

## SECTION 03315 - CONCRETE WORK (SEWERS)

### PART 1 - GENERAL

#### SUMMARY

Section Includes. Extent of concrete work as shown on Drawings and specified in this Section.

Related Documents. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1, apply to Work of this Section.

#### REFERENCES

##### ASTM

- A 185 Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
- A 497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- A 615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- C 150 Portland Cement.
- C 260 Air-Entraining Admixtures for Concrete.
- C 309 Liquid Membrane-Forming Compounds for Curing Concrete.
- C 494 Chemical Admixtures for Concrete.
- C 595 Blended Hydraulic Cements.
- C 618 Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

##### MDOT

- 8.02.03 Coarse Aggregates for Portland Cement Concrete.
- 8.02.07 Fine Aggregates for Portland Cement Concrete and Mortar 2NS.

#### SUBMITTALS

Shop Drawings. Submit in accordance with Section 01330, Shop Drawings covering the items included under this Section. Shop Drawing submittals shall include:

Mix Design: Submit concrete mix design as early as possible, but no later than 4 weeks before scheduled pouring. Submittal shall also include a sieve analysis of the course aggregates, including the quantity of deleterious materials present.

Product Data: Submit data for proprietary materials and items, including reinforcement, admixtures, patching compounds, waterstops, joint systems, curing compounds, and others used under this Section.

Test and Inspection Report. A written report shall be submitted to ENGINEER documenting testing and/or inspection results. The report shall be prepared as noted under Section 01600.

#### QUALITY ASSURANCE

Testing. During the progress of construction and at direction of ENGINEER, perform tests to determine that the concrete complies with the compressive strength and consistency requirements.

One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

ENGINEER will witness the preparation of test cylinders.

Provide concrete for (4) test cylinders in each set. Make, handle, and store test specimens. Pack and ship specimens in substantial packages to prevent damage during transit.

CONTRACTOR shall bear expenses of shipment and testing specimens by an approved, independent testing laboratory.

## PART 2 - PRODUCTS

### FORM MATERIALS

Forms for Exposed Finish Concrete. Use plywood, metal, metal-framed plywood faced, or other acceptable panel materials, to provide continuous, straight, smooth, exposed surfaces. Provide largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.

Form for Unexposed Finished Concrete. Use plywood, lumber, metal, or other acceptable material. Use lumber dressed on at least two edges and one side for tight fit.

### REINFORCING MATERIALS

Reinforcing Bars: ASTM A 615, Grade 60, deformed.

Welded Wire Fabric: ASTM A 185, welded steel wire fabric.

Welded Deformed Steel Wire Fabric: ASTM A 497.

### CONCRETE MATERIALS

Portland Cement: ASTM C 150, Type I or Type III. Use Type III where high-early-strength is required.

Blended Hydraulic Cement: Conforming to ASTM C 595, Type IP (Portland Pozzolan cement), with Pozzolan content not to exceed 20 percent by weight.

Fly Ash: ASTM C 618, Type C or Type F, with loss on ignition not more than 6 percent.

Ground Granulated Blast-Furnace Slag: ASTM C 989.

Aggregates: Fine aggregate - MDOT (Michigan Department of Transportation) 2NS. Coarse aggregate - MDOT 6AA.

Water: Potable.

Air-Entraining Admixture: ASTM C 260.

Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.

Curing Compound: ASTM C 309, Type 1 or Type 2, Class B. Limit moisture loss to 0.040 gm per square centimeter when applied at 200 square feet per gallon coverage.

Fiber Reinforcement: Monofilament Polypropylene, ASTM C 1116, Type III.

## CONCRETE MIX DESIGN

### Classes:

Class A: All concrete not otherwise indicated.

Class C: Fill within manholes, mud mats, fill under structures, encasement for piping below or adjacent to structures and encasement for floor drains, sewer inlets and similar items.

Proportions: Proportion concrete by volume in agreement with the following table and ACI 211.1.:

Concrete Class	A	C
28-day Compressive strength, psi *	4,000	2,000
Laboratory Trial Batch for Selecting Concrete Proportions, average 28-day		
Compressive Strength, psi, design mix	4,700	2,600
Cement Content per cubic yard of concrete, sacks minimum **	6	4
Water/Cement Ratio by weight, maximum	0.44	0.75
Air Content, percent by volume	5+1	NA
Slump at point of placement, inches ***	2-4	3-6

\* 7-day compressive strength for high-early-strength concrete.

\*\* For concrete with fly ash, values are total of cement plus fly ash (Except Class F).

\*\*\* For concrete containing HRWR admixture (superplasticizer), slump shall not exceed 8 inches after addition of HRWR to verified 2-4 inches slump concrete.

## PART 3 - EXECUTION

### FORMS

Install forms to conform to the shape, lines, and dimensions of the structures as called for on Drawings. Forms shall be substantial and sufficiently tight to prevent leakage of mortar, and shall be properly braced or tied together to maintain position and shape. Forms shall be clean inside before concrete is poured.

Provide removable panels at the bottom of forms for walls, columns, or piers for cleaning and inspections

Remove braces inside the forms as the concrete is poured. For walls and columns, use form tie which permits the tie to be cut or broken off not less than 1-1/2 inches back of the surface of the concrete leaving a hole in the surface. Point up holes with mortar. To prevent leakage of mortar, structural wooden forms shall be free from distortion, deformity and cracks.

Reinforcement: Place bars in the exact position shown on Drawings. Fasten bars to prevent displacement while depositing concrete.

Space bars with a clear distance of not less than the diameter of the bar, or 1-inch. Place bars so that the distance from the surface of the concrete to the nearest surface of the nearest bars is 2 inches in slabs, walls, beams, and columns, and 3 inches in the bottom of footings (where no mud mat is used).

Splicing of Reinforcement: At splices, lap bars a distance of not less than the following to ensure full bond development of each bar:

<u>Bar Size</u>	<u>Lap Length</u>	<u>Bar Size</u>	<u>Lap Length</u>
No. 3	16 inches	No. 8	38 inches
No. 4	20 inches	No. 9	42 inches
No. 5	24 inches	No. 10	50 inches
No. 6	28 inches	No. 11	62 inches
No. 7	34 inches		

Wiremesh: 14 inches overlap between outermost cross wires of each fabric.

#### MIXING CONCRETE

Mix concrete components in an approved manner and until the mass is uniform. Place no frozen or lump material in the mix. No mortar or concrete shall be retempered for use. Always keep mixing apparatus clean.

#### PLACING CONCRETE

Forms shall be moist when concrete is placed. Concrete shall be handled to maintain its consistency and not to permit the ingredients to separate. Place concrete in layers not over 18 inches deep.

Vibrate, rod, tamp, or work into places after each layer so that no voids or segregation of the aggregate show when the forms are removed.

Discharge concrete at Work within 1-1/2 hours after the cement has been added to the water or the aggregates. When the air temperature exceeds 85 degrees F, reduce the maximum permitted mixing time to 45 minutes.

When depositing concrete against the ground for slabs and footings, place the concrete on undisturbed or compacted granular base moistened but free from standing water, mud, frost, and ice.

#### REMOVAL OF FORMS

The removal of forms shall be made without damage to the concrete and in a manner to ensure complete safety to the structures. Do not remove shoring until the member has acquired sufficient strength to support safely its weight and loads placed thereon.

After form removal, exposed vertical and overhead surfaces shall have burrs and fins removed, and holes filled with nonshrink nonmetallic grout. The surfaces shall be true to line, with full corners and shall be reasonably smooth.

#### CURING

Maintain concrete in a moist condition for at least the first 7 days after placing for normal concrete, and 3 days after placing for high-early-strength concrete. This shall be done by keeping the surface continuously wet, covering it with a plastic membrane, or by the application of a curing compound approved by ENGINEER.

The surfaces of concrete from which forms are removed before 7 days after placing shall be similarly protected until the concrete has been in place for 7 days.

#### CONCRETE WORK IN COLD WEATHER

Concrete, when deposited, shall have a temperature of not less than 50 degrees F or more than 85 degrees F. Placement of the concrete shall comply with ACI 306 and this specification. During cold weather, which shall be taken to mean weather in which the temperature of the air falls as low as 40 degrees F during any part of the 24 hours which follows, the ingredients of the concrete, including the water, shall be heated immediately before being mixed.

Do not use antifreeze additives except as allowed by ENGINEER.

During cold weather, concrete work shall be housed, or covered with canvas or other suitable material, and shall be kept warm by salamanders or by other means which shall ensure protection from freezing during the setting period.

#### CONCRETE WORK IN HOT WEATHER

During hot weather, concrete temperature shall be closely monitored and kept below 85 degrees F with the use of cold water or ice for mixing water. Placement of the concrete shall comply with ACI 305 and this specification.

The total water in the concrete mix shall not exceed the quantity approved in the concrete mix design.

END OF SECTION 03315