DIVISION 3 - CONCRETE

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 - DESCRIPTION

A. For other requirements see General Conditions and General Requirements (Division 1).

B. SCOPE OF WORK
Furnish all labor, material, equipment, special tools and all services required to complete all cast-in-place concrete work required by the project, shown on the drawings or herein specified:

1. Exterior sidewalks.
2. Patch work of walks shall match existing color and finish (texture). Sawcut of walks shall <u>not</u> have an overcut.

1.02 - REFERENCE SPECIFICATIONS, CODES AND STANDARDS

The following standards are hereby incorporated as part of the project specifications.

A. The "Specifications for Structural Concrete for Buildings" ACI 301-latest edition, including all modifications as hereinafter specified are hereby incorporated as a part of these specifications and are as much a part of the contract documents as if reproduced herein. Modifications shall take precedence over items specified in ACI 301 designation. All ACI 301 items unless so modified below are incorporated as written. When any part of any item is modified or voided by these modifications, the unaltered provisions of that part shall apply as written. Copy of ACI 301 shall be kept in the project field office at all times. No work shall proceed until persons directly responsible for the project representing the Contractors, Subcontractors, suppliers and testing agencies have a copy of this specification and an understanding of the provisions therein.

B. Concrete shall conform to all provisions of the latest edition of the (ASTM) American Society for Testing and Materials and the (ACI) American Concrete Institute noted within this specification, except as modified by the Supplemental Requirements contained herein.

C. ACI 318-latest edition, "Building Code Requirements for Reinforced Concrete."

D. Governing Building Code. Comply with all requirements of the governing building code that are more stringent than the above referenced codes, standards and specifications.

E. ACI SP-15, Field Reference Manual. A copy of this publication must be kept in the field office at all times during concrete construction.

F. Concrete Reinforcing Steel Institute "Manual of Standard Practice".

1.03 - SUBMITTALS

A. Shop drawings for reinforcing steel and accessories prepared in accordance with "Details and Detailing of Concrete Reinforcement," ACI 315. Submit reinforcing steel shop drawings for approval before proceeding ahead with fabrication.

B. Submit mix design and test results for each specified strength concrete per A.C.I. 301, Article 3.9 for approval 3 weeks minimum before ordering any concrete.

C. Following submittals shall be provided in accordance with ACI 301:

1. Mill tests for cement.
2. Admixture certification. Chloride ion content must be included.
3. Aggregate certification.
4. Concrete mix designs.
5. Construction and control joints.
6. Method of developing bond at joints.
7. Method of adding admixtures.
8. Materials and methods for curing.
9. Testing Agency to perform services required in ACI 301, Section 16.7.
10. Laboratory tests on concrete.
11. Field and laboratory tests that are the Contractor's responsibility.
12. Concrete coloring.

D. The Architect's review of details and construction operations shall not relieve this Contractor of his responsibility for completing the work successfully in accordance with these Specifications and within the Contract time.

E. Manufacturer's Data: For information only and as requested by the Architect, submit two (2) copies of

manufacturer's data with application and installation instructions for all proprietary materials.

F. Substitutions: Any request for product substitution must be submitted for review, with all necessary documentation, prior to time of bid. No requests for substitutions will be considered after bid has been received.

G. Throughout the Specification, types of materials may be specified by manufacturer's name in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the Bidder may assume the phrase "or approved equal", except that the burden is upon the Bidder to prove such equality. If the Bidder elects to prove such equality, it must request the Architect's approval in writing to substitute such items for the specified item, stating the cost difference involved with supporting data, and samples, if required, to permit a fair evaluation of the proposed substitute with respect to quality, serviceability, warranty and cost.

1.04 - PRODUCT DELIVERY, STORAGE AND HANDLING

A. Store all reinforcement at the site, off the ground and protect from damage, accumulation of dirt and excessive rust.

1.05 - SUPPLEMENTAL REQUIREMENTS AND MODIFICATIONS TO ACI 301

The following statements modify and supplement ACI 301.

<u>CHAPTER 2 (ACI 301) MATERIALS FOR CONCRETE</u>

2.1.1.1 -
Cement to be Portland Cement, ASTM C-150 Type I. All cement for concrete exposed to public view to be from same mill.

2.2.1.1 -
Air entraining admixtures (ASTM C260) are required for A.E. concrete. Refer to TABLE I, herein, for concrete mixes requiring air entrainment.

2.2.1.2 - ADMIXTURES

A. WATER REDUCING ADMIXTURE
ACCEPTABLE PRODUCTS:

1. "Eucon WR-75" by The Euclid Chemical Co.
2. "Pozzolity 200N" by Master Builders.

3. “Plasticrete 160" by Sika Chemical Corp.

The admixture shall conform to ASTM C-494, Type A and not contain more chloride ions than are present in municipal drinking water.

B. PROHIBITED ADMIXTURES
Calcium chloride, thicyanates or admixtures containing more than 0.05% ions are <u>not</u> permitted.

2.4.1 -
All aggregates - normal weight, conforming to Michigan Department of Transportation regulations as required for superstructures.

2.6 -
Related materials for concrete construction shall be as follows:

2.6.2 - CURING AND SEALING COMPOUND
The compound shall be a clear styrene acrylate type, 30% solids content minimum, and have test data from an independent testing laboratory indicating a maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon.

ACCEPTABLE PRODUCTS:

1. "Super Rez-Seal" by The Euclid Chemical Company.
2. "Masterkure" by Master Builders.
3. "Vulkem 2101" by Mameco International, Inc.

Manufacturer's Certification Required.

(SODIUM SILICATE COMPOUNDS ARE PROHIBITED).

2.6.6 - BITUMINOUS OUTDOOR CONTROL AND ISOLATION JOINTS

1/2" thick (unless otherwise noted) "Sealtight" preformed asphaltic bituminous joint material to conform with ASTM D-994, FS HH-F-341F, Type III, AASHTO M33, FAA specification item P-610-2.7. Depth to match slab thickness.

Provide dowels.

2.6.13 - EPOXY JOINT FILLER
Shall be a three (3) component, 100% solids compound with a minimum shore D hardness of 50.

ACCEPTABLE PRODUCTS:

1. "Euco Epoxy #600 or #700" by The Euclid Chemical Co.
2. "Sikadur Lo-Mod Mortar" by Sika Chemical Corp.

2.6.16 - NON-SHRINK GROUT

The grout shall conform to CRD C-621-83, "Corps of Architects Specification for Non-Shrink Grout". The grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

A. NON-METALLIC

Provide where there is any possibility of staining.

ACCEPTABLE PRODUCTS:

1. "Euco-NS"; Euclid Chemical Company.
2. "Masterflow 713"; Master Builders.
3. "Five Start Grout" by U.S. Grout Corp.

CHAPTER 3 (ACI 301) PROPORTIONING

3.2.1 - STRENGTH

Minimum concrete strength shall be in accordance with the following TABLE I:

CLASS/ TYPE	LOCATION	REQ'D 28 DAY COMPRESSIVE STRENGTH PSI	MAXIMUM WATER CEMENT RATIO	AIR CONTENT
III	**EXTERIOR SLABS SUBJECTED TO DEICERS,**	**4500**	**0.45**	**4.5% - 7.5%**

NOTE: All aggregate sizes shall be #57.

3.4.6 -

Water shall not be added to the surfaces of slabs or other concrete members by spray, brush, or by any other means. This does not preclude the practice of fogging the concrete surface during hot windy weather to minimize plastic shrinkage cracks.

3.5 -

All concrete shall have a maximum slump of 3" for slabs and 4" for other members. This maximum slump may not be exceeded.

3.7.3 -

All concrete shall contain the specified water-reducing admixture. All concrete slabs, placed at air temperatures below 50°F shall contain the specified non-corrosive

non-chloride accelerator. All concrete required to be air-entrained shall contain an approved air-entraining admixture.

3.8.1 -

Proportions for concrete mixes shall be selected by ACI 301, Section 3.9. All mixes must be approved by the Architect prior to use on the job. No deviations from the approved mixes will be permitted without prior approval of the Architect.

Where the concrete production facility can establish the uniformity of its production for concrete of similar strength and materials based on recent test data, the average strength used as a basis for determining mix design proportions shall exceed the specified design strength by the requirements of ACI-318-latest edition, Section 4.3 or ACI-301-latest edition, Section 3.9.

When a concrete production facility does not have field test records for calculation of standard deviation, the required average strength shall be at least 1200 psi greater than the specified design strength.

CHAPTER 4 (ACI 301) FORMWORK

4.1.3 -

Earth cuts shall be used for vertical forms for footings below ground where approved by the EPA's On-Site Representative prior to concreting.

4.2.14 - CLEANING AND TIGHTENING

Thoroughly clean forms, excavations if requested by EPA's On-Site Representative, and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, mud, loose dirt or debris just before concrete is placed. Do not place concrete on frozen soils.

4.2.15 - PROVISIONS FOR OTHER TRADES

Provide openings in concrete and concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms by others.

4.4.2.1.1 - FORM COATINGS

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

4.7.3 -

Forms may be removed when the concrete reaches the specified 28 day strength, or when the concrete reaches 75% of the specified 28 day strength and is no less than seven (7) days old. The seven (7) day minimum age requirement may be waived pending review of the proposed mix designs, forming systems, and reshoring procedures.

4.7.4 -

Between the dates of October 1 and April 1, or when the average daily temperature has been below 50°F. for the duration of the curing period, forms may not be removed until the actual in-place strength of the concrete is demonstrated by two field-cured test cylinders or by Windsor Penetrometer, regardless of the results of tests on laboratory-cured cylinders.

CHAPTER 5 (ACI 301) REINFORCEMENT

5.2.2.1 -

Reinforcing steel shall be in accordance with ASTM A615, Fy minimum 60 ksi.

5.2.5.1.1 -

Welded wire fabric shall be in accordance with ASTM A185.

5.2.5.2.1 -

Welded wire fabric shall be furnished in flat sheets for concrete toppings and slabs less than 5" in depth.

5.3 -

No welding of reinforcing bars will be permitted without approval of the Architect.

5.5.3.1 -

Placement of reinforcing bars shall be in accordance with the detailed recommendations given in the Concrete Reinforcing Steel Institute's "Placing Reinforcing Bars", latest edition. Use cement bricks to support steel on ground. All reinforcing shall be SECURELY fastened in place and approved by EPA’s On-Site Representative in writing BEFORE ORDERING THE CONCRETE. All muddy reinforcing shall be cleaned with wire brush.

Provide additional accessory reinforcing to fasten securely the structural reinforcing in place during the pouring of concrete.

5.5.3.2 -

The portions of all accessories within 3/4" of the concrete surface for painted or unpainted exposed concrete surfaces shall be stainless steel and bars shall be tied with stainless steel wire.

CHAPTER 6 (ACI 301) JOINTS AND EMBEDDED ITEMS

6.5.1 -

All sleeves, inserts and embedded items required by electrical trades shall be furnished and placed by the appropriate Contractor. All other sleeves, inserts, reglets, dovetail anchor slots, anchors and embedded items shall be furnished by the appropriate supplier and placed by the Contractor performing the work of this Section.

CHAPTER 7 (ACI 301) PRODUCTION OF CONCRETE

7.1.3 -

Furnish to the Project Superintendent two (2) delivery tickets with each load of R/M concrete. Tickets shall contain the following information:

A. Date

B. Producer and plant

C. Job

D. Contractor

E. Truck No. and time dispatched

F. Concrete designation and cement type

G. Admixtures description and content

H. Time discharge started and completed

I. Amount of concrete in load

J. Amount of water in mix at plant

K. Amount of any material added at the site and authorized signature

L. Where a ready-mix concrete supplier has more than one batch plant, make all deliveries from the same plant.

7.2 -

Site-mixed concrete is prohibited. Pre-mixed sacks of concrete are prohibited.

7.5.2.2 -

All concrete arriving at the site above the maximum slump shall be rejected. Do not add water at site unless approved by EPA's On-Site Representative.

7.5.3 -

Discharge concrete from mixer within 1-1/2 hours after the introduction of mixing water to the cement and aggregates. After this time it will not be acceptable. Time to be reduced to one hour if air temperature exceeds 85°F.

CHAPTER 8 (ACI 301) PLACING

8.1.5 -

Notify the EPA's On-Site Representative at least two (2) working days prior to placing concrete. All concrete placement shall be observed by EPA's On-Site Representative, unless this requirement is waived in writing.

8.3.4.1 -

All concrete shall be consolidated by vibration.

8.3.5 -

The height of free fall of concrete shall be limited to six (6) feet, unless a separation of coarse aggregates is observed, in which case the limit shall be decreased.

8.4.1.1 -

Adequate protection against rain, sleet or snow shall be defined as protection which prevents any and all adverse effects of the rain, sleet or snow on the appearance, strength and durability of the concrete. Do not pour concrete footings or "flat work" when outdoors if forecasting 20% chances or greater of rain, unless previously approved by EPA's On-Site Representative.

CHAPTER 9 (ACI-301) REPAIR OF SURFACE DEFECTS

9.1 -

All voids, damaged places, fins, projections, honeycomb areas, and tie rod holes shall be removed down to sound concrete and shall be repaired immediately after form removal and after a concrete curing compound is applied. The specified bonding agent shall be used for all patching and the specified epoxy adhesive and/or epoxy mortar shall be used for all structural repairs. All patching and repairs shall have prior approval of the EPA's On-Site Representative as to method and procedure. Any concrete which has not been formed as shown on the contract drawings, is out of alignment or level or indicated a defective surface or unsoundness of any nature shall be removed and replaced to the limits required by the EPA's On-Site Representative unless grants permission to patch or otherwise correct the defective work.

CHAPTER 10 (ACI 301) FINISHING OF FORMED SURFACES

10.1.3 - SPECIFIED FINISHES AND FORMED SURFACES

A. EXPOSED SURFACES

1. Match existing exposed aggregate finish and color as selected by architect for all exterior slabs on grade, walks, curbs, etc.

CHAPTER 11 (ACI 301) SLABS

11.1.1 -
Concrete for slabs shall be in accordance with TABLE 1.

11.5.1 - JOINTING

A. EXTERIOR SLABS ON GRADE

1. DOWELED CONTROL JOINTS: Full depth, with 1/2” joint filler, at intersections of sidewalks, at abrupt changes in width and corners, and at a spacing not exceeding 15’, unless otherwise noted on drawings.
2. ISOLATION JOINTS: Provide where slabs abuts vertical surfaces and curbs, if not subject to settlement.
3. Joint material to be flush with slab surface when no calking or seal required.
4. TOOLED JOINTS: tooled, 1/2” deep, 4'-0" to 6'-0" on center between control or isolation joints, unless noted otherwise.
5. Unless otherwise indicated, seal all exterior control and isolation joints with the here-in specified joint sealing compound.
6. Construction joints in exterior work are not permitted. Place slabs continuously between control and isolation joints.

11.9 - SELECT DESIRED FINISH TOLERANCES

A. Finish all slabs, to a tolerance of F25. Differences in elevation, between two points, shall not exceed 0.16" in 12", 0.38" in 5' and 0.50" in 10'.

CHAPTER 12 (ACI 301) CURING AND PROTECTION

12.2.1 - CURING AND PROTECTION: SURFACES NOT IN CONTACT WITH FORMS

All exterior slabs, sidewalks, curbs, etc. shall be cured with the specified clear curing and sealing compound.

The curing period shall be continuous for a minimum duration of seven (7) days when the ambient temperature exceeds 50°F.

When concrete slab placements are subjected to high temperatures, wind and/or low humidity the EPA's On-Site Representative may require the use of an evaporation retarder to minimize plastic cracking. The compound may be required to be applied one (1) or more times during the finishing operation. The initial application is usually made after the strike-off operation.

CHAPTER 16 (ACI 301) TESTING

16.1.1 -
Field inspection and testing will be performed by a testing agency retained and paid by the Contractor and selected by EPA's On-Site Representative.

16.1.2. - CAST-IN-PLACE CONCRETE

In general, testing and inspection is to comply with ACI 301, Chapter 16.

1. SLUMP TESTS
Make slump tests for each batch delivered or at least one (1) test per hour during continuous pours, in accordance with requirements of ASTM C143. Test to be done after adding water, if approved by EPA's On-Site Representative.

a. REQUIREMENTS

Review requirements with EPA's On-Site Representative at meeting prior to installation of concrete.

2. STRENGTH CYLINDERS

a. QUANTITY
Make, cure and test at least three (3) test cylinders (min. 6" x 12") of each Class of concrete for each day placed, for pole bases and per 20 cubic yards of sidewalk. Make test cylinders in accordance with ASTM C31.

b. INFORMATION REQUIRED
For each set of test cylinders, include exact mix tested, location of placement in project, cylinder identification, date of receipt of cylinder in laboratory, slump, temperature of concrete when cylinder made, date, cement and type, admixtures used, dates and records of test cylinders, names of inspectors and/or

laboratory testing personnel, and evaluation of analysis of cause in case of test failure, and recommendations for remedial action.

c. SPECIAL REQUIREMENTS
All specimens must be taken after any addition of water to the concrete mix on the job, if approved by EPA's On-Site Representative.

Take specimens at placement location when pumping.

d. TESTING
One cylinder shall be broken at seven (7) days and two (2) broken at 28 days, unless otherwise required by EPA's On-Site Representative.

e. Notify EPA's On-Site Representative and Contractor, the same day by phone, if concrete cylinders do not attain 75% of 28 day strength at seven (7) days.

3. AIR CONTENT TESTING
For concrete mixes with required air content, provide air content tests for each set of compressive test cylinders.

CHAPTER 17 (ACI 301)

17.2 & 17.3
When concrete fails to meet the acceptance criteria specified in Section 17.2, the Architect may order further testing of concrete in place in accordance with Section 17.3. When such tests are ordered, cost of testing shall be paid by the Contractor.

CHAPTER 18 (ACI 301) ACCEPTANCE OF STRUCTURE

18.1.4 -
The Contractor shall bear all costs of correcting rejected work, including the cost of the Architect's additional services thereby made necessary.

1.06 - COLD WEATHER CONDITIONS

A. The provisions of ACI 301 shall be followed for all concrete placed or cured when the average daily temperature is below 40°F. The methods of protection used for cold weather concreting shall be submitted in writing to the EPA's On-Site Representative for review at least two (2) weeks prior to cold weather placement. No concrete shall be placed if air temperature is less than 25°F. and dropping.

B. The concrete temperature as discharged shall not be less than 50°F nor greater than 70°F. The temperature of the concrete being discharged shall be tested by the testing agency.

C. Concrete shall be exposed to ambient temperature in a gradual manner after being cured. Refer to ACI 306 Table 1.4.1.

1.07 - HOT WEATHER CONCRETING

A. The provision of ACI 305 shall be followed for all concrete placed when the air and/or form temperature is greater than 90°F and rising. Note: Concrete protection during windy conditions combined with hot and/or low humidity shall also conform to ACI 305. The methods of protection used for hot weather concreting shall be submitted in writing to the Architect for review at least two (2) weeks prior to hot weather placement.

1.08 - MINIMUM REINFORCING

A. All concrete slabs on grade, including sidewalks, etc., shall have a 6 x 6 - W2 x W2 welded wire fabric, placed at TOP of slab, <u>unless otherwise noted.</u>

B. All concrete work shall have a minimum amount of reinforcing as required by ACI-318, 7.12, unless otherwise noted or required by drawings.

1.09 - WARRANTIES

a. All work to be guaranteed for one (1) year after <u>FINAL</u> acceptance of the <u>WHOLE</u> project by the EPA.

END