill materials to the site unless/until the Engineer has approved of material testing results. Submit samples from alternate sources if intended for use.
3. The laboratory will defer testing on an area until the Contractor states that he has reached the specified compaction of the particular area. Areas for which tests indicate insufficient compaction shall be recompacted and retested until the areas conform to the requirements of the Specifications. All costs for retesting material shall be borne by the Contractor.

B. Compaction Tests
1. At Concrete Pavement
2. Under wall and stair footings
3. Final locations will be coordinated with the Engineer.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Gravel Borrow Type b (Aggregate) as noted on the drawings.
1. Gravel borrow shall be processed fill material consisting of inert material that is hard durable stone and coarse sand, free from loam and clay, surface coatings, and deleterious materials. Gradation requirements shall be determined by AASHTO T11 and T27 and shall conform to Section M1.03.0 of the Massachusetts Highway Department Standard Specifications:

Type b	
U.S. Sieve No.	Percent Passing By Weight
1/2”	50-85
#4	40-75
#50	8-28
#200	0-10

2. The gravel borrow material shall not contain stones greater than three (3) inches in diameter and shall not contain clays or organic matter.
3. Gravel borrow shall be placed and mechanically compacted in 2, 4-inch lifts and properly compacted to the minimum density of 95 percent of the maximum density as determined by ASTM D1557 (Modified Proctor). Any settlements or other defective work and material shall be promptly repaired or replaced at the Contractor’s expense. The density of the compacted fill shall be determined by the ASTM D6938 Nuclear Method or latest ASTM standard.

B. Ordinary Borrow
1. Material shall comply with the Massachusetts Highway Department Standard Specifications section M1.01.0.

2. Ordinary Borrow shall consist of a material satisfactory to the Engineer and not specified as gravel borrow, sand borrow, special borrow material or other particular kind of borrow.

3. This material shall have the physical characteristics of soils designated as group A-1, A-2-4 or A-3 under AASHTO M 145. It shall have properties such that it may be readily spread and compacted for the formation of embankments.

1. The use of PGA meeting the requirements of M2.01.8: Processed Glass Aggregate may be homogeneously blended with the borrow material up to an addition rate of 10 % by mass in areas that will not be exposed, providing the AASHTO M 145 physical characteristics are maintained.

C. 3/4" Crushed Stone

1. Material shall comply with the Massachusetts Highway Department Standard Specifications section M2.01.4.
2. Crushed stone shall consist of one or the other of the following materials:
   a. Durable crushed rock consisting of the angular fragments obtained by breaking and crushing solid or shattered natural rock, and free from a detrimental quantity of thin, flat, elongated* or other objectionable pieces. A detrimental quantity will be considered as any amount in excess of 15% of the total weight.
   b. Durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone with a minimum diameter before crushing of 8 in.
   *Thin or elongated pieces are defined as follows: thin stones shall be considered to be such stones whose average width exceeds 4 times their average thickness. Elongated stones shall be considered to be such stones whose average length exceeds 4 times their average width.
3. The crushed stone shall be reasonably free from clay, loam, or deleterious material and not more than 1.0% of satisfactory material passing a No. 200 sieve will be allowed to adhere to the crushed stone. The crushed stone shall have a maximum percentage of wear as determined by the Los Angeles Abrasion Test (AASHTO T 96) as follows:

   Crushed Stone for Subbase..... 45%

   The crushed stone shall be uniformly blended according to the grading requirements for the respective stone sizes shown in Table M2.01.0-1.

. ***Table M2.01.0-1: Stone Sizes Percent by weight Passing Through***

Square Opening Sieve	M2.01.4
1 in.	100%
¾ in.	90-100%
½ in.	10-50%
3/8 in.	0-20%

No. 4	0-5%

D. Geotextile Fabric
1. Material used shall be polyester non-woven geotextile fabric composed of 100% polypropylene fibers at an average thickness of 20ml and meeting the requirements as outlined in AASHTO M-288 for Class 3 applications.
2. Geotextile fabrics meeting the above standards are Mirafi 140N as manufactured by Mirafi Inc., Pendergrass, GA; US 120NW, as manufactured by US Fabrics, Cincinnati, OH, Foss-65 by Foss Manufacturing Co., Hampton, NH or approved equal.
3. Submit manufacturer data to Designer for approval.

F. Trench and Excavation Backfill
1. In general, and unless other material is indicated on drawings or specified, material used for backfilling trenches and excavations shall be suitable material which was removed in the course of making the construction excavations. If sufficient suitable material is not available from the excavations, the backfill material shall be crushed stone or gravel borrow as directed by the Engineer, in according to respective Specification Sections.

G. Structure Backfill
1. Unless otherwise indicated or specified, all fill and backfill under structures and pavement adjacent to structures shall be compacted gravel borrow containing not more than 10 percent material passing a 200 sieve. When coarse aggregate and fine aggregate are indicated or specified for use under structures, they shall conform to the requirements for coarse and fine aggregate specified in SECTION 03300.

H. Filling and Embankment Backfill
1. Suitable selected materials available from the excavations and not required for backfill around pipes or against structures may be used for filling and building embankments, except as otherwise specified. Material needed in addition to that available from construction operations shall be obtained from suitable gravel banks or other suitable deposits. The Contractor shall furnish, at his own expense, all borrow material needed on the work.

I. Compaction of Existing In-Place Material
1. After the existing pavements and base materials are removed, the Engineer will determine if the underlying base is satisfactory for new pavement subbase. If the existing materials meets the above specifications for sieve analysis, the Contractor shall fine grade and compact the existing gravel in place and/or to supplement it with additional material as required to bring the subbase to the proper grade.

2.02 SOURCE QUALITY CONTROL

A. Provide Engineer with access to location of off-site sources of materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all existing utilities and facilities prior to excavation.

3.02 PROTECTION

A. Utilities
   1. Support and protect from damage existing pipes, poles, wires, fences, curbing, property line markers, and other structures, which the Engineer decides must be preserved in place without being temporarily or permanently relocated.
   2. Restore items damaged during construction without compensation, to a condition at least equal prior to construction.

B. Trees – See SECTION 02200 for additional information
   1. Protect the trunks of trees adjacent to work to a height necessary to protect trees from injury from piled material, equipment, operations or otherwise.
   2. Employ excavating machinery and cranes of suitable type and size and operate with care to prevent injury to trees not to be cut and particularly to overhanging branches and limbs.
   3. When trimming is required, make all cuts smooth and neat without splitting or crushing.
   4. Cover cut areas with an application of grafting wax or tree healing paint.
   5. Branches, limbs, and roots shall not be cut except by permission of the Engineer.

C. Plantings
   1. Protect by suitable means or temporarily replant and maintain cultivated hedges, shrubs, and plants which may be injured by the Contractor's operations.
   2. Replant in their original positions and care for until growth is re-established once the construction operations have been substantially completed.
   3. If cultivated hedges, shrubs, and plants are injured to such a degree as to affect their growth or diminish their beauty or usefulness, they shall be replaced by items of kind and quality at least equal to which existed prior to the start of the Work.

D. Paved surfaces
   1. Do not use or operate tractors, bulldozers, or other power-operated equipment with treads or wheels shaped as to cut or injure paved surfaces.
   2. All surfaces which have been injured by the Contractor's operations shall be restored to a condition at least equal to which existed prior to start of the Work.
   3. Suitable materials and methods shall be used for such restoration.

3.03 PREPARATION

A. Pavement Removal
   1. Remove only existing pavement as necessary for the prosecution of the work.
   2. Engineer may require that pavement be cut with pneumatic tools or saws without extra compensation to Contractor, where in the opinion of the Engineer it is necessary to prevent damage to the remaining road surface.
   3. Dispose large of pieces of broken pavement before proceeding with excavation.

B. Topsoil Removal

1. From areas which excavations are to be made, loam and topsoil shall be carefully removed and separately stored to be used again as directed; or, if the Contractor prefers not to separate surface materials, he shall furnish, as directed, loam and topsoil at least equal in quantity and quality to that excavated.

C. Subgrade
1. Remove loam and topsoil, loose vegetable matter, stumps, large roots, etc., from areas where embankments will be constructed, or material will be placed for grading.
2. Shape as indicated on the drawings and prepare by forking, furrowing, or plowing to bond first layer of the new material placed.

3.04 RELOCATION AND REPLACEMENT OF EXISTING STRUCTURES

A. The structures to which the provisions of this article apply include pipes, wires, and other structures which meet all of the following:
1. Are not indicated on the drawings or otherwise provided for.
2. Encroach upon or are encountered near and substantially parallel to the edge of the excavation.
3. In the opinion of the Engineer will impede progress to such an extent that satisfactory construction cannot proceed until they have been changed in location, removed (to be later restored), or replaced.

B. In removing existing pipes or other structures, the Contractor should use care to avoid damage to materials, and the Engineer shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

C. Whenever the Contractor encounters certain existing structures as described above and is so ordered in writing, he shall do the whole or such portions of the work as he may be directed to change the location of, remove and later restore, or replace such structures, or to assist the Owner thereof in so doing. For all such work, the Contractor shall be paid under such items of work as may be applicable, otherwise as Extra Work.

D. When fences interfere with the Contractor's operations, he shall remove and (unless otherwise specified) later restore them to a condition which existed prior to the start of the Work, all without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

3.05 SHEETING AND BRACING

A. Furnish, put in place, and maintain such sheeting, bracing, etc., as necessary to support the sides of the excavation and to prevent any movement of earth which could in any way diminish the width of the excavation to less than that necessary for proper construction, or could otherwise injure or delay the work, or endanger adjacent structures.

B. Whenever possible, sheeting shall be driven ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the sheeting will be driven. Care shall be taken to prevent voids outside of the sheeting, but, if voids occur, they shall be filled immediately with sand and compacted.

C. Leave in place to be embedded in the backfill, or concrete, all sheeting, bracing, etc., which is indicated on the drawings to be left in place. Leave in place any and all other sheeting, bracing, etc., which the Engineer may direct to leave in place, at any time during the progress of the work, for the purpose of preventing injury to structures or property.

D. The Engineer may direct that sheeting and bracing to be left in place be cut off at any specified elevation.

E. All sheeting and bracing not to be left in place shall be carefully removed in such manner as not to endanger the construction or other structures. All voids left or caused by the withdrawal of sheeting shall be backfilled immediately using suitable materials and compaction methods.

3.06 DEWATERING

A. Keep excavation continuously free of water from all sources without extra cost to the Owner. Provide, maintain, and operate pumps and related equipment, including standby equipment of sufficient capacity to keep excavations free of water at all times and under any and all contingencies that may arise until the completion of the Contract.

B. Dispose of water through temporary pipelines or ditches with outfall to erosion control carry-off agencies. Prevent erosion of surrounding areas. Protect roads and other improvements of the site. Build temporary culverts if required. At completion of dewatering, remove temporary facilities and restore subgrade and damaged areas.

3.07 EXCAVATION

A. The work of excavation shall be conducted at such locations, at such rates of progress and in such a manner as will ensure the continued progress of the work, with a minimum of inconvenience to the general public.

B. Removal of existing concrete paving and structure footings shall be for the full depth thereof and shall include any base courses. The Contractor shall use power saws for cutting and trimming, that will remove the materials to the neat lines as shown on the Drawings, with minimum damage to pavement, sidewalk, and curbs that are to remain. Damage done at these locations shall be repaired and restored with like material by the Contractor at his expense.

C. Excavation of all materials to the elevations, dimensions and form as shown on the Drawings and as specified for the construction of lawn and site improvements necessary for the completion of the site work. Excavation to elevations indicated or required, as will allow footings to rest on firm, undisturbed earth, free of loose materials, and as will permit rough grades to be indicated or specified depths. The elevations of the bottom footings, as shown on the Drawings, shall be considered as approximate only and the Engineer or play equipment manufacturer may order in writing such changes in elevations of footings as may be necessary to secure a satisfactory foundation.

D. After completion of the excavation and prior to commencement of foundation footings, pavements and concrete slab construction, the excavation will be reviewed by the Engineer to ensure that foundation elevations have been reached.

E. No excavation shall be deposited or stockpiled at any time so as to endanger portions of the new or any existing structure, either by direct pressure or indirectly by overloading

banks contiguous to the operation. Material, if stockpiled, shall be stored so as not to interfere with the established sequence of the construction or future work as determined by the Engineer. If there is not sufficient area available for stockpiling within the limits of the project, the Contractor will be required to furnish his own stockpiling area.

F. All excess and unsuitable material shall be removed from the limits of the work and be disposed of by the Contractor. The Contractor will be required to furnish his own disposal area. Topsoil stripped and stockpiled at the site shall not be removed unless authorized by the Engineer. As directed, screen excess topsoil and use for backfill material in lawn and planting areas.

G. Comply with local safety regulations and with provisions of "Accident Prevention in Construction" published by the Associated General Contractors of America, Inc.

H. The sequence of all excavation operations shall be such as to ensure the most efficient utilization of excavated materials for backfill and subgrade preparation (or the removal of excess material from the site). When the plans require excavation in areas in close proximity to existing buildings, roads, structures, and utilities, it shall be the responsibility of the Contractor at his expense to construct suitable drainage ditches or use other satisfactory means and methods to protect and maintain the stability of such walkways and structures located immediately adjacent to but outside the limits of excavation.

I. Render bottom of excavations firm, dry and acceptable in all respects.

J. Do not plow, scrap, or dig by machinery, earth at finished subgrade which results in disturbance of material below subgrade, unless indicated or specified, and remove with pick and shovel, last of material to be excavated, just before placing pipe, masonry or other structure.

K. Excavation Near Existing Facilities

1. As the excavation approaches pipes, conduits, or other underground structures, digging by machinery shall be discontinued and the excavation shall be done by means of hand tools. Such manual excavation when incidental to normal excavation shall be included in the work to be done under items involving normal excavation.

L. Unauthorized Excavation

1. If the bottom of any excavation is taken out beyond the limits indicated or prescribed, the resulting void shall be backfilled at the Contractor's expense with thoroughly compacted gravel borrow, if the excavation was for a pipeline, or with Class B concrete, if the excavation was for a masonry structure.

M. Unsuitable Material

1. If material unsuitable for foundation (in the opinion of the Engineer) is found at or below the grade to which excavation would normally be carried in accordance with the Drawings and/or Specifications, the Contractor shall remove such material to the required width and depth and replace it with thoroughly compacted, crushed stone, gravel borrow, fine aggregate or concrete as directed.

3.09 BACKFILLING

A. General

1. Frozen material shall not be placed in the backfill nor shall backfill be placed upon frozen material. Previously frozen material shall be removed or shall be otherwise treated as required, before new backfill is placed.

B. Fill And Backfill Under Structures

1. The fill and backfill materials shall be placed in layers not exceeding 6 in. in thickness. Unless otherwise indicated or specified, each layer shall be compacted to 95 percent in accordance with ASTM D1557.

C. Backfilling Around Structures

1. Do not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking, or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been done, special leakage tests, if required, shall be made. Promptly after the completion of such tests, the backfilling shall be started and then shall proceed until its completion. The best of the excavated materials shall be used in backfilling within 2 ft. of the structure. Unequal soil pressures shall be avoided by depositing the material evenly around the structure.

2. The material shall be placed and compacted to 90 percent in accordance with ASTM D1557 unless otherwise indicated or specified.

D. Placing and Compacting Embankment Material

1. After the subgrade has been prepared as hereinbefore specified, the material shall be placed thereon and built up in successive layers until it has reached the required elevation.
2. Layers shall not exceed 12 in. in thickness before compaction. In embankments at structures, the layers shall have a slight downward slope away from the structure; in other embankments the layers shall have a slight downward slope away from the center. In general, the finer and less pervious materials shall be placed against the structures or in the center, and the coarser and more pervious materials, upon the outer parts of embankments.
3. Each layer of material shall be compacted by the use of approved rollers or other approved means so as to secure a dense, stable, and thoroughly compacted mass. At such points as cannot be reached by mobile mechanical equipment, the materials shall be thoroughly compacted by the use of suitable power-driven tampers.
4. Previously placed or new materials shall be moistened by sprinkling, if required, to ensure proper bond and compaction. No compacting shall be done when the material is too wet, from either rain or too great an application of water, to compact it properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compaction, or such other precautions shall be taken as may be necessary to obtain proper compaction.
5. The portion of embankments constructed below proposed structures shall be compacted to 95 percent in accordance with ASTM D1557. The top 2 ft. of an embankment below a pavement base shall be compacted to 95 percent. All other embankments shall be compacted to 90 percent in accordance with ASTM D1557.

3.10 METHODS OF COMPACTION

A. Water-Jetting

1. Saturate backfill material throughout its full depth and at frequent intervals across and along the trench until all slumping ceases.
2. Furnish one or more jet pipes, each of sufficient length to reach the specified depth and of sufficient diameter (not less than 1-1/4 in.) to supply an adequate flow of water to compact the material.
3. Equip jet pipe with a quick-acting valve, supply water through a fire hose from a hydrant or a pump having adequate pressure and capacity to achieve the required results.

B. Tamping and Rolling

1. Deposit backfill material and spread in uniform, parallel layers not exceeding 8 in. thick before compaction. Before the next layer is placed, each layer shall be tamped to obtain a thoroughly compacted mass. Care shall be taken that the material close to the bank, as well as in all other portions of the trench, is thoroughly compacted. When the trench width and the depth to which backfill has been placed are sufficient to make it feasible, and it can be done effectively and without damage to the pipe, backfill may, on approval, be compacted by the use of suitable rollers, tractors, or similar power equipment instead of by tamping. For compaction by tamping (or rolling), the rate at which backfilling material is deposited in the trench shall not exceed that permitted by the facilities for its spreading, leveling, and compacting.
2. If necessary to ensure proper compaction by tamping (or rolling), the backfill material shall first be wet by sprinkling. However, no compaction by tamping (or rolling) shall be done when the material is too wet either from rain or too great an application of water to be compacted properly; at such times the work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compaction.

C. Miscellaneous Requirements.

1. Whatever method of compacting backfill is used, care shall be taken that stones and lumps shall not become nested and that all voids between stones shall be completely filled with fine material. Only suitable quantities of stones and rock fragments shall be used in the backfill; the Contractor shall, as part of the work done under the items involving earth excavation and rock excavation as appropriate, furnish and place all other necessary backfill material.
2. All voids left by the removal of sheeting shall be completely backfilled with suitable materials, and thoroughly compacted.

3.11 DISPOSAL OF SURPLUS EXCAVATED MATERIALS

A. No excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or permitted by the Engineer.

B. Surplus excavated materials suitable for backfill shall be used to backfill normal excavations in rock or to replace other materials unacceptable for use as backfill; shall be neatly deposited and graded so as to make or widen fills, flatten side slopes, or fill depressions; or shall be neatly deposited for other purposes within a haul of 1 mile from the point of excavation; all as directed or permitted and without additional compensation.

C. Surplus excavated materials not needed as specified above shall be hauled away and dumped by the Contractor, at his expense, at appropriate locations, and in accordance with arrangements made by him.

3.12 DUST CONTROL

A. During the progress of the Work, maintain the area of activities, by sweeping and sprinkling of streets to minimize the creation and dispersion of dust. If the Engineer decides that it is necessary to use calcium chloride for more effective dust control, the Contractor shall furnish and spread the material, as directed.

3.13 FIELD QUALITY CONTROL

A. Site Tests
   1. In accordance with GENERAL CONDITIONS

3.13 ROUGH GRADING

A. Rough grading shall include the shaping, trimming, rolling, and refinishing of all surfaces of the subbase, shoulders, and earth slopes, and the preparation of grades as shown in the Drawings. The grade of shoulders and sloped areas may be done by machine methods. Up to 2 inches in 10'-0" tolerance will be permitted on slopes provided the slopes are uniform in appearance and without abrupt changes. All ruts shall be eliminated. Traffic of personnel and equipment across soil subgrade areas shall be prohibited following excavation to the required lines and grades.

B. If, during the progress of the work other construction is damaged due to operations under this Contract, the Contractor shall repair all damage at no additional cost to the Owner and restore damaged areas to their original conditions.

C. Do all other cuttings, filling and grading to the lines and grades indicated on the Drawings. Grade evenly to within the dimensions required for grades shown on Drawings and as specified herein. No stones larger than 4 inches in largest dimension shall be placed in upper 6 inches of fill. Fill shall be left in compacted state at the end of the workday and sloped to drain.

D. The Contractor shall bring all areas to grades as shown on the Drawings and in the details. The Engineer, however, may suggest such adjustments in grades and alignments as are found necessary to avoid special conditions encountered.

E. No rubbish of any description shall be allowed to enter fill material. Such material shall be removed from the site.

F. Wherever lawns, sidewalks or other items contained 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 materials 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. Notify the proper authorities prior to restoring surfaces outside the Contract Limit Lines.

G. Placed fill materials which become disturbed shall be regraded and recompacted. Fill materials which become contaminated shall be removed and replaced.

3.14 FINE GRADING

A. Shall be performed as preparation for finish surfaces as shown in plans and described in various material specification sections. Contractor shall notify Engineer 72 hours prior to installation of final materials to obtain written approval to place finish materials.

3.15 CARE AND RESTORATION OF PROPERTY

A. Restoration of existing property or structures done as promptly as practicable and not left until the end of the construction period.

SECTION 4 – MEASUREMENT & PAYMENT

4.01 MEASUREMENT

A. EARTH EXCAVATION shall be measured for payment per CUBIC YARD complete in-place as shown on the Drawings and as specified herein to consist of all backfilling, compaction, rough grading, including all labor, materials, equipment, testing, and all other incidentals.

B. FINE GRADING AND COMPACTING shall be measured per SQUARE YARD complete in-place as shown on the Drawings and as specified herein to consist of all labor, materials, equipment, testing, and all other incidentals.

C. GRAVEL BORROW shall be measured for payment per CUBIC YARD compacted in place as shown on the Drawings and as specified herein.

D. ORDINARY BORROW shall be measured for payment per CUBIC YARD compacted in place as shown on the Drawings and as specified herein.

4.02 PAYMENT

A. EARTH EXCAVATION will be paid for at the contract CUBIC YARD price as specified above.

B. FINE GRADING AND COMPACTING will be paid for at the contract SQUARE YARD price as specified above.

C. GRAVEL BORROW shall be paid for at the contract CUBIC YARD price as specified above.

D. ORDINARY BORROW shall be paid for at the contract CUBIC YARD price as specified above.

4.03 PAYMENT ITEMS

ITEM	DESCRIPTION	UNIT
02300-1	Excavation	CY
02300-2	Fine Grading and Compacting	SY
02300-3	Gravel Borrow – Type b	CY
02300-4	Ordinary Borrow	CY

END OF SECTION

SECTION 02745

BITUMINOUS PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes requirements for construction of bituminous pavement under ADD ALTERNATE #2 at the walkway around the synthetic turf field and areas affected or damaged by the Contractors operations, whether inside or outside work limits, as indicated on the Drawings and as herein specified. Area to include new top course unless area is thoroughly damaged and requires a full-depth reconstruction.

B. Related Sections
   1. Section 02200 – Site Preparation.
   2. Section 02300 – Earthwork

1.02 REFERENCES:

A. This specification refers to the requirements of additional specifications as listed. The Contractor shall obtain and familiarize himself with all requirements referenced by this specification prior to preparation and installation of any pavements.
   1. Massachusetts Department of Transportation 2020 Standard Specifications for Highways and Bridges, together with all errata addenda additional revisions, and supplemental specifications, all of which are hereinafter referred to as the MassDOT Standard Specifications.
   2. Bituminous pavement shall conform to shall be in accordance with Section 460.
   3. All required saw cutting in the existing pavement shall be in accordance with Sections 450 and 455.

1.03 PAVEMENT SCHEDULE:

A. All pavement thickness specified in this specification shall be of the thickness required after compaction.

Type:	Flexible 4 ½ "
Requirements:	2 ½ " - Superpave Surface Course 12.5(SSC-12.5) Over 2" - Superpave Intermediate Course 12.5(SIC-12.5) Over 12" - Gravel Borrow Type b

1.04 SUBMITTALS:

A. Qualification Data: For qualified manufacturer and Installer.

B. Material Certificates: For each paving material, from manufacturer.

C. Material Test Reports: For each paving material.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Asphalt Tack

1. Tack coat shall consist of emulsified asphalt, grade RS-1 or cutback asphalt, conforming to the requirements of the MassDOT Standard Specification Section M3.11.06.

B. Superpave Surface and Intermediate Courses shall be from a MassDOT qualified hot mix asphalt production facility.

1. Superpave Surface Course shall conform to the requirements of the MassDOT Standard Specification Section 460 Item 460.23.
2. Superpave Intermediate Course shall conform to the requirements of the MassDOT Standard Specification Section 460 Item 460.31.

C. Hot Poured Rubberized Asphalt Sealer

1. Sealer shall conform to the requirements of the MassDOT Standard Specification Section 460 and the material requirements of M3.05.0 of the MassDOT Standard Specifications and shall be on the MassDOT qualified products list.

D. Gravel Sub-Base Course

1. The gravel sub-base course shall consist of Gravel Borrow Type b, (3”-inches largest dimension) as specified in MassDOT Standard Specification Section M1.03.0
2. The gravel sub-base shall be spread and compacted in one layer, 12” inches in depth compacted measurement, to not less than 95 percent of the maximum dry density of the material, as determined by the Standard AASHTO Test Designation T99 compaction test Method C within 5% of optimum moisture content as determined by the Engineer. If the material retained on the #4 sieve is 50% or more of the total sample, this test shall not apply, and the material shall be compacted to the satisfaction of the Engineer. The specific density of the Gravel Sub-base shall be maintained by determining the number of passes of a roller required to produce a constant and uniform density, after conducting a series of tests either using the sand/volume or the nuclear density-testing device.
3. Any stone with a dimension greater than 3” inches shall be removed from the sub-base before the gravel is compacted. Compaction shall continue until the surface is even and true to the proposed lines and grades within a tolerance of ½-inch above or below the required cross-sectional elevations and to a maximum irregularity not exceeding ½ inch under a l0 foot line longitudinally. Any specific area a gravel sub-base which, after being rolled, does not form a satisfactory, solid, stable foundation shall be removed, replaced and recompacted by the Contractor without additional compensation.

E. Pavement Marking Paint:

1. Pavement-Marking Paint: Latex, waterborne emulsion, lead, and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
   a. Color: White.

PART 3 - EXECUTION

3.01 PREPARATION:

A. Where pavement to be demolished is located within or adjacent to pavements to remain, the Contractor shall make provisions to protect that pavement to remain. Cut concrete pavement back to score line and cut bituminous concrete pavement back far enough so as not to allow disturbance to base course materials. Pavements damaged as a result of Contractor activities shall be replaced to the extent determined by the Engineer at no additional cost to the Owner. Dispose according to SECTION 02200 SITE PREPARATION.

B. Prior to placing pavement, all backfill shall have been properly compacted as specified under SECTION 02300 to eliminate settling of backfill. No pavement shall be placed over poorly compacted backfill. Backfill and gravel base course shall be compacted, brought to the proper elevation, and dressed so that new pavement construction shall be at the required grade. The Contractor shall maintain the surfaces of all excavated and disturbed areas until the pavement is placed. If there is a time lapse of more than 24 hours between completion of preparation of subgrade or placing of gravel base course and placing of paving, or if subgrade or gravel base course has been eroded or disturbed by traffic, the subgrade or gravel base course shall be restored before placing pavement.

C. When extending the existing bituminous parking lot, the edges of existing pavement shall be cut back 12-inches, or more as required, to sound undamaged material, straightened, cleaned, and painted with an accepted asphalt emulsion to ensure a satisfactory bond between it and the newly placed surface courses. Existing surface courses shall be trimmed square and straight. Existing pavement shall be swept clean prior to placing any asphalt emulsion over it. Existing pavement that will be under new pavement shall be painted with asphalt emulsion to ensure a satisfactory bond.

D. Before permanent pavement is installed, the base shall be brought to the proper grade, and temporary pavement and excess gravel base shall be removed.

E. All manhole covers, catch basin grates, valve and meter boxes, curbs, walks, walls, and fences shall be adequately protected and left in a clean condition. Where required, the grades of manhole covers, catch basin grates, valve boxes, and other similar items shall be adjusted to conform to the finished pavement grade.

F. The Contractor shall remove and acceptably dispose of all surplus and unsuitable material.

3.02 INSTALLATION:

A. General

1. Unless indicated otherwise, all permanent bituminous pavement shall be installed in two courses or more. Bituminous base courses shall be carefully spread and raked to a uniform surface and thoroughly rolled before application of the top course.
2. All top courses of permanent paving shall be applied with acceptable mechanical spreaders in widths of at least 9 feet.
3. The rolling for all bituminous and gravel base courses shall conform to the standards listed in the appropriate Subsection of the Standard Specification.

4. Pavement shall be placed so that the entire paved area shall have a true and uniform surface, and the pavement shall conform to the proper grade and cross section with a smooth transition to existing pavement.

B. Gravel Base Course
1. The base course shall be placed to such depth that the furnished compacted base course is the depth as indicated on the Contract Drawings and specified herein.
2. The top of the base course shall be below the furnish grade a distance required to accommodate the compacted pavement material as indicated on the Contract Drawings and specified herein.

C. Superpave shall be installed in accordance with MassDOT Standards and as noted in this specification.

D. Hot Poured Rubberized Sealant
1. All transverse joints and all longitudinal joints of the surface course shall be treated prior to laying the next lane of hot mix asphalt as follows:
2. The joint shall be coated with a hot poured rubberized asphalt sealant meeting the requirements of M3.05.0. When using pavers in tandem, the use of the hot poured rubberized asphalt sealer may be omitted at the discretion of the Engineer, if the temperature of the mixture at the longitudinal joint does not fall below 200°F (95°C) prior to the placement of the adjacent mat. No re-heating of the joint shall be permitted/required.
3. The hot poured rubberized asphalt shall be applied to the joints from a double jacketed heating kettle with a positive drive gear pump that is connected to a suitable applicator. The nozzle of the applicator shall be set to deliver sufficient sealant to effectively bond and seal the transverse and longitudinal paving joint between two adjacent lanes of hot mix asphalt.
4. Longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed, and true to line and grade. Where and as directed, transverse joints for all courses and longitudinal joints for the top course placed under this or previous contracts shall be cut back to expose the full depth of the course and, when the laying of the course is resumed, the exposed edge of the joint shall be treated as above.
5. In making joints along any adjoining edge such as curb, gutter, or an adjoining pavement, and after the mixture is placed by the mechanical spreader, just enough of the hot material shall be placed by hand method to fill any space left open. These joints shall be properly "set-up" with the back of a rake at the proper height and level to receive the maximum compaction. The work of "setting-up" these joints shall be performed only by competent workmen. Where and as directed, the first width of any course shall be placed not less than one foot wider than the first width of top course, and successive widths of top and as any other courses shall be so placed that there will be at least a one foot overlap between the joints in the top course and the other course.
6. The rolling of the successive widths of courses shall overlap and shall be performed to leave smooth, uniform joints and cross sections.

E. Sidewalks, Driveways, Parking Lots and Curbing
1. Sidewalks, driveways, parking lots and curbing that are removed or damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they are found immediately prior to the start of operations. Materials and methods used for such restoration shall be in conformance with the requirements of the MassDOT Standard Specification.

2. Parking lots shall be repaved in accordance with Article 3.01 of this section.
3. Gravel base course under sidewalks (pedestrian) shall not be less than 8-inches thick and driveways (vehicular) shall not be less than 12” (inches) thick.

F. Surface Maintenance
1. During the guarantee, period, the Contractor shall maintain the bituminous surface and shall promptly make good all defects such as cracks, depressions, and holes that may occur. At all times, the surfacing shall be kept in a safe and satisfactory condition for traffic. If defects occur in surfacing constructed by the Contractor, the Contractor shall remove all bituminous concrete and base courses as is necessary to properly correct the defect. After removing bituminous concrete and base course, the Contractor shall correct the cause of the defect and replace the base course and bituminous concrete in accordance with these specifications.

G. Pavement Marking
1. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.
2. Allow paving to age for 30 days before starting pavement marking.
3. Sweep and clean surface to eliminate loose material and dust.
4. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 m).

PART 4 – MEASUREMENT & PAYMENT

4.01 MEASUREMENT:

A. BITUMINOUS PAVEMENT for the following items shall be measured for payment per TON complete in-place as shown on the Drawings and as specified herein to consist of all pavements, labor, materials, equipment, saw cutting, asphalt sealer and all other incidentals. Tonnage shall be determined by weight slips submitted to the Engineer. Also, this number will be verified by the inch per square yard method of determining tonnage (inches of approved thickness, multiplied by square yard unit measurement, multiplied by the volume to weight conversion factor of 0.056 tons/inch/square yard).

Excavation, Gravel Borrow Compacted, and Fine Grading and Compacting shall be measured and paid for separately under SECTION 02300 Earthwork.
Tack Coat and Hot Poured Rubberized Asphalt Sealer shall be incidental to this item, complete in-place as specified herein to consist of all labor, materials, equipment, and all other incidentals.

4.02 PAYMENT:

A. BITUMINOUS PAVEMENT – SUPERPAVE 2 ½” SURFACE 12.5 shall be paid for at the contract unit prices for the quantities determined as specified above which price shall be considered full compensation for all labor, equipment, materials, and incidentals, including tack coat, as necessary to complete the work to the satisfaction of the Engineer. This price shall also include all necessary work to prepare the pavement surface, including street sweeping, as well as any requirements as listed in Section 460 contained herein that are not covered under other specified payment items.

B. BITUMINOUS PAVEMENT – SUPERPAVE 2" INTERMEDIATE 12.5 shall be paid for at the contract unit prices for the quantities determined as specified above which price shall be considered full compensation for all labor, equipment, materials, and incidentals, including tack coat, as necessary to complete the work to the satisfaction of the Engineer. This price shall also include all necessary work to prepare the pavement surface, including street sweeping, as well as any requirements as listed in Section 460 contained herein that are not covered under other specified payment items.

4.03 PAYMENT ITEMS:

ITEM	DESCRIPTION	UNIT
02745-1	Bituminous Pavement – Superpave 2 ½" Surface 12.5	TON
02745-2	Bituminous Pavement – Superpave 2" Intermediate 12.5	TON

END OF SECTION

SECTION 02880

PLAY FIELD EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes under ADD ALTERNATE #5 requirements for the provision and installation of two new basketball backboards and hoops (including nets) to replace existing systems at the two existing basketball goals on site.

1.02 RELATED WORK UNDER OTHER SECTIONS:

A. Section 02200 – Site Preparation

1.03 QUALITY ASSURANCE:

A. Construction shall be in accordance with applicable Massachusetts Department of Transportation 2020 Standard Specifications for Highways and Bridges, together with all errata addenda, additional revisions, and supplemental specifications, all of which are hereinafter referred to as the MassDOT Standard Specifications 2014 unless otherwise specified below. Also included is the furnishing and installation of appurtenant materials required for construction of the site furnishings as shown on the Plans.

1.04 DELIVERY, STORAGE AND HANDLING:

A. Check materials upon delivery to assure that specified type, grade, and color of materials have been received and are undamaged.

B. Prevent excessive mud, wet concrete, epoxies, and like materials that may affix themselves, from coming in contact with materials.

C. Store and handle materials in accordance with manufacturer’s recommendations.

D. Protect materials from damage.

1.04 SUBMITTALS:

A. Reference SECTION 01330 for additional information.

B. Provide manufacturer’s literature and data for all site furnishings.

C. Provide samples of finished metal and wood.

PART 2 - PRODUCTS

2.01 BASKETBALL BACKBOARD AND HOOP:

A. Basketball Backboard shall be acrylic or polycarbonate rectangular shape. Color and finish

of Backboard shall be Clear, target and perimeter shall be white with an aluminum frame. Goal shall be Double Rim, and net shall be White Nylon.

B. Acceptable manufacturers include the following:
   1. Patterson Williams – Backboard Target Model No. 27, Goal Model No. 45, Net Model No. 34
   2. Jaypro Sports Equipment – Backboard Target Model No. ACRB-72, Goal Model No. GDR-54, Net Model No. JNY-4HP
   3. Douglas Industries – Backboard Model No. 39110A, Goal & Net Model No. 39159
   4. Or equivalent

C. Submit manufacturer's data sheets and standard colors and finishes to be chosen by Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Bench:
   1. Bench shall be surface mounted on a concrete pad or in-ground as shown on the drawings.
   2. Install bench level and plumb in-ground with 4,000 psi concrete footing as shown on the plans or as directed by the Engineer.
   3. Corrosion resistant mounting hardware shall be provided and installed per the manufacturer's recommendations. Contractor shall coordinate installation requirements and parts with the manufacturer. Provide written warranty, signed by the contractor, fabricator, and installer agreeing to repair or remove, replace, and reinstall at no additional cost any of the above items that become defective within three years from date of substantial control.
   4. Repair minor damages to finish in accordance with manufacturer's instructions or as directed by the Engineer. Remove and replace damaged components that cannot be successfully repaired as directed by the Engineer. Clean individual components with mild cleaner in accordance with manufacturer's instructions using a mild cleaner as approved by the manufacturer.

3.02 CLEANUP:

A. After completion of play equipment work, all debris and excess material shall be removed from the project area to the satisfaction of the Engineer. Pavements shall be broomed or hosed clean.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. BASKETBALL BACKBOARD AND HOOP shall be measured for payment per EACH as detailed, complete in place to include the provision and all labor materials and fasteners required for installation.

4.02 PAYMENT:

A. BASKETBALL BACKBOARD AND HOOP shall be paid for at the contract unit price EACH for the quantity determined as specified above and as specified herein to consist of all labor, and other incidentals.

4.03 PAYMENT ITEMS:

ITEM	DESCRIPTION	UNIT
02870-1	Basketball Backboard and Hoop	EA

END OF SECTION

SECTION 02920

LOAMING AND SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Requirements for loaming, fertilizing, seeding, and related work in areas disturbed in the process of performing the Work under this contract and soil for grassed swales.

1.02 SUBMITTALS:

A. In accordance with SECTION 01300 SUBMITTALS submit the following:
   1. Submit with seed, certificates confirming seed mixture, purity, germinating value, and crop year identification.
   2. Submit test samples of loam types.

1.03 DELIVERY, STORAGE AND HANDLING:

A. Fertilizer:
   1. Delivered mixed as specified in standard size, unopened containers showing weight, analysis, and name of manufacturer.
   2. Store in weatherproof place.

B. Seed:
   1. Delivered in original unopened containers with mixture listed.

1.04 MATERIAL TESTING:

A. All testing shall be performed by UMASS Soil and Plant Tissue Laboratory, West Experiment Station, North Pleasant Street, Amherst, MA, (413-545-2311). The Contractor shall provide the laboratory with representative soil samples for testing, payment for testing, and shall have the test reports sent directly to the Engineer.

B. Loam tests shall include:
   1. Routine Soil Analysis (including pH, Buffer pH, Extractable Nutrients (P, K, Ca, Mg, Fe, Mn, Zn, Cu, B, S, Extractable Aluminum, Percent Base Saturation, Extractable Lead)
   2. Soil Organic Matter,
   3. Soluble Salts, and
   4. Soil Texture

C. Loam test reports shall contain specific recommendations as to the types, times, and rates of applications of soil additives, amendments and fertilizers based on the test results of the supplied samples and the type of planting (turf establishment, needleleaf trees and shrubs, deciduous trees, and shrubs.

D. Compost testing shall be the Standard Compost Test which includes, pH, Extractable Nutrients (P, K, Ca, Mg, Fe, Mn, Zn, Cu, B), Extractable Aluminum, Equivalent Base

Percentages, Organic Matter, Total Nitrogen, C.N Ratio, Nitrate-N, Ammonium-N, Electrical Conductivity, Percent Moisture, and Bulk Density.

PART 2 - PRODUCTS

2.01 LOAM BORROW:

A. All loam borrow used in the work of this section of the specification, whether stripped topsoil or from off-site, shall be tested and approved for use by the Engineer prior to being spread.

B. Topsoil stripped from the site, tested, and stockpiled prior to application may, upon the approval of the Engineer, be used as loam for preparation of areas to be seeded. It shall be free of large (two inches or greater) cobbles, roots, old sod, trash, wood, weeds, or other contaminants and be of a friable consistency and suitable for plant growth.

C. Loam borrow (from off-site) shall be a "Fine Sandy Loam" or a "Sandy Loam" determined by mechanical analysis and based on the USDA Classification System. It shall be of uniform composition without mixture of subsoil. It shall be free of stones, lumps, plants and their roots, debris, or other deleterious material. The Contractor shall furnish additional loam as may be necessary to repair areas disturbed during construction where loam is not called out on the drawings at his own expense. The Engineer may request samples before acceptance or spreading.

D. If an excess of topsoil exists after all seeding is completed, it shall be stockpiled on the reservation as directed by the Owner.

2.02 LIME AND FERTILIZER:

A. Soil additives to improve chemical or physical properties including fertilizers, lime, sulfur, etc. and shall be as recommended by the soil test results and analysis.

B. Fertilizer. Fertilizer shall be a standard commercial dry granular mixture. The mixture shall be as determined by testing and approved by the Engineer. The fertilizer shall be delivered in the manufacturers' containers containing a guaranteed analysis by weight of Nitrogen, Phosphorous and Potash.

C. Limestone. Limestone shall be a standard commercial ground limestone and shall be applied at a rate determined by testing and approved by the Engineer. The rate shall not be more than 4,000 pounds per acre.

D. Sulfur. Sulfur for adjustment of pH shall be unadulterated flowers of sulfur, ferrous sulfate, or aluminum of sulfate.

E. Superphosphate/Phosphates shall not be used.

2.03 SOIL AMENDMENTS:

A. Compost. Compost for used in loam for seeding and rain gardens shall be a stable humus-like material produced from the aerobic decomposition of organic residues. The compost shall meet the requirements of the Massachusetts DEP Type 1and the following:

1. The material shall be a well decomposed, dark in color, stable, weed free organic matter source. It shall be derived from agricultural, food, and/or yard trimmings.
2. The product shall contain no substances toxic to plants and shall be reasonably free (less than 1 percent by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
3. Compost shall have a pH between 5.5 pH and 8.0 pH and a moisture content between 35 percent and 55 percent. The particle size shall pass through a 1/2-inch screen or smaller. It must be stable to highly stable, pass growth screening and have a soluble salt concentration at 2.5 d s/m or less for soil blend.
4. The compost must meet US EPA Part 503 exceptional quality concentration limits for trace elements/heavy metal. The Carbon/Nitrogen ratio shall be between 10/1 to maximum 25/1 without the addition of nitrogen and the degree of maturity should meet Grades V 'very stable compost'.
5. The Contractor shall submit samples of the Compost for testing to approved soils laboratory service before mixing with loam to boost organic percentage, as applicable. Tests shall be submitted and approved by the Engineer before mixing.

B. Peat Moss. Peat moss shall be a blend of various species of sphagnum moss. It shall be free of wood, colloidal residue, and foreign matter. It shall have a pH between 3.5 and 6.0 as determined by testing.

C. Sand. Sand shall be uniformly graded coarse sand (masonry sand) up to 6mm particles.

2.04 SEED MIXES:

A. Lawn Seed.

1. Grass seed for lawn areas shall be of an approved perennial variety mixture, the previous year's crop, clean, and high in germinating value. Weed seed content shall be less than 0.5 percent and include no noxious weeds. Seed shall be obtained from a reliable seed company and shall be accompanied by certificates of compliance relative to mixture purity and germinating value. Seed shall be furnished and delivered in new, clean, sealed and properly labeled containers. All seed shall comply with applicable State and Federal laws. Seed that has become wet, moldy, or otherwise damaged shall not be accepted.
2. Grass seed for lawn areas shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Chewing's Fescue (*Festuca rubra commutata*)	30%	70%	97%
'Kentucky 31' Tall Fescue (*Festuca arundinacea 'Kentucky 31')*	30%	90%	98%
Kentucky Bluegrass (*Poa pratensis)*	20%	80%	85%
Perennial Ryegrass *(Lolium perenne)*	20%	90%	98%

B. Temporary Cover Crop

1. Temporary cover crop shall conform to the following requirements:

Botanical and Common Names	Proportion by Weight	Germination Rate	Purity Minimum
Annual Rye (*Lolium multiflorum)*	80%	85%	90%
Creeping Red Fescue (*Festuca rubra)*	4%	85%	95%
Perennial ryegrass (*Lolium perenne)*	3%	90%	98%
Red Clover *(Trifolium pratense)*	3%	90%	90%

Other Crop Grass 0.5% max.
Noxious Weed Seed 0.5% max.
Inert Matter 1.0% max.

2.05 STRAW:

A. Straw for erosion control and moisture retention shall be stems or stalks after threshing. Hay shall not be used. Stakes, netting or pins shall be used to keep the straw in place.

PART 3 - EXECUTION

3.01 GENERAL:

A. Supply suitable quantities of water, hose, and appurtenances.

3.02 LOAM BORROW:

A. Amend as necessary based on approved test recommendations for use as lawn or plant bed.

B. Spread loam on areas to 6-inch depth after compaction, or as shown on drawings. Fine grade and compact.

3.03 LIME AND FERTILIZER FOR LAWN SEED AREAS ONLY:

A. Apply lime by mechanical means at rate of 3000 pounds per acre.

B. Apply fertilizer at rate of 1200 pounds per acre.

C. Remove weeds or replace loam and reestablish finish grades, if any delays in seeding lawn areas and weeds grow on surface or loam is washed out prior to sowing seed and without additional compensation.

3.04 SEEDING:

A. Sow seed on a calm day, by mechanical means. Sow one-half of seed in one direction, and other half at right angles to original direction. Rake seed lightly into loam, to depth of not more than 1/4 inch and compact by means of an acceptable lawn roller weighing 100 to 150 pounds per linear foot of width.

B. Seeding by hydroseeding method is acceptable.

1. The application of lime, fertilizer, grass seed and mulch may be accomplished in a single operation with the use of approved hydroseeding equipment. The materials shall be mixed with water in the machine and kept in an agitated state in order that the materials may be uniformly suspended in the water. The slurry shall be of such consistency that it can be sprayed from a hydroseed gun or through at least 200 feet of 1 inch diameter hose. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of lime, fertilizer, grass seed, and mulch shall be equal to the specified quantities.
2. Prior to the start of hydroseeding, the Contractor shall furnish to the Engineer, in writing, the weights of limestone, fertilizer, grass seed, mulch, tackifier (as required) and moisture retention agent (as required) per 100 gallons of water to be used. This statement should also specify the number of square yards of seeding that can be covered with the solution specified above. If the results of hydroseeding operations are unsatisfactory, the Contractor will be required to abandon this method and to apply the lime, fertilizer, grass seed and mulch by other means.

3. Seed shall be incorporated with the mulching material to obtain a minimum hydroseeded sown coverage at the specified seed mix per square foot as noted below, or as directed by the Engineer.
4. Wood fiber mulch shall be uniformly spread over certain selected seeded areas at the minimum rate of 1,400 pounds per acre unless otherwise directed. Mulch shall be placed by spraying from an approved spraying machine with pressure sufficient to cover the entire area in a single operation.
5. The Contractor shall immediately cleanup hydroseed oversprays from plant materials, pavements, furnishings, etc., to the satisfaction of the Engineer.

C. Seeding rates shall be as follows:

Seed Mix	**Seeding Rate**
Lawn Mix	6 lbs. per 1,000 SF

D. Water lawn areas adequately at time of sowing and daily thereafter with fine spray and continue throughout maintenance and protection period.

E. Seed during approximate time periods of April 1 to May 15 and August 15 to October 1, and only when weather and soil conditions are suitable for such work, unless otherwise permitted.

3.05 MAINTENANCE OF SEEDED AREAS:

A. Maintain lawn areas and other seed areas at maximum height of 2-1/2 inches by mowing at least three times. Weed thoroughly once and maintained until time of final acceptance. Reseed and re-fertilize with original mixtures, watering or whatever is necessary to establish over entire area of lawn and other seeded areas a close stand of grasses specified, and reasonably free of weeds and undesirable coarse native grasses.

B. Begin maintenance immediately after each portion of lawn is seeded and continue for minimum of 45 days.

C. Repair or replace all seeded areas which, in judgment of Engineer, have not survived and grown in satisfactory manner, for a period of one year after acceptance.

D. Seeding replacement, same seed mixture as specified and furnished and installed as specified.

3.06 TEMPORARY COVER CROP:

A. Sow a temporary cover crop if there is insufficient time in the planting season to complete seeding, fertilizing, and permanent seeding at the option of Contractor or order of Engineer. Cut and water cover crop as necessary until the beginning of the following planting season, at which time it shall be plowed or harrowed into soil, the areas shall be fertilized, and permanent seed crop sown as specified.

PART 4 – MEASUREMENT AND PAYMENT

4.01 MEASUREMENT:

A. LOAM BORROW shall be measured for payment per CUBIC YARD complete and in place as shown on the Drawings and as specified herein to consist of all labor, testing, materials, fertilizer, amendments, equipment, and all other incidentals to complete the work.

B. SEEDING shall be measured for payment per SQUARE YARD complete and in place as shown on the Drawings and as specified herein to consist of all labor, materials and equipment, maintenance, and all other incidentals to complete the work.

4.02 PAYMENT:

A. LOAM BORROW shall be paid at the contract unit prices for the quantities determined as specified above.

B. SEEDING shall be paid at the contract unit prices for the quantities determined as specified above.

4.03 PAYMENT ITEMS:

ITEM	DESCRIPTION	UNIT
02920-1	Loam Borrow	CY
02920-2	Seeding	SY

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY:

A. Section Includes under ADD ALTERNATE #4 requirements for furnishing and installing forms, reinforcing steel, concrete and expansion and/or construction joints for but not limited to:
   1. Concrete pads for placement of existing bleachers.

B. Related Sections
   1. Section 02200 – Site Preparation
   2. Section 02300 – Earthwork

1.02 REFERENCES:

A. American Society for Testing and Materials (ASTM)
   1. A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   2. A615, Specification for deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   3. C31, Practice for Making and Curing Concrete Test Cylinders in the Field.
   4. C33, Specification for Concrete Aggregates.
   5. C39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   6. C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   7. C94, Specification for ready Mixed Concrete.
   8. C143, Test Method for Slump of Hydraulic Cement Concrete.
   9. C150, Specification for Portland Cement.
   10. C172, Practice for Sampling Freshly Mixed Concrete.
   11. C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   12. C260, Test Method for Air-Entraining Admixtures for Concrete.
   13. C494, Specification for Chemical Admixtures for Concrete.
   14. C920, Specification for Elastomeric Joint sealants.
   15. D994, Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
   16. D1056, Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
   17. D1751, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

B. American Concrete Institute (ACI):
   1. ACI 301, Specification for Structural Concrete for Buildings.
   2. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

3. ACI 305, Recommended Practice for Hot Weather Concreting.
4. ACI 306, Recommended Practice for Cold Weather Concreting.
5. ACI 315, Building Code Requirements for Reinforced Concrete.
6. ACI 347, Guide to Formwork for Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):
1. Manual of Standard Practice.

1.03 SUBMITTALS:

A. Submit Shop Drawings in accordance with SECTION 01300 for the following:
1. Reinforcing Steel
a. Furnish in detail and completeness that all fabrication and placement at the site can be accomplished without the use of contract drawings for reference.
b. Include number of pieces, sizes, and grade of reinforcing steel, accessories, and any other information required for fabrication and placement.
c. Show joint layout and design
d. Check structural and site drawings for anchor bolts, anchors, inserts, conduits, sleeves, and any other items which are required to be embedded in concrete, and make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.
2. Concrete mix designs.
3. Grout manufacturer/design mix (if included in this section)
4. Manufacturer's data for ancillary materials such as joint fillers and sealants, epoxy bonding compound.

1.04 QUALITY ASSURANCE:

A. Inspection and testing of concrete mix will be performed in accordance with SECTION 01400 – Quality Control.

B. At the start of construction, and at least 48 hours before any materials are to be used on the job, contractor shall contact accredited laboratory for testing.

C. Provide free access to work and cooperation with firm.

D. Submit proposed concrete mix design to Engineer for review prior to commencement of work.

E. Three concrete test cylinders will be taken for every 75 or less cubic yards (57 or less cubic meters) of concrete placed.

F. One additional test cylinder will be taken during cold weather concreting and be cured on job site under same conditions as concrete it represents.

G. One slump test will be taken for each set of test cylinders taken.

H. Sample and Test Concrete as follows:

1. Test Specimens: Make, cure and have tested, a minimum of one set of four test specimens from the concrete of each day's pour and for each fifty cubic yards of concrete cast in accordance with ASTM C172, C31 and C39. One cylinder shall be broken after seven days and three cylinders after twenty-eight days.
2. Slump: A slump test shall be made for each truckload of concrete in accordance with ASTM C143. Slumps greater than design mix limit will be grounds for rejection of the concrete.
3. Air Content: An air content test shall be made from each day's pour of concrete by the pressure method in accordance with ASTM C231. Air contents above or below the limits specified will be grounds for rejection of the concrete.
4. In the event the compressive strength of the cylinders, when tested, is below the specified minimum, the Engineer may require test cores of the hardened structure to be taken by the Testing Laboratory in accordance with ASTM C42. If such test indicates that the core specimen is below the required strength, the concrete in question shall be removed and replaced without cost to the Owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the Engineer at no additional cost to the Owner. The cost of coring will be deducted from the contract amount. Where the Testing Laboratory has taken core cylinders and the concrete proves to be satisfactory, core holes shall be filled in a manner satisfactory to the Engineer at no additional cost to the Owner.
5. The Contractor shall coordinate the date and location of tests with the Engineer before any concrete work is started.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Reinforcing steel.

1. Transport to the site, store, and cover in a manner which will ensure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete or chip protective epoxy coating.
2. Store on the site at all times, a supply of approved reinforcing steel to ensure that there will be no delay of the work.
3. Identification of steel shall be maintained after bundles are broken.

PART 2 – PRODUCTS

2.01 MATERIALS:

A. The following table of minimum cement contents for various minimum 28 days compressive strengths (6"x12" cylinder) are based on air entrained and water reduced mixtures. The use of an approved additive other than air entraining and water reducing additives shall not affect the minimum cement content. Minimum cement contents may

be supplemented by the addition of Slag (GGBFS) or Fly Ash in percentages by weight as stipulated below.

The Contractor shall submit to the Field Engineer, for approval his proposed concrete supplier, source and type of materials, with current ASTM C-33 aggregate data, and concrete mix designs by an approved laboratory complete with trial mix data. Trial mixtures will be designed and tested within the specified slump and air content for each designated class of concrete. The trial mix 28 day strengths will be 1200 PSI over F'C for mixes 4000 PSI and above.

All concrete for construction shall have a minimum compressive strength of 4000 psi, a max. size aggregate of $^{3}/_{4}$" and contain 6% entrained air plus or minus 1.5% and may contain a maximum of 20% Slag or up to 15% Fly Ash by weight.

Minimum 28 day Compressive Strength	**Minimum Cement Pounds/Cu. Yd. Max. Size C.A. Inches**			**In Place Slump Inches**
Lbs./Sq.In.	**1 1/2**	**3/4**	**3/8**	
2000	376	423	470	3-5
2500	423	470	517	3-5
3000	470	517	564	3-5
3500	517	564	611	3-5
4000	564	611	658	3-5
4500	611	658	705	3-5
5000	658	705	752	3-5
Air Content				
% ± 1 1/2	5.0	6.0	7.5	

A. Portland Cement.
   1. In accordance with ASTM C150, Type II of U.S. manufacture.
   2. Only one brand of cement shall be used on the project.

C. Aggregates.
   1. Fine aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to fines.
   2. Coarse aggregate, in accordance with ASTM C33, clean and graded from 1/4 inch to maximum sizes hereinafter specified.

D. Air Entraining Agent.
   1. In accordance with ASTM C260.

E. Water Reducing Agent.
   1. In accordance with ASTM C494 Type A.

F. Microsilica Admixture.
   1. Packaged in easily dispersing form.

G. Water.
   1. Clean and potable,
   2. Free of impurities detrimental to concrete.

H. Reinforcing Bars.
   1. New, deformed billet steel bars, in accordance with ASTM A615, Grade 60.

I. Welded Wire Fabric
   1. In accordance with ASTM A185.

J. Accessories.
   1. Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place.
   2. All accessories shall be dielectric coated steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards.

K. Tie wire.
   1. 16 gauge or heavier black annealed wire.

L. Form Ties and Spreaders.
   1. Standard metal form clamp assemble and plastic cone, of type acting as spreaders and leaving no metal within 1 inch of concrete face.
   2. Provide form tie with water stop for all walls to be in contact with earth or liquid.
   3. Inner tie rod shall be left in concrete when forms are removed.
   4. No wire ties or wood spreaders will be permitted. Use ½" x 1" C.T. plastic cones for sinkages.

M. Form Coatings.
   1. Non-grain raising and non-staining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface.
   2. "Nox-Crete Form Coating" as manufactured by Nox-Crete Company or approved equal.
   3. Coatings containing mineral oils or the non-drying ingredients will not be permitted.

N. Grout.
   1. High-strength, non-shrink grout with saltwater resistance.
   2. Five Star Special Grout 120 or equivalent.

2.02 CONCRETE STRENGTHS AND PROPORTIONS:

A. Cast-in-place concrete shall have the minimum compressive strength at 28 days as indicated on the Drawings.

B. The exact proportions for the mix, including amounts admixture (if any), and water, shall be determined by the concrete supplier.

C. The proportions of aggregate to cement for any concrete shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed not be work, but without permitting the materials to segregate or excess free water to collect on the surface.

D. Air-Entrainment: The air content in all concrete shall be maintained at 5 to 7 percent.

2.03 PREMOLDED JOINT FILLER

A. Bituminous Type.
   1. In accordance with ASTM D994 or D1751.

B. Sponge Rubber Type.
   1. Neoprene, closed-cell, expanded in accordance with ASTM D1056, Type 2C5, with a compression deflection, 25 percent deflection (limits), 17 to 24 psi (119 to 168 kPa) minimum.

2.04 POURABLE JOINT FILLERS

A. Filler for Non-potable Water Structures
   1. Specific Gravity: Greater than 1.0 for cured, in-place filler.
   2. Vertical and Sloped Joints: Furnish gun grade material that will remain as placed in joints and will not run down slope.
   3. Suitable for continuous immersion and exposure to liquid being contained in the structure.

2.05 JOINT SEALANTS

A. In slabs.
   1. In accordance with ASTM C920 for poured 2-component polyurethane sealant.
   2. Sikaflex-2c, as manufactured by Sika Corporation or approved equivalent.

B. In walls.
   1. Type II, Class A, compound conforming to Interim Federal Specification TT-S-00227E (3) (COM-NBS) for Sealing Compound; Elastomeric Type, Multi-Component (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
   2. Sikaflex-1a, as manufactured by Sika Corporation or approved equivalent.

2.06 EPOXY BONDING COMPOUND

A. The epoxy bonding compound shall be a three-component, solvent-free, moisture-tolerant, epoxy modified, cementitious product specifically formulated as a bonding

agent and anti-corrosion coating. The product shall have suitable contact time, fluidity, and application temperature for this type of application.

PART 3 - EXECUTION

3.01 FORMWORK

A. Falsework for Forms

1. Build and maintain necessary false work for the forms.

B. Construction of Forms

1. General
   a. Construct in accordance with ACI 347.
   b. Construct of sound material, to the correct shape and dimensions, mortar tight, of sufficient strength, and so braced and tied together that the movement of men, equipment, materials, or placing and vibrating the concrete will not throw them out of line or position.
2. Embedded Items
   a. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
   b. Do not embed wood, other than necessary nailing blocks, in concrete.
   c. Extended complete cooperation to suppliers of embedded items in their installation.
   d. Secure information for embedded items from other trades as required.
   e. Securely anchored embedded items in correct location and alignment prior to placing concrete.
3. Openings for Items Passing Through Concrete
   a. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
   b. Coordination work of this nature in order that there will be no unnecessary cutting and patching of concrete.
   Cutting and repairing of concrete as a result of failure to provide for such openings shall be paid for by the Contractor at no additional expense to the Owner.

C. Removing Forms and False work

1. Forms shall not be removed for at least 72 hours after concrete has been placed.
2. Forms shall not be removed until the concrete has attained sufficient strength to insure stability.

3.02 REINFORCING STEEL

A. General

1. Place reinforcing steel in accordance with the drawings and approved shop drawings and the applicable requirements of the CRSI, Manual of Practice.
2. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and the placement of concrete.

B. Reinforcing Steel Supports

1. Support bars on approved plastic or dielectric-coated metal chairs or spacers, accurately placed and securely fastened to forms or steel reinforcement in place.

2. Supply additional bars, whether specifically shown on the drawings or not, where necessary to securely fasten reinforcement in place.
3. Support legs of accessories in forms without embedding in form surface.
4. Spacing of chairs and accessories shall conform to CRSI, Manual of Standard Practice. Accurately space hoops and stirrups and wire to the reinforcement.
5. Permit no lose wood inside forms.
6. Lifting of welded wire fabric into proper position while concrete is being poured rather than supporting fabric on chairs will not be permitted.

C. Placing and Tying
1. Set in place, space, and rigidly and securely tie or wire with tie wire at all splices and at all crossing points and intersections in the positions shown, or as directed.
2. Re-bending of bars on the job to accommodate the job to accommodate existing conditions will not be permitted without the written approval of the Engineer
3. Points ends of wire ties away from forms.

D. Spacing
1. Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings, or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1½ inches or less than 1½ times the maximum size aggregate.

E. Splices
1. Maximum 50% of steel spliced occurring within lap length.
2. Top bars shall be 1.3 times values given in 3.01.D.5.c.
3. Splice lengths.
#6 bars and smaller: 50-bar diameter
#7 bars and larger: 60-bar diameter

F. Concrete Covering
1. In accordance with ACI 315, except where shown otherwise on drawings.

3.03 CONCRETE

A. Mixing of Concrete
1. All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with ASTM C 94. The batch plant of the concrete producer shall be certified for compliance with the standards established by the National Ready-Mixed Concrete Association.
2. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept to a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first class condition and kept in constant rotation during delivery.

3. Concrete shall be placed within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.
4. No admixtures, except those mentioned in paragraph 2.1 shall be used. Calcium chloride will not be

permitted.

5. Truck delivery slips of all concrete delivered to the job shall indicate the quantity and quality of concrete, additives, date and time of batching and delivery, and the location of placement. Delivery slips shall be forwarded to the Engineer at the end of each pour.

B. Cold Weather Concreting.
1. In accordance with ACI 306.
2. Concrete shall not be mixed or placed when the temperature is below 40 degrees F, or when conditions indicate that the temperature will fall below 40 degrees F within 72 hours unless precautions are taken to protect the concrete.
3. Concrete temperature shall be maintained, when deposited, at not less than 60 degrees F. Reinforcement, forms, and ground which concrete will contact must be completely free of frost.

4. Concrete and formwork must be kept at a temperature of not less than 50 degrees F. for not less than 96 hours after placing.

5. Calcium chloride shall not be used.

C. Hot Weather Concreting.

1. In accordance with ACI 305.
2. The maximum temperature of the concrete, when deposited, shall be 85 degrees F. If the weather causes the placing temperature to exceed 85 degrees F., the mix shall be cooled by methods approved by the Engineer.
3. No concrete shall be deposited when the air temperature is greater than 90 degrees F.

D. Conveying and Placing Concrete.
1. In accordance with ACI 304.
2. Notification: Before placing concrete, forms shall be thoroughly inspected. All chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement, and which is set and dry, shall be cleaned off, and the forms and steel washed off before proceeding. Remove all foreign matter from forms and excavations.
3. Water shall be removed from place of deposit before concrete is placed unless otherwise permitted by the Engineer. Any flow of water into an excavation

shall be diverted through proper side drains into a sump or shall be removed by other approved methods which will avoid washing away the freshly deposited concrete.

4. Soil on which concrete will be poured shall be thoroughly wetted (except in freezing weather).

5. Anchors and Embedded Items: Anchors, bolts, sleeves, inserts, wood blocking, and any other items to be embedded in concrete shall be accurately secured in position before the concrete is placed. Aluminum shall not be embedded in concrete.

6. Handling and Depositing

a. Before any concrete is placed, notify all whose work is in any way connected with or influenced by the concrete work, and give them reasonable time to complete all portions of their work that must be completed before concrete is deposited.

b. Immediately before concrete is placed, inspect all forms to ensure that they are in proper position, sufficiently rigid, thoroughly clean, properly oiled and free from foreign materials, and that all reinforcement is in proper position.

c. Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.

d. Concrete shall be conveyed as rapidly as practicable from the mixer to the place of final deposit by methods that prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid rehandling or flowing.

e. Concrete shall not be dropped freely where reinforcement will cause segregation, nor shall it be dropped freely more than six (6) feet. Concrete shall be deposited to maintain a plastic surface approximately horizontal.

f. Concrete that has partially hardened shall not be deposited in the work.

7. Pumping

a. Concrete may be placed by pumping if first approved in writing by the Engineer for the location proposed.

b. Equipment for pumping shall be of such size and design as to ensure a practically continuous flow of concrete at the delivery end without separation of materials.

c. The concrete mix shall be designed to the same requirements as herein before specified and may be richer in lubricating components in order to allow proper pumping.

d. Concrete shall not be pumped through aluminum pipes.

8. Vibrating and Compacting

a. All concrete shall be thoroughly consolidated and compacted by suitable means during the operation of placing, and shall be thoroughly worked around reinforcement, embedded items, and into the corners of the forms. All concrete against forms shall be thoroughly spaded. Internal vibrators shall be used under experienced supervision and shall be kept out of contact with reinforcement and wood forms. Vibrators shall not be used in a manner that forces mortar between individual form members.

b. Vibrators shall be flexible electric type or approved compressed air type, adequately powered and capable of transmitting to the concrete not less than seven thousand (7,000) impulses per minute. Vibration shall be sufficiently intense to cause the concrete to flow or settle readily into place without separation of the ingredients. A sufficient number of vibrators shall be employed so that complete compaction is secured throughout the entire volume of each layer of concrete. At least one (1) vibrator shall be kept in readiness as a spare for emergency use. Vibrators shall be such that the concrete becomes uniformly plastic with their use.

c. Vibration shall be close to the forms but shall not be continued at one spot to the extent that large areas of grout are formed or the heavier aggregates are caused to settle. Care shall be taken to not disturb concrete that has its initial set.

d. Where conditions make compacting difficult, or where the reinforcement is congested, batches of mortar containing the same proportions of cement to sand as used in the concrete shall first be deposited in the forms, to a depth of at least on inch.

e. The responsibility for providing fully filled out, smooth, clean, and properly aligned surfaces free from objectionable pockets shall rest entirely with the Contractor.

3.04 CONSTRUCTION JOINTS

A. Construction joints shall be located a maximum of 40 feet apart. If, for any reason, the contractor feels a change is necessary, he shall prepare a placing plan and submit it to the Engineer for approval.

B. Where a joint is to be made, the surface of the concrete shall be sandblasted or thoroughly picked, thoroughly cleaned, and all laitance removed. In addition to the foregoing, joints shall be thoroughly wetted, but not saturated, and slushed with a coat of grout immediately before the placing of new concrete.

C. Approved keys shall be used at all joints, unless detailed otherwise.

D. Forms shall be retightened before placing of concrete is continued. There shall be an interval of at least 48 hours between adjacent pours.

E. Bonding Concrete at Construction Joints

1. To new concrete construction joints:
   a. Thoroughly clean and saturate joint with water.
   b. Cover horizontal wall surfaces as specified in this Section, and immediately place concrete.
   c. Limit concrete lift placed immediately on top of bonding compound to 12 inches thick.
   d. Thoroughly vibrate to mix and consolidate bonding compound and concrete together.

F. Bonding new concrete to old concrete:
1. Mechanically roughen existing concrete surfaces to a clean, rough surface using appropriate mechanical means to remove the existing concrete surface and provide a minimum roughness profile of ¼-inch.
2. Saturate surface with water for 24 hours, cover with epoxy bonding compound and place concrete as specified for new concrete.

G. Expansion Joints
1. Expansion joints shall be located as shown on contract drawings.
2. The joint shall include a joint filler, a bond breaker and joint sealant and installed as indicated on contract drawings.

H. Joint Sealants.
1. Prepare surface in accordance with manufacturers' directions.
2. Apply primer as recommended by sealant manufacturer.
3. Install sealant with the proper tools and methods as directed by the sealant manufacturer.

I. Patching
1. Immediately after stripping forms, patch minor defects, form-tie holes, honeycombed areas, etc., before concrete is thoroughly dry.
2. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar consisting of 1-part cement to 2 parts fine sand; compact into place and neatly finish. Honeycombed areas or gravel pockets which, in the Engineer's opinion are too large and unsatisfactory for mortar patching as described above, shall be cut out to solid surface, keyed, and packed solids with matching concrete to produce firm bond and surface.
3. The Contractor shall do all the cutting as required by himself or other trades. All such work shall be of the minimum size required. No excessive cutting will be permitted, or shall any structural members or reinforcement be cut.
4. The Contractor shall do all patching after work by other trades has been installed, where required, using Portland Cement Mortar 1:2 mix.

J. Protection and Curing
1. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.

2. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured, for at least (7) days.

3. Carefully protect exposed concrete corners from damage.

4. Allow no slabs to become dry at any time until curing operations are complete. In general, slabs shall be cured with non-staining curing paper, hosing or fog spray; vertical surfaces shall be curing with Burlene or fog spray or an approved curing compound.
5. Protect fresh concrete from drying winds, rain, damage, or spoiling. Curing paper shall be lapped 4 inches minimum at joints and sealed with waterproof tape.

K. Concrete Finishes
1. Unexposed Surfaces: All unexposed surfaces shall have any form finish, at the Contractor's option.

2. Wearing Surface Finish: Float the surface by hand using a wooden or magnesium float. Finish with a flexible bristle broom. Permit surface to harden sufficiently to retain the scoring or ridges. Broom transverse to traffic or at right angles to the slope of the slab.

3. Addition of Material: The addition of cement, sand, water, or mortar to slab surfaces while finishing concrete is strictly prohibited.

L. Defective Work
1. The following concrete work shall be considered defective and may be ordered by the Engineer to be removed and replaced at Contractor's expense:
   a. Incorrectly formed.

   b. Not plumb or level.

   c. Not specified strength.

d. Containing rock pockets, voids, honeycomb, or cold joints.
e. Containing wood or foreign matter.

f. Otherwise not in accordance with the intent of the Drawings and Specifications.

PART 4 - MEASUREMENT AND PAYMENT

4.01 MEASUREMENT

A. CAST-IN -PLACE CONCRETE for granite edging, footbridge/boardwalk seats, and footings for boardwalk, signs, wood guardrail, and bench shall not be measured for payment but shall be incidental to their respective items.

4.02 PAYMENT

A. CAST-IN -PLACE CONCRETE shall be paid at the Contract Unit Price per Cubic Yard, as specified above and as specified herein to consist of all labor, and other incidentals.

B. Gravel Borrow and Excavation shall be paid for separately as noted under Gravel Borrow, or Excavation in SECTION 02300 Earthwork or under their respective item as noted in the specifications.

4.03 PAYMENT ITEMS

ITEM	DESCRIPTION	UNIT
03300-1	Cast-in-Place Concrete	CY

END OF SECTION