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GENERAL

Submittals - Product Data: Required

03100 CONCRETE FORMWORK

03100.10 QUALITY ASSURANCE

Reference Standards – The latest publications of the following standards shall establish the minimum requirements when not otherwise specified in this section.

ACI Standard 347, "Recommended Practice for Concrete Formwork".

03100.20 PRODUCTS

Forms shall be wood, plastic, fiberglass or metal, complete with shores, bracing, etc., as required and shall conform to the shapes, lines and dimensions of the members shown on the drawings.

Forms for exposed concrete shall be constructed of metal or smooth A-A plywood, or other material to provide a smooth surface finish.

03100.30 EXECUTION

Forms shall be substantially constructed and securely braced so as to maintain position and shape, and resist springing or settling as concrete is placed, and sufficiently tight to prevent leakage or mortar.

Before concrete is poured, forms shall be cleaned of all ice, snow, shorings, wood cutting, and other debris. The University Representative shall inspect all forms prior to placing the concrete.

All forms shall be cleaned and treated each time they are used.

03150 EXPANSION AND CONTRACTION JOINTS

03151 EXPANSION JOINT FILLERS

03151.10 GENERAL

Foam expansion joint materials will generally be used at all building expansion and control joints. Asphalt impregnated joint fillers may be used at joints with minimum design movement and are not to be caulked over.

03151.20 RELATED WORK SPECIFIED ELSEWHERE

Joint materials in sidewalks and other exterior concrete flat work. Curbs and Gutters – Section 02620 -, and Concrete Walks –Section 02630 -.

03151.30 QUALITY ASSURANCE

Acceptable Manufacturers: (_____)

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03151.40 PRODUCT DESCRIPTION

Asphalt Impregnated - Asphalt impregnated expansion joint fillers shall be a premolded rigid cane fiber board product, uniformly impregnated with an asphalt compound to prevent degradation. Joint filler shall meet or exceed ASTM Specification D-994-53.

Polyvinyl Chloride – Polyvinyl chloride expansion joint fillers shall be closed cell, non-extruding PVC or polyurethane foam, or equal. Joint filler should normally be ½ inch thick.

Polyethylene - Polyethylene expansion joint fillers shall be ultraviolet stable and of closed cell sheet material with a density of 2.50 – 3.00 lbs./cu. Ft. and shall have a water absorption rate of less than 2% after 48 hours with 10 ft. of head.

03151.50 INSTALLATION

Install all expansion joint fillers slightly below the finished surface. Foam expansion joint fillers will be placed to allow for a well designed bead of sealant. Asphalt impregnated joint fillers will not be caulked over.

03152 WATERSTOPS

03152.10 GENERAL

All below grade construction joints in concrete not otherwise protected by waterproof membranes shall have waterstops.

03152.20 QUALITY ASSURANCE

Acceptable Manufacturers: (_____)

03152.30 PRODUCT DESCRIPTION

Waterstop shall consist of extruded vinyl made only from virgin raw materials. Waterstop shall be highly resistant to alkalis, acids, oxygen, ozone, and waterborn chemicals.

Waterstop shall be serrated split type with center bulb.

03152.40 EXECUTION

Waterstops shall be ventered in concrete with half of the waterstop embedded in the first pour of concrete, the other half shall be spread open and stapled or nailed to the bulkhead. After removing the first pour formwork, the split flange is joined by rings or staple, and then the second pour made.

All waterstop splices shall be heat-sealed according to manufacturer's instruction.

03200 CONCRETE REINFORCEMENT

03210 STEEL BARS AND WELDED WIRE FABRIC REINFORCING

03210.01 QUALITY ASSURANCE

Reference Standards – The latest publication of the following standards shall establish the minimum requirements when not otherwise specified in this section.

Placing reinforcing bars – CRSI

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Manual of Standard Practice for Detailing Reinforced Concrete Structures – No. 315 by ACI.

03210.10 PRODUCT DESCRIPTION

Bar reinforcement strength shall be 60,000 PSI minimum and shall meet ASTM A615, Grade 60.

Welded wire fabric shall meet ASTM A185. Provide in flat sheets only.

Epoxy coated re-bar and applicable installation techniques are recommended for exterior concrete with no further coatings or sealers, especially in areas subject to salt exposure.

Wire, bar, and chain type reinforcements supports shall be corrosive resistant, hot dipped galvanized, or plastic coated in accordance with CRSI.

03210.20 EXECUTION

Fasten the reinforcement securely to supports. At control joints the reinforcement shall be held 1-1/2" short of the joint. Reinforcement will be covered by a minimum of 1-1/2" bar diameters of concrete; however, the minimum will be one inch of cover in concrete against grade, and a minimum 1-1/2 inches of cover in concrete exposed to road salt.

03300 CAST-IN-PLACE CONCRETE

03300.12 QUALITY ASSURANCE

Quality Standards:

- Formwork and concrete: ACI 318, Building Code requirements for Reinforced Concrete.
- Reinforcement: CRSI manual of Standard Practice.

03300.20 PRODUCTS

03300.21 MANUFACTURERS/PRODUCTS:

Form Materials:

Sheet: Plywood; Lumber; Prefabricated; Steel; Glass Fiber; Plastic;

Type: Pan Type (Steel; FRP)

Tubular Column Type: Round, spirally wound laminated corrugated cardboard.

Void Forms: Moisture resistant treated paper.

Form Ties: Removable, Snap-off

Waterstops: Rubber; Polyvinyl chloride.

Accessories: Dovetail anchor slots; flashings, reglets, formed construction joints for shab-on-grade.

Reinforcement Materials: Reinforcing steel: ASTM A615, 60 ksi, deformed billet steel bars, plain finish; Welded steel wire fabric: Plain type, plain finish.

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Concrete Materials: Cement: ASTM C150, Normal-Type1, Portland type; Fine and Coarse Aggregates: ASTM C33.

03300.22 ACCESSORIES/MIXES

Vapor Retarder: 6 mil thick clear polyethylene film.

Curing Compound and Sealer: Acrylic, Chlorinated liquid runner, type, clear, translucent.

Chemical Hardener: Metallic, Non-metallic, type, clear, colored.

Concrete Design Mixes: Minimum 28 days compressive strength as scheduled.

03300.23 QUALITY CONTROL

Shop Test: Required; Not Required.

Shop Inspection: Required; Not Required.

03300.30 EXECUTION

03300.31 INSTALLATION

Provide chamfer strips on external corners of beams; joists and columns.

Install vapor retarder under interior slabs on grade.

Cure surfaces with sealer; absorptive matting.

03300.32 FIELD QUALITY CONTROL

Field Test: Required; Not required.

Field Inspection: Required; Not required.

03300.33 SCHEDULES

Concrete Design Mixes: Minimum 28 Day Compressive Strength.

Columns, beams, walls, foundations, and footings: () psi; () Mpa.

Slabs on grade and paving base: ()psi () Mpa.

Concrete on metal Deck: () psi () Mpa.

Site concrete and pads exposed to weather: () psi () Mpa.

Concrete Finishes – Formed Surfaces

Surfaces not exposed to view: As cast form finish.

Surfaces exposed to view: Smooth form; Smooth rubber; Grout-cleaned; Special textured form; finish.

Concrete Finishes: Slabs.

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Surfaces to receive concrete floor topping or setting beds: Scratch finish.

Surfaces covered with carpet, resilient flooring: Trowel finish.

Surfaces to receive thin set tile: Trowel and fine broom finish.

Exterior concrete platforms, steps, and ramps: Broom finish.

Exterior walks; paving; exposed aggregate; patterned: Color Finish.

03310 CONCRETE

03310.01 GENERAL

Additives will be allowed as shown in this Section or as included in the approved mix design submitted by the structural engineer responsible for the structural integrity of the project.

Section 02620 and 02630 shall not be incorporated into Division 3 in any way. Site concrete (pavement and curb and gutter) shall be separate sections.

03310.02 RELATED WORK SPECIFIED ELSEWHERE

Curbs and Gutters – Section 02620
Concrete Site Pavement – 02630

03310.10 QUALITY ASSURANCE

Reference Standards – Concrete Materials, testing, mixing, and placement, except as herein specified, shall be in accordance with the Portland Cement Association publication – Design and Control of Concrete Mixtures. –

Cost of Testing – The cost of testing will be covered by an allowance which will be included in the contractor's bid. The amount of the allowance will be defined in the allowance section of the specifications.

Test Reports and Certification – WMU will retain the services of an approved testing laboratory, to determine the quality of all concrete. The laboratory personnel will take the samples, cast the cylinders, or perform other tests as required. The Owner will receive reports of all tests directly from the testing laboratory.

Provide the required testing and inspection as indicated in 01400. Perform one (1) test for slump and air content, and one (1) test for compressive strength from each concrete batch. Provide two (2) unnotarized copies of the report to the owner for each test. Concrete sampling, testing, and inspection shall conform to the following requirements:

Sampling Fresh Concrete – ASTM C172, except initial samples will be taken immediately after first $\frac{1}{4}$ c.y. has been discharged and subsequent samples will be taken as specified herein. If found to be in non-conformance, the concrete will be removed from the forms.

Slump – ASTM C143, Additional tests will be made for each set of compressive strength test specimens and as additional tests may be required by the Project Representative.

Air Content – ASTM C231 and additional tests at the end of the load, if possible.

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Concrete Temperature – Taken each time compression test specimens are made and hourly when temperature is below 40F or over 80F.

Unit Weight – ASTM C138, except the sample volume will be equal to air content specimen.

Compressive Strength – ASTM C31 and C39, except one set of 4 cylinders for every 40 c.y. or fraction thereof. One specimen will be tested at 7 days and the remaining 2 specimens will be tested at 28 days. Strength level of the concrete will be considered unsatisfactory if the seven-day compressive strength does not equal or exceed 60% of the twenty eight-day design strength. Strength level of concrete will be considered satisfactory if the average compressive strength of two consecutive twenty eight-day tests equals or exceeds the 28 day design strength, and neither individual strength test result falls below the specified compressive strength requirement by more than 100 psi.

Inspection – All concrete placed shall also conform to the installation procedures of this specification.

Concrete Replacement – Failure of any test or to follow proper installation procedures will require that the concrete be removed and properly replaced at Contractor's expense.

Additional Tests – WMU may have the testing service make additional tests of in-place concrete when test results indicated specified concrete strengths and other characteristics have not been attained. The testing inspection agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or such non-destructive testing methods that may be approved by the project representative. WMU shall pay for all such tests conducted. Any holes made shall be patched by the Contractor at his expense.

03310.20 MATERIALS

Shall be Portland cement conforming to the requirements of the current specifications for Portland Cement ASTM C150 Type 1A.

Air Entraining Admixture – Shall conform to ASTM C260 for concrete

Bonding Admixtures – Specify latex or acrylic bonding agents when placing new concrete against existing concrete. Mix bonding agents in concrete mix when patches require thin and/or feathered sections in accordance with manufacturer's recommendations.

Sand – Shall conform to the MDOT Specifications for Sand 2NS.

Aggregate – Shall be well graded gravel and crushed stone of hard, durable uncoated particles or limestone, if specifically required. Gradation and physical requirements to conform to MDOT Specifications 6AA.

Water – Shall be potable.

03310.30 CONCRETE PROPORTIONS

The concrete mix shall be designed by a licensed professional engineer to meet the project design conditions and minimum loading conditions indicated in these Standards. The mix design shall be submitted to the Project Representative for review and approval.

Unless specified otherwise by the structural engineer; maximum allowable slump shall be 4 ½ inches, air entrainment shall be 5% to 7%, compressive strength shall be 4,000 psi with a minimum of 6 sacks of cement per cubic yard of concrete.

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The contractor shall provide the Project Representative with delivery tickets which shall list slump, sack mix, percent of air entraining agent, time the truck left the plant, arrival on the job site and departed the job site, and water added at the site.

When requested, the Contractor shall provide documentation from the concrete supplier certifying the concrete meets the specifications of this section.

Retempering of concrete will be allowed only with prior written approval of the Project Representative.

Where conditions make consolidation of concrete difficult, or where the reinforcement is congested, batches or 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 one (1) inch.

03310.40 CONCRETE PLACEMENT

Placing the concrete shall not commence until the subgrade, reinforcing, and forms have been approved. The subgrade shall be moistened in advance of concreting, but shall not be muddy or excessively wet. A sufficient quantity of forms shall be placed to accommodate all of the concrete that is scheduled to be poured at any one time. Concrete shall be deposited with a minimum of rehandling and shall be spaded adjacent to forms and joints. In the case of isolation joints, concrete shall be placed simultaneously against both sides of the joint.

PROTECTION OF NEW CONCRETE

Hot/windy Weather – Project freshly placed concrete form premature drying. Do not let estimated rate of evaporation exceed .02 lb./sq. ft./hr. per Portland Cement Association recommendations relating air temperature, relative humidity, concrete temperature, and wind velocity.

Cold Weather – Concreting shall not be continued when the air temperature is below 45F unless the aggregates and/or water are heated to produce a placing temperature of the concrete between 60F and 90F and unless adequate provisions are made for maintaining protection against freezing of the concrete for at least 7 days after placing. Furnish insulation, enclosure, or enclosure and heat as required.

No concrete shall be placed on frozen subgrade.

03310.50 CONCRETE SLAB FINISHING

Concrete shall be carefully compacted and screeded off to the correct elevations. Bull-float shortly after placing. Move any stone pockets to sandier area of slab and tamp or vibrate.

When slabs are sufficiently hard, machine float surface to remove all irregularities and secure a uniformly dense floor.

Provide all the necessary jointing and edging.

Mechanical steel troweling and minimum of one hand troweling shall be used to bring slabs to a true hard surface such as will ring with the touch of a trowel.

Exterior slabs will have a finished steel float surface, or an approved broomed finish in lieu of a steel troweled finish.

All interior floors, including areas to receive vinyl sheetgoods, vinyl tile or carpet shall have a smooth troweled finish; unless other finish is required by finished flooring materials.

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Concrete surfaces on interior or exterior loading docks shall have a broom finish to provide a non-skid surface.

Floor surfaces shall not vary from a true plane more than 1/8 inch in 10 ft. – 0 inches. Except those areas of door opening and swing. In these areas, the floor shall be completely level.

03310.60 CONCRETE CURING, HARDENING, AND SEALING

Curing General - All concrete will be cured in accordance with ACI. 301 procedures and as described herein. Water loss from new concrete will be limited to a rate of 1 lb. Sq. ft. per 72 hrs.

Curing Compounds – Damp curing is preferred over using curing compounds to avoid incompatibility with the many finish materials, hardeners, and sealers. Curing compounds will be used where required by weather, approved construction schedules, and construction that is not adaptable to damp curing. The sodium silicate base curing compounds that follow are compatible with the Physical Plants preferred sealer, most resilient flooring adhesives and many point finishes.

Specify other curing compounds as approved by the manufacturer of the finish materials to be installed. Curing compounds should contain a fugitive dye, or when hot weather conditions dictate, a fugitive heat reflecting pigment.

Surface hardeners – The use of hardeners should be considered for special areas, but the incidental hardening of most curing compounds and sealers has been adequate. Magnesium zinc fluoressilicate hardener is generally compatible with the sodium silicate curing compounds listed above, but is not recommended for finished areas because the surface is often rough and mottled.

SEALERS

General – All interior floors and stairs not receiving additional finishes shall receive a sealer to provide a smooth non-dusting surface for ease of maintenance. Air plenum chamber floors and areas to receive carpet will also be sealed.

Material and Application – Sealer will be sodium silicate applied generally by the WMU Custodial Department as follows: (coordinate during the design stage)

Clean floor by power scrubbing with a good detergent or vegetable oil soap.

FIRST COAT – Mix one part sodium silicate (water glass) with four parts water. Apply a heavy coat using a mop, and work into the floor for ten minutes or until solution becomes tacky. Mop-up puddles and runs immediately. Mop floor dry and allow to air dry for a minimum of eight hours.

SECOND AND THIRD COATS – Mix one part sodium silicate (water glass) with three parts water. Apply each coat using same method as first coat: Allow each coat to dry eight hours.

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03505 SELF-LEVELING UNDERLAYMENT

03505.10 GENERAL

03505.11 SUBMITTALS

Product Data: Required.

03505.12 QUALITY ASSURANCE

Regulatory Requirements: Flame/Smoke rating of [__/__].

03505.20 PRODUCTS

03505.21 MANUFACTURERS/PRODUCTS

Source: (_____), Product (_____), Model (_____).

Underlayment: Gypsum; Cementitious based mix.

03505.22 ACCESSORIES/MIXES

Mix to achieve following characteristics:

- Density: (100) (115) (_____) lb./cu ft [(1600) (1840) (_____) kg/cu m)

- Compressive Strength: (1,000) (2,500) (_____) psi [(6.9) (17.2) (_____) Mpa minimum.

03505.30 EXECUTION

03505.31 APPLICATION

Place to thickness (indicated; as scheduled) (minimum (1/8) (_____) [(3) (_____) mm) and maximum (1/2) (_____) inch [(6) (_____) mm thickness.

Place (before; after) partition installation.

03505.32 FIELD QUALITY CONTROL

Field Tests: Required, Not Required.

Field Inspection: Required, Not Required.

03505.33 SCHEDULES

On Drawings.