DIVISION 8

REINFORCED CONCRETE STRUCTURES

8.01 Description:

This work shall consist of construction of all reinforced concrete structures, both above and below ground as well as items directly related to the proper functioning of the completed concrete work.

8.02 Materials:

8.02.01 Concrete – Shall conform with the materials identified in Section 7.02 Concrete of the City of Wyoming Standard Specifications.

8.02.02 Reinforcing Steel – Steel reinforcement shall conform to the requirements for structures in the current Standard Specifications for Bridge and Road Construction of the Michigan Department of Transportation, except that structural grade billet steel bars will not be allowed. All Reinforcing Steel shall be Epoxy coated.

8.02.03 Form Material – All face form lumber for exposed surfaces shall be either dressed tongue and groove; dressed shiplap, or square edged lumber, sized four sides pattern, with form linings. Face form lumber shall be of uniform width and thickness, and shall be sound and free from loose or rotten knots, knot holes, check splits or wane showing on the surface in contract with concrete.

Dressed tongue and groove and dressed shiplap lumber used for exposed surfaces to be left unfinished shall be not less than three-quarter (¾") inch actual thickness and not more than eight (8") inches in width.

In lieu of ace form lumber, the Contractor may use plywood for structural boarding. It shall be at least five (5) ply, not less than three-quarter (¾") inch in thickness, and in computing stud spacing, it will be considered as one (1") inch lumber.

Used face form lumber having defects which may produce work inferior to that resulting from new material shall not be used.

Metal forms shall be of such thickness and so constructed that the forms will remain true to shape. All bolts and rivet heads occurring in the inside face of the forms shall be so countersunk so that a plane smooth surface of the desired contour is obtained.

8.03 Construction Methods:

8.03.01 Foundation Excavation shall be made of sufficient size to permit construction of the foundation units and to provide for adequate drainage. Special care shall be taken not to disturb the bottom of the excavation, and the final removal of the foundation material to grade shall not be made until just before the masonry is to be placed. Concrete shall not be placed until the depth of excavation has been checked and the suitability of foundation material has been approved by the Engineer. Excavated material suitable for the purpose shall be stored and later used for backfill. The elevations for the bottom of footings shall be subject to such changes as are necessary to insure a satisfactory foundation.

Footing excavation may be trimmed to the exact size of the footing and the footing forms omitted, where soil conditions permit and when approved by the Engineer. In this case, guide forms to establish the grade for the top of the footing will be required.

All unsound material underlying proposed structures shall be removed and replaced with bank run gravel or coarse aggregate, in layers not exceeding six (6") inches in depth, and each layer shall be thoroughly compacted by tamping or by vibrating. The thickness of each layer of backfill may be increased to more than six (6") inches, provided the full depth of each layer of backfill is compacted to not less than 95% of maximum unit weight. Concrete mudmat shall be used when required by the Engineer.

8.03.02 Forms – All forms shall be of wood or metal and shall be built mortar-tight of sound material sufficiently strong and rigid to prevent distortion during the placing and curing of concrete. They shall be built true to the lines designated and shall be so maintained until the concrete has sufficiently hardened to permit their removal. Forms shall be constructed and maintained to prevent warping and the opening of joints due to shrinkage of the lumber. Vertical forms shall be designed to withstand pressures imposed by the wet concrete.

Clamps, pins or other connecting devices shall be designed to hold the form rigidly together and to allow removal without injury to the concrete. Metal forms which do not present a smooth surface or line up properly shall not be used. Special care shall be exercised to keep metal forms free from rust, grease or other foreign material such as will tend to discolor the concrete.

Construction – Forms shall be securely braced to prevent movement while placing concrete. All face form lumber on upright studs shall be secured to the studs or uprights with true horizontal joints. Unless otherwise provided on the plans or by authorization, all corners shall be finished square without moldings, and for exposed faces of concrete, the edges of forms at corners shall be sawed square and straight and placed to a tight fit.

Chamfered corners, when required, shall be formed with a mill cut triangular molding dressed on three sides, measured on the sides.

Oiling – The inside of all forms for exposed concrete surfaces shall be oiled with a light, clear, paraffin-base oil which will not discolor or otherwise injuriously affect the concrete surface. Oiling shall be done after all necessary planning is complete.

8.03.03 Placing of Steel Reinforcement – Steel reinforcement shall be accurately placed in the position shown on the plans. If not indicated or shown on the plans, the concrete cover over the outermost structural bar shall be as follows:

Bottom face of foundation slabs and footings	3 inches
Walls, both faces, and upper face of foundation slabs and footings of structure below grade	2 inches
Bottom face of main floor slab and top face of main floor slab	1-1/2 inches

Bars shall be placed with a variation between adjacent bars of not more than one-sixth (1/6) of the spacing shown on the plans, and the clear distance from the surface of the concrete to the reinforcement shall not vary by more than one-fourth (1/4) of the dimensions.

Bars shall be tied at all intersections except where spacing is less than one (1') foot in each direction when alternate intersections shall be tied. Supports for reinforcement which are to remain in the work shall be precast concrete blocks of approved shape and dimensions. Metal chairs for use in flat slabs when permitted by the Engineer shall be of sufficient strength to satisfactorily support the reinforcing.

In general, the steel reinforcement shall be accurately secured against displacement by the use of standard chairs, bolsters, spacers, and the like, supplemented by such additional supporting and spacing devices as may be required.

When placed in final position, it shall be free from dirt, rust, mill scale, paint, oil or other foreign material. When there is a delay in depositing concrete, reinforcement shall be re-inspected and corrected as to position and cleaned where necessary. Projecting reinforcement from prior concrete pours shall be cleaned of adhering mortar and loose rust before being incorporated in the concrete.

8.03.04 Building in Work – All necessary ties, anchors, bolts, inserts, manholes and steps and other work shall be accurately set and securely held in concrete work in accordance with details shown on the plans or standard practice.

Suitable sleeves shall be set in concrete for all small piping of every kind and for all large piping where shown on the plans where such piping passes through concrete work. Such

sleeves shall be set with due regard to their position in the final surface finish. Proper allowance shall be made in concrete work where necessary for other work to be installed.

8.03.05 Placing Concrete – Concrete shall be placed in any unit of the structure only after the forms, bracing, and preparations for casting have been approved. At the time concrete is placed, the forms shall be clean and all sawdust, chips and other debris shall have been removed from the interior of the forms. Struts, stays and braces, serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their location, shall be removed when the concrete placing has reached an elevation rendering their service unnecessary.

The concrete shall be promptly placed with minimum handling to avoid segregation of the materials. Each pour shall be completed in a continuous operation with no interruption between the placing of continuous portions of concrete, and, in any case, each layer shall be placed and compacted before the preceding layer has taken initial set.

Concrete shall be compacted thoroughly by means of internal vibration during and immediately after pouring. For thin walls or inaccessible portions of the forms where vibration is impractical, the concrete shall be assisted into place by tapping or hammering the forms opposite the freshly deposited concrete, and the concrete shall be worked thoroughly around the reinforcement, around embedded fixtures, and into the corners of the forms.

In order to obtain clean and firm bearing surfaces, all water and softened material shall be removed from excavations immediately before concrete is deposited. Concrete shall not be deposited in water, nor shall water be allowed to rise over the concrete until it has hardened sufficiently to prevent injury thereto. Any flow of water into the excavation shall be diverted through proper side-drains to a sump, or shall be removed by other approved methods which will avoid washing the freshly deposited concrete. Water vent pipes and drains shall be filled by grouting or other means approved by the Engineer after the concrete has thoroughly hardened.

The concrete shall be deposited in the forms in horizontal layers not more than twelve (12”) inches thick unless otherwise specified by the Engineer and to as near final position as possible. When placing operations would involve dropping the concrete more than five (5’) feet, it shall be deposited through sheet metal or other approved pipes made in sections not to exceed four (4’) feet in length. The use of long troughs, chutes or pipes for conveying concrete from the mixing plant to the forms will not be permitted. Short troughs, chutes or pipes used as aids in placing concrete shall be arranged and used in such manner that the concrete ingredients do not become separated. Where steep slopes are required, troughs and chutes shall be equipped with baffle boards or shall be in short lengths that reverse the direction of movement. Troughs and chutes shall be of metal or shall be lined with metal and shall extend as nearly as possible to the point of deposit. When the discharge must be intermittent, a hopper or other device for regulating the discharge shall be provided.

Before depositing concrete on or against concrete which has set, the forms shall be re-tightened and the surface of the hardened concrete shall be roughened as required by the Engineer and thoroughly cleaned of foreign matter. The new concrete placed in contact with hardened or partly hardened concrete shall contain an excess of mortar to insure bond. To insure this excess mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and saturated surfaces of the hardened concrete, including horizontal, vertical and inclined surfaces, shall first be slushed with a coating of neat cement grout or of mortar against which the new concrete shall be placed at once before the grout or mortar has attained its initial set.

The placing of concrete shall be so regulated that the pressures caused by wet concrete shall not exceed those used in the design of the forms. The consistency of the concrete shall be as in 7.03.03. The slump shall not be less than one and one-half (1-1/2") inches and not more than three and one-half (3-1/2") inches unless otherwise specified by the Engineer.

Such spading as is necessary to insure smooth surfaces and dense concrete shall be done along form surfaces and in corners. After the initial set of the concrete, the forms shall not be jarred. All forms above concrete being placed, and all placing equipment shall be kept clean and free from coatings of hardened concrete. Water used for flushing the placing equipment shall be discharged clear of the concrete and forms.

8.03.06 Construction Joints – In general, necessary construction joints are shown on the plans, and modifications of locations shall be subject to the approval of the Engineer.

Construction joints when called for on the plans between footings and walls and/or in walls below grade shall be provided with a polyvinyl-chloride thermo-plastic type water stop as approved by the Engineer. All water stops shall be continuous with ends lapped or spliced to make the joint watertight, and plates shall be adequately supported in accurate position and in a manner that does not interfere with the reinforcing steel. Water stops shall be placed at junctions of walls with floor slab and/or as shown on the plans.

The contact surface of concrete already in place, and the faces of all joints shall be thoroughly wetted before placing new concrete. The face edges of all joints shall be carefully finished true to line and elevation.

8.03.07 Patching and Finishing Concrete – Immediately following the removal of forms, all fins and other irregular projections shall be removed from exposed surfaces. On all surfaces, the cavities produced by form ties and other holes, broken corners and edges and similar defects shall be thoroughly cleaned and after being saturated with water for a period of not less than one hour shall be carefully pointed and trued with a mortar of cement and fine aggregate of the same proportions as the concrete being finished. Mortar used in pointing shall be not more than one hour old.

If, in the judgement of the Engineer, any defects present in the concrete are of such a nature as to warrant condemnation, such portion of the pour may be ordered replaced in their entirety and the Contractor shall promptly replace the same.

The top surface of the concrete slabs where not specifically designated to be otherwise finished, shall be struck off at the elevations shown on the plans and given a smooth wood float finish. Where floors are drained, they shall slope uniformly to the floor drain.

8.03.08 Protection and Curing

(a) Protection – When existing temperature conditions will produce concrete of less than 50˚ F., protection from freezing shall be accomplished as specified in the current Michigan Department of Transportation Standard Specifications for Road and Bridge Construction Division for Structures.

(b) Curing – Exposed surfaces of concrete shall be covered with burlap or cotton fabric immediately after the forms are removed and shall be kept continuously wet for a period of four days. During this period, only such areas as are in the process of being finished may be uncovered. Footings may be cured by flooding, when permitted. Curing may be used in accordance with Section 7.03.06 of these Specifications.

Curing periods specified above apply only when concrete is placed at a temperature of approximately 70˚ F. For lower temperatures, minimum curing periods may be increased to seven (7) days.

8.03.09 Waterproofing – The materials and methods for waterproofing will be done in accordance with the current Michigan Department of Transportation Standard Specifications for Road and Bridge Construction Division for Waterproofing, where called for on the plans, specifications or otherwise authorized.

8.03.10 Testing of Concrete – Strength tests shall be made with concrete test cylinders molded at frequent intervals from the concrete of routine batches being incorporated in the work. Concrete for test specimens and assistance for making them on the project, will be furnished by the Contractor. Molds and testing equipment will be furnished by the City.

If the average results from test specimens cured at an average temperature of 70˚ F. are below the 28-day required compressive strength, it will be sufficient reason for rejecting for further use, the materials entering into the concrete, and for removal of defective material or reducing the unit price of same.

8.04 Backfill:

Backfill shall not be placed against any portion of the structure until the structure has been approved by the Engineer for backfilling. All spaces excavated and not occupied by

the new structure shall be backfilled with sand or other approved material from the excavation. The backfill shall be carried up to the surface of the adjacent ground or to the elevation for the proposed earth grade, and its surface shall be neatly graded.

8.05 Method of Measurement:

Concrete will be measured in the units indicated on the Proposal.

8.06 Basis of Payment:

"Reinforced Concrete Structures," if included on the Proposal, will be paid for as provided in the units indicated on the proposal. Curing will be considered included in placing the concrete.