SECTION 02 41 19 - SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolishing designated building equipment and fixtures.
   2. Demolishing designated construction.
   3. Cutting and alterations for completion of the Work.
   4. Removing designated items for reuse and Owner's retention.
   5. Protecting items designated to remain.
   6. Removing demolished materials.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Demolition Schedule: Indicate overall schedule and interruptions required for utility and building services.

C. Shop Drawings:
   1. Indicate demolition and removal sequence.
   2. Indicate location of items designated for reuse and Owner's retention.
   3. Indicate location and construction of temporary work.

1.3 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of capped utilities, concealed utilities discovered during demolition, and subsurface obstructions.

C. Operation and Maintenance Data: Submit description of system, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

A. Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

B. Conform to applicable code for procedures when hazardous or contaminated materials are discovered.

C. Obtain required permits from authorities having jurisdiction.

D. Perform Work in accordance with Roseville standard.

E. Maintain one copy of each document on site.

1.5 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.6 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Owner will conduct salvage operations before demolition begins to remove materials Owner chooses to retain.

1.7 SCHEDULING

A. Section 01 32 16 - Construction Progress Schedule: Requirements for scheduling.

B. Cooperate with Owner in scheduling noisy operations and waste removal that may impact Owners operation and in adjoining spaces.

C. Coordinate utility and building service interruptions with Owner.
   1. Do not disable or disrupt building fire or life safety systems without three days prior written notice to Owner.
   2. Schedule tie-ins to existing systems to minimize disruption.
   3. Coordinate Work to ensure fire sprinklers, fire alarms, smoke detectors, emergency lighting, exit signs and other life safety systems remain in full operation in occupied areas.

1.8 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 - PRODUCTS

2.1 Not Used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Notify affected utility companies before starting work and comply with their requirements.

B. Mark location and termination of utilities.

C. Erect, and maintain temporary barriers and security devices at locations indicated requested by owner, including warning signs and lights, and similar measures, for protection of the public, Owner, and existing improvements indicated to remain.

D. Layout cuts in post tensioned concrete elements to avoid cutting concrete within 12 inches of any stressing tendon. Notify Architect/Engineer three days in advance of cutting post-tensioned concrete.

E. Erect and maintain weatherproof closures for exterior openings.

F. Erect and maintain temporary partitions to prevent spread of dust, odors, and noise to permit continued Owner occupancy.

G. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

H. Provide appropriate temporary signage including signage for exit or building egress.

I. Do not close or obstruct building egress path.

J. Do not disable or disrupt building fire or life safety systems without **3** days prior written notice to Owner.

3.2 SALVAGE REQUIREMENTS

A. Coordinate with Owner to identify building components and equipment required to be removed and delivered to Owner.

B. Tag components and equipment Owner designates for salvage.

C. Protect designated salvage items from demolition operations until items can be removed.

D. Carefully remove building components and equipment indicated to be salvaged.

E. Disassemble as required to permit removal from building.

F. Package small and loose parts to avoid loss.

G. Mark equipment and packaged parts to permit identification and consolidation of components of each salvaged item.

H. Prepare assembly instructions consistent with disassembled parts. Package assembly instructions in protective envelope and securely attach to each disassembled salvaged item.

I. Deliver salvaged items to Owner. Obtain signed receipt from Owner.

3.3 DEMOLITION

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Maintain protected egress from and access to adjacent existing buildings at all times.

C. Do not close or obstruct roadways or sidewalks without permits.

D. Cease operations immediately when structure appears to be in danger and notify Architect/Engineer.

E. Disconnect and remove utilities within demolition areas.

F. Cap and identify abandoned utilities at termination points when utility is not completely removed. Annotate Record Drawings indicating location and type of service for capped utilities remaining after demolition.

G. Demolish in orderly and careful manner. Protect existing improvements, and supporting structural members.

H. Carefully remove building components indicated to be reused.
1. Disassemble components as required to permit removal.
2. Package small and loose parts to avoid loss.
3. Mark components and packaged parts to permit reinstallation.
4. Store components, protected from construction operations, until reinstalled.

I. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

J. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

K. Remove temporary Work.

END OF SECTION 02 41 19

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SECTION 03 00 10 - CONCRETE

PART 1. GENERAL

1.1 RELATED DOCUMENTS

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this specification.

1.2 SECTION INCLUDES

A. Work included in this section includes furnishing all labor, materials, equipment and incidentals required for complete installation of formwork, reinforcement, accessories, cast-in-place concrete, finishing and curing. This section pertains to building concrete work.

B. Related work specified elsewhere:
   1. Section 03 75 00 – Concrete Rehabilitation

1.3 SUBMITTALS

A. Comply with ACI 315 "Details and Detailing of Concrete Reinforcement". Indicate reinforcement sizes, spacings, locations, and quantities, bending and cutting schedules, supporting and spacing devices.
B. See Structural and/or Architectural drawings for General Notes and Special Conditions.
C. Provide data on joint devices, attachment accessories, mix design for each type concrete, proportions of all ingredients, admixtures, slump range, expected strength and water cement ratio. Provide historical test data with each proposed mix design.

1.4 QUALITY ASSURANCES

A. Building Code Requirements for Structural Concrete (ACI 318) and latest supplements thereto.

B. Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete (ACI 211.1).

C. Hot Weather Concreting (ACI-305R).

D. Cold Weather Concreting (ACI-306R).

E. Guide for Measuring, Mixing, Transporting and Placing Concrete (ACI 304R).

F. Guide to Curing Concrete (ACI 308R).

G. Specifications for Structural Concrete (ACI 301).

H. Guide for Concrete Floor and Slab Construction (ACI 302.1R).

I. Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete (ASTM C618).

J. Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type) - (ASTM D994).

K. Guide to Formwork for Concrete (ACI 347).

L. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice.

M. Design and workmanship of all concrete shall be in accordance with referenced specifications and code listed above. Quality, tolerances, and level of performance of work shall be as specified therein. Contractor shall keep on file, in project office, current copies of all references listed above.

PART 2. PRODUCTS

2.1 FORM MATERIALS

A. Form Material for Exposed Concrete: Plywood; 5/8" APA B-B polyform Class 1, exterior. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Furnish in largest sizes to minimize joints.

B. Form Material for Unexposed Concrete: Plywood; 5/8" APA B-B-G-2, exposure 1, exterior, plywood graded per PS-1 standards for construction and industrial plywood. Use plywood thickness sufficient to support concrete at temperature and rate of pour. Use only sound, undamaged sheets with clean, true edges. Lumber shall be standard grade or better.

C. In lieu of "A" above, the material specified under "B" may be used for exposed concrete if a 3/16" smooth one side, treated, pressed fiberboard liner is utilized.

D. Lumber for light framing (less than 6" wide): standard grade and species. Framing (6" wider and from 2" to 4" thick): provide No. 1 grade in one of the following species:
   1. Douglas Fir (WWPA).
   2. Southern Pine (SPIB).
   3. Redwood (RIS).

E. Prefabricated steel or metal shall be minimum 16 ga. as approved to produce surfaces equal to those specified for wood. Forms shall be matched, tight fitting, and stiffened to support weight of concrete.

F. Metal Form Deck: Utilized to support exterior slabs; shall be S.D.I. approved and equal to Vulcraft. Spacing of slab reinforcing shall be adjusted if required to match corrugations of metal deck.

G. Form Ties: Bolt and rod type so designed that upon removal of the form no metal shall be within 1-1/2" of the concrete surface and no holes larger than 1" in diameter. Concrete exposed to the exterior shall utilize galvanized ties.

H. Waterstops

1. Expansion joints: Purpose made polyvinyl chloride (PVC) or rubber profile and size as indicated on drawings or as required by field conditions, maximum possible lengths as manufactured by Williams, Greenstreak or approved.

2. Construction joints: Inorganic clay material manufactured from Wyoming type, high swelling bentonite as indicated on drawings as manufactured by American Colloid Company or approved.

I. Dovetail Anchor Slots: Galvanized steel, foam filled, release tape sealed slots, bond tab anchors as manufactured by Heckmann, Hohmann & Barnard, Inc. or approved.

J. Form Release Agent: Colorless mineral oil which will not stain the concrete or impair natural bonding characteristics of coating intended for use on concrete.

K. Formed Construction Joints for Slab-on-Grade: Galvanized steel, tongue and groove type profile with knockout holes to receive doweling, min. 26 gage unless noted otherwise. Size and profile as indicated on drawings or as required to fit field conditions.

L. Slab Edge Joint Filler: ASTM D994, premolded asphaltic board, thickness as indicated or (if not indicated, 1/2" thick minimum).

M. Vapor Barrier: Vapor/Intrusion Barrier/Fluid Applied Gas Barrier.
1. Acceptable Manufacturers:
a. EPRO: Geo Seal System.
1. Refer to Spec Section 025619.13 “Vapor Intrusion Barrier/Fluid Applied Gas Barrier.

N. Nails, spikes, lag bolts, through bolts, anchorages: Size as required, of sufficient strength and character to maintain formwork in place while

placing concrete.

2.2 REINFORCEMENT MATERIALS

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

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

C. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
2. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

D. Inert fiber reinforcement: Polypropylene fiber meeting ASTM-C1116; Fiber mesh, Forta Corporation, or other Architect approved U.L. Listed. Add to plant mixed concrete at a rate of 1.5 lbs. per cubic yard of mix.

2.3 CONCRETE MATERIALS

A. Cement; controlling specification for Portland Cement, ASTM C150, Type I-Normal or Type II.

B. Aggregates shall conform to ASTM C-33. Maximum size of aggregate shall not be larger than 1/5 of narrowest dimension between forms of member for which concrete is to be used, nor larger than 3/4 of minimum clear spacing between reinforcing bars, nor larger than 1/3 of slab depth.

C. Lightweight aggregates shall conform to ASTM C 330.

D. Water: Clean and potable.

E. Air Entrainment Admixture: ASTM C260, as manufactured by Master Builders, Euclid, or W.R. Grace.

F. Chemical Admixtures: ASTM C494; Type 'A' - water reducing; Type 'B' - retarding, Type 'C' - accelerating, Type 'D' - water reducing and regarding, Type 'E' - water reducing and accelerating, Type 'F' - water reducing high range; Type 'G' - water reducing high range and retarding. Calcium chloride or admixtures containing more than .05 percent chloride ions by weight of

admixture shall not be used. Each admixture shall not contribute more than 5 ppm by weight, of chloride ions to the total concrete constituent. Use admixtures in strict compliance with manufacturer's directions.

G. Fly Ash: ASTM C618, Type 'C' or 'F'.

H. Bonding Agent: Refer to Spec Section 03300 “Bonding Agents for Concrete”.

I. Non-Shrink Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents. Capable of developing a minimum compressive strength of 7000 psi at 28 days.

J. Adhesive Anchoring: Injectable adhesive or self-contained capsule as manufactured by:

1. 'Hilti' HIT System, or Architect approved/reviewed equal.

2.4 CURING COMPOUNDS & SEALERS

A. Curing Compound/Sealer: Liquid curing compound, water base, concrete curing-sealing compound, VOC (volatile organic content) compliant, containing fugitive dye that does not leave residue (resin, varnish, wax, etc.). Fugitive dye must disappear in 7 days, as manufactured by:

1. Sonneborn Building Products, Kure-N-Seal W.
2. Dayton Superior Corporation, Safe Cure & Seal (J-18).
3. Burke by EDOCO Spartan-Cote WB Cure Seal Hardener.
4. MasterKure 100W, Master Builders, Inc.
5. Vocomp-20, W.R. Meadows.

B. Absorptive Mats: Burlap cloth, commercial quality suitable for purpose. Constructed of jute or kenaf, weighing approximately 9 oz. per square yard, complying with AASHTO M182, Class 2.

C. Moisture retaining cover, complying with ASTM C171; one of the following: waterproof paper, polyethylene film, or polyethylene coated burlap.

D. Crack Repair Material: Floor slabs - 2 part, 100% solid epoxy adhesive in formulation recommended by manufacturer for application, as manufactured by:

1. W.R. Meadows Reziweld 1000 or Architect approved/reviewed equal.

E. Concrete Densifier/Hardener/Sealants:
Liquid applied, lithium silicate based concrete hardener/sealer. Manufacturers to include:

1. Dayton Superior “Pentra-Hard Densifier”
2. WR Meadows “Liqi-Hard Ultra
3. Laticrete (L+M) “L+M Lion Hard”
4. Prosoco “Consolideck LS Premium Concrete Sealer, Hardener and Denisfier.
5. Sika “Sikaflorr-956 LD
6. SureCrete “SureCrete LD 1800 Lithium Densifier and Cement Hardener”

2.5 CONCRETE MIX

A. Mix concrete in accordance with ACI 304 and deliver concrete in accordance with ASTM C94.

B. Quality working stresses for the design of this project shall be based on specific minimum 28-day compressive strength of concrete or on specified minimum compressive strength at earlier age at which concrete may be expected to receive full load. Provide concrete of the following properties:

1. Exterior concrete; i.e. entry slabs, ramps, etc. - 4,000 psi. 28-day compressive strength; water-cement ratio, 0.40 maximum (air entrained).
2. Interior slab on ground – 4,000 psi. 28-day compressive strength; water- cement ratio, 0.44 maximum (non-air entrained).
3. Footings, walls, supported slabs and all other concrete – 3,000 psi. 28-day compressive strength; water-cement ratio, 0.51 maximum (non-air-entrained), 0.46 maximum (air entrained).

C. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

1. Ramps and Sloping Surfaces: Not more than 3".
2. Reinforced Foundation Systems: Not less than 1" and not more than 4".
3. All Other Concrete: Not less than 1" & not more than 4".
4. Concrete containing high-range water-reducing admixture (superplasticizer). Not more than 8 inches after adding admixture to site-verified 2-3 inch slump concrete.
5. Site added water to increase slump is strictly prohibited.

D. Proportions of aggregate to cement shall be such as to produce a mixture which will work readily into corners, angles of forms, and around reinforcement without permitting materials to segregate. Excess free water shall not collect on concrete surface.

E. Fly ash shall not exceed 25% of cement content by weight. No fly ash shall be used in slabs.

F. Select admixture proportions for normal weight concrete in accordance with ACI 301, Method 1 and in strict accordance with manufacturer's instructions.

G. Air Entraining Agent: Use in all exterior concrete exposed to weather; i.e. exposed foundation walls, supported slabs, ramps, etc. Air entrainment shall be accomplished by use of approved additives used in accordance with manufacturer's instructions. Limit air to 4% minimum to 7% maximum.

H. Adjustment to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather or other circumstances warrant, as accepted by the Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

PART 3. EXECUTION

3.1 FORMWORK ERECTION

A. Erect formwork, shoring and bracing to achieve design requirements. Fabricate forms for easy removal without hammering or prying against exposed concrete surfaces.

B. Provide bracing to ensure stability of formwork.

C. Apply form release agent to formwork in accordance with manufacturer's instructions, prior to placing for accessories and reinforcement.

D. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings which are affected by agent.

E. Clean forms as erection proceeds, to remove foreign matter.

F. Footings and foundations shall be formed, notched and/or sleeved as indicated to provide for installation of mechanical, electrical or plumbing piping/conduit.

G. Forms shall conform to shape, lines and dimensions of members as called for, substantially and sufficiently tight to prevent leakage of concrete.

H. Forms shall be properly braced, and tied together so as to maintain position and shape. Forms for exposed concrete shall be braced so as to provide dimensions called for, and have taped joints.

I. Construction joints, whether indicated on drawings or not, shall be made or located so as to least impair strength of the structure. Where joint is to be

made, the surface of the concrete shall be thoroughly cleaned and all latency removed. In addition, vertical joints shall be keyed.

3.2 INSERTS, EMBEDDED COMPONENTS, AND OPENINGS

A. Provide formed openings where required for work to be embedded in and passing through concrete members.

B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

C. Install concrete accessories straight, level, and plumb.

3.3 REINFORCEMENT PLACEMENT

A. Place reinforcement, supported and secured against displacement.

B. Ensure reinforcing is clean, free of loose scale, dirt, or other foreign coatings.

C. Provide for continuity of reinforcing around corners in footings and walls. Lap corner bars 30 bar diameters.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 PLACING CONCRETE

A. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

B. Install vapor intrusion barrier/fluid applied gas barrier under interior slab-on-grade.

1. Installation shall be in accordance with manufacturer’s instructions.

    a. Refer to Spec Section 025619.13 “Vapor Intrusion Barrier/Fluid Applied Gas Barrier” for additional information.

C. Separate exterior slabs-on-grade from vertical surfaces with ½ inch thick joint

filler, extended full thickness of slab. Also, provide filler strips at supported slabs and vertical surfaces.

D. Place concrete continuously between predetermined control and construction joints. Do not break or interrupt successive pours such that cold joints occur. Where applicable, construction joints shall occur at control joint locations, unless noted otherwise.

E. Concrete slabs on grade shall be constructed of thickness indicated. If thickness is not indicated, provide a minimum thickness of 4". Minimum thickness at pipes embedded in concrete shall not be less than three times o.d. of the pipe. All buried piping shall have been tested before placement of concrete.

F. Provide interior control joints where called for on drawing as detailed. When interior construction joints occur, they shall also be considered as control joints. Provide sawed groove similar to a control joint at all construction joints.

G. Concrete shall be conveyed from the mixer to place of final deposit by methods which will prevent separation and loss of material.

H. All equipment used for transporting equipment shall be cleaned of all debris. Ice shall be removed from all places to be occupied by concrete forms, and masonry fillers shall be thoroughly wetted except where air temperatures are below 40 degrees F.

I. Equipment for chuting, pumping, pneumatically conveying concrete, shall be such size and design as to insure practically continuous flow of concrete at delivery and without separation of materials.

J. Concrete shall be deposited as soon as practicable in its final position to avoid segregation due to re-handling, flowing. Concreting shall be carried on at such rate that concrete is at all times plastic and flow readily into space between bars. No concrete that has partially hardened or has been contaminated by foreign materials shall be deposited on work, nor shall re-tempered concrete be used.

K. Concreting, once started, shall be carried on as a continuous operation until placing of panel or section is completed. Top surface shall be generally level.

L. All concrete shall be thoroughly compacted by suitable means during operation of placing and shall be thoroughly worked around reinforcement, embedded fixtures, and into corners of forms. Vibrator shall not be used to flow concrete.

M. Where new concrete is doweled to existing work, drill holes in existing

concrete, insert steel dowels and pack with non-shrink grout or chemical adhesive. Follow manufacturer's recommendations for installation.

N. Screed floors slabs-on-grade and concrete base for toppings level, maintaining surface flatness of maximum 1/8 inch in 10 ft.

O. Construct all concrete site work items to shape, size, thickness and elevations shown. Concrete supported slabs shall be 4" thick on 1” form deck with reinforcing as indicated, unless otherwise shown. Side form all work. Slope surfaces of supported slabs, 1/4" per foot to low side or as directed by Architect/Engineer.

P. Provide 1/2" bituminous expansion joint filler along all joints where supported slabs abut other walks, building walls, etc.

Q. Protecting and sealing: Protect concrete supported slabs, ramps, platforms, slabs, etc., from pedestrian traffic for three days after pouring. Concrete shall be cured using two layers of burlap kept wet for minimum of 5 days; or at Contractor's option, he may use sprayed-on compound according to manufacturer's recommendations as approved by Architect. Curing method used shall not discolor original color of concrete, nor shall white liquid curing compound be used.

R. Provide concrete pads, bases, foundations, etc., as indicated and/or required by mechanical, electrical or other equipment supplier. Set anchor bolts for machine and equipment to templates or measurements provided.

3.5 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Remove formwork progressively and in accordance with code requirements.

3.6 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.

B. Uniformly spread, screed, and float concrete.

C. Wood float surfaces which will receive quarry tile or ceramic tile with full bed setting system.

D. Steel trowel surfaces which will receive carpeting, resilient flooring, seamless flooring, epoxy terrazzo. Scarify floors to receive all thin set quarry or

ceramic tile. Steel trowel corridor slabs (3 passes) and finish to ACI 302.1R, Class 5 floor.

E. Maintain surface flatness, with maximum variation of 1/8 inch in 10 ft. Corridor slabs to have overall FF=40, local FF=20.

F. In areas with floor drain, maintain floor level at walls and pitch surfaces uniformly to drains.

G. Apply concrete hardener on all floor surfaces not receiving resilient flooring tile, hard tile, carpet, epoxy flooring, etc. Apply in accordance with manufacturer's instructions.

H. Floor shall be finished without excessive floating. Delay troweling until concrete is sufficiently hard to prevent water working to surface. Bring finish to smooth level surface with minimum troweling possible.

I. Finishes, other than floors, exposed on exterior or interior shall be formed true, free from marks, irregularities. Remove any loose material, grind all projections, fill any honeycombing or holes, finish smooth. Use carborundum stone to hand rub and provide smooth, even surface where directed.

J. Thoroughly clean and prepare concrete floors scheduled to receive a densifier/hardener/sealer. Apply in strict accordance with manufacturer's instructions.

3.7 CURING

A. Place absorptive matting and dampen as required.

B. Immediately after placement, protect concrete from premature drying.

C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

D. Provisions shall be made for maintaining concrete in moist condition for at least five (5) days after placement, except high early concrete which shall be cured for at least two (2) days.

E. Cold Weather Requirements:

1. General: Except as modified herein, all work shall be in accordance with ACI 306R.
2. Adequate equipment shall be provided for heating concrete materials

and protecting concrete during freezing or near freezing weather. No frozen materials or materials containing ice shall be used.

F. Weather Conditions:

1. In hot weather, sprinkle and cover all concrete for at least 24 hours longer than specified for normal curing periods. In hot weather work shall be in accordance with ACI 305R.
2. In weather when temperature falls below freezing, and in any event between December 1 and April 1, no concrete shall be poured without adequate frost protection.

3.8 CONCRETE FINISHING

A. Provide concrete surfaces to be left exposed, concrete walls, columns, etc., with smooth rubbed finish not later than one day after form removal.

1. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Provide ¾" x ¾" beveled edges at corners of exposed concrete

3.9 FIELD QUALITY CONTROL

A. Inspection and testing shall be performed by an independent firm selected by the Owner and retained by the Construction Manager, in accordance with Division 1.

B. The Contractor shall notify the Architect/Engineer and the Testing Lab at least five (5) days prior to the commencement of concrete operations.

C. See Division 1 for inspection and testing allowances.

D. Specimens shall be molded and cured as per ASTM C31. Three specimens per test, not less than one test for each day's pour, each 50 yards concrete poured, each building unit, or each strength concrete. Specimens shall be laboratory cured.

E. Specimens shall be tested in accordance with ASTM C39. One specimen shall be tested at 7 days, two at 28 days.

F. When average strength of laboratory control cylinders fall below required compressive strength, Architect shall have right to order change in proportions and water content for remainder of structure. Architect shall have right to require tests as per ACI Building Code; Chapter 20 where load tests show concrete does not conform with drawings or specifications. Deficiency shall be corrected without additional cost to Owner.

G. A PDF copy of test reports at 7 days, 28 days, shall be sent directly to the Architect by the Testing Laboratory, with all required information shown.

H. Slump tests per ASTM C-172 and C-143, minimum of one test for each set of cylinders, or more as conditions warrant. Deliveries exceeding specified slump shall be rejected.

3.10 DEFECTIVE CONCRETE

A. Modify or replace concrete not conforming to required lines, details and elevations, as directed by the Architect/Engineer.

B. Failure of concrete topping to bond to substrate (as evidenced by a hollow sound when tapped), or disintegration or other failure of topping to perform as a floor finish, will be considered failure of materials and workmanship. Repair of replace toppings in areas of such failures, as directed.

END OF SECTION 03 00 10

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SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Chemical cleaning of decorative masonry
2. Repointing of mortar joints.

B. Related Requirements:

1. Section 03 01 00 - Maintenance of Concrete: Repair of concrete surfaces.
2. Section 04 05 13 - Masonry Mortaring
3. Section 07 90 00 - Joint Protection: Sealants, sealers, and gaskets for sealing joints.

C. Repointing:

1. Basis of Measurement: By square foot.
2. Basis of Payment: Includes repointing and cleaning.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

1.3 PREINSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.4 SCHEDULING

A. Section 01 30 00 - Administrative Requirements: Requirements for scheduling.

B. Perform cleaning and repointing to exterior masonry at time coordinated with owner.

1.5 SEQUENCING

A. Section 01 10 00 - Summary: Requirements for sequencing.

B. Cleaning may be required before applying tuckpointing efforts to ensure a better match for the new mortar, as existing dirt and stains can make matching the color of old buildings difficult.

C. Perform repointing before cleaning masonry surfaces. Allow mortar to dry for several hours to a few days for brushing and 7 – 14 days before using liquids.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information on cleaning compounds and

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Qualifications Statements:

1. Submit qualifications for manufacturer and applicator.
2. Submit manufacturer's approval of applicator.

1.7 QUALITY ASSURANCE

A. Perform Work according to ACI 530/530.1.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Storage:

1. Store materials according to manufacturer instructions.
2. Store cleaning materials in manufacturer packaging.
3. Store mortar ingredients in manufacturer packaging, or if delivered loose, with adequate weatherproof covering.

1.10 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Cold Weather Requirements: Comply with ACI 530/530.1 if ambient temperature or temperature of masonry units is less than 40 degrees F (4 degrees C).

C. Hot Weather Requirements: Comply with ACI 530/530.1 if ambient temperature is greater than 100 degrees F (38 degrees C), or if ambient temperature is greater than 90 degrees F (32 degrees C) with wind velocity greater than 8 mph (13 km/h).

PART 2 - PRODUCTS

2.1 MASONRY RESTORATION AND CLEANING

A. Manufacturers:

1. American Building Restoration Products, Inc.
2. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
3. Dominion Restoration Products.
4. Dumond Chemicals, Inc.
5. EaCo Chem, Inc.
6. Hydroclean; Hydrochemical Techniques, Inc.
7. Price Research, Ltd.
8. PROSOCO, Inc.

B. Substitutions: As specified in Section 01 60 00 - Product Requirements

2.2 MATERIALS

A. Cleaning Agent: detergent cleaner

B. Mortar Materials: As specified in Sections 04 05 13

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.

B. Verify that surfaces to be cleaned and pointed are ready for Work of this Section.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.

B. Protect elements surrounding Work of this Section from damage or disfiguration.

C. Immediately remove stains, efflorescence, or other excess resulting from Work of this Section.

D. Protect roof membrane and flashings from damage by laying ½ inch plywood on roof surfaces over full extent of Work area and traffic route.

3.3 INSTALLATION

A. Comply with procedures used in approved mockup.

B. Repointing:

1. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.
2. Do not use power tools.
3. Do not damage masonry units.
4. When cutting is complete, remove dust and loose material by brushing.
5. Mortaring:

    a. Premoisten joint and apply mortar as specified in Section 04 05 13 - Masonry Mortaring
    b. Pack tightly in maximum 1/4 inch layers.
    c. Form smooth, compact concave joint [to match existing].
    d. Moist cure for 72 hours.

C. Cleaning Existing Masonry:

1. Cleaning Detergents:
    a. Brush, spray or hand wash decorative masonry surface at all locations with detergent.
    b. Saturate masonry with clean water before and after application of cleaning detergent and flush loose mortar and dirt.

D. Restoration Cleaning:

1. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.
2. Spray or brush coat type masonry with restoration cleaner mixed into solution identical to solution required for mockup area.
3. Provide second application if required by preliminary test of mockup area.
4. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.
5. Rinse from bottom up with potable water applied at 600 psig and at rate of 4 gpm.

3.4 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. As Work proceeds and upon completion of Work, remove excess mortar, smears, and droppings.

C. Clean surrounding surfaces.

END OF SECTION 04 01 00

SECTION 04 05 13 - MASONRY MORTARING

1.1 SUMMARY

A. Section Includes: Mortar for masonry.

B. Related Requirements:

1. Section 04 01 00 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration Work.

2. Section 04 72 00 – Cast Stone Masonry

C. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

D. ASTM International:

1. ASTM C5 - Standard Specification for Quicklime for Structural Purposes.
2. ASTM C91 - Standard Specification for Masonry Cement.
3. ASTM C91M - Standard Specification for Masonry Cement.
4. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
5. ASTM C150 - Standard Specification for Portland Cement.
6. ASTM C150M - Standard Specification for Portland Cement.
7. ASTM C199 - Standard Test Method for Pier Test for Refractory Mortars.
8. ASTM C206 - Standard Specification for Finishing Hydrated Lime.
9. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
10. ASTM C387 - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
11. ASTM C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar.
12. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
13. ASTM C595M - Standard Specification for Blended Hydraulic Cements.
14. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
15. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry.
16. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
17. ASTM C1329 - Standard Specification for Mortar Cement.
18. ASTM C1329M - Standard Specification for Mortar Cement.
19. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength.

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Samples: Submit two samples of mortar, illustrating mortar color and color range.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit premixed mortar installation instructions.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.3 QUALITY ASSURANCE

A. Comply with ACI 530/530.1.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.6 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Cold Weather Requirements: Comply with ACI 530/530.1 if ambient temperature or temperature of masonry units is less than 40 degrees F (4 degrees C).

C. Hot Weather Requirements: Comply with ACI 530/530.1 if ambient temperature is greater than 100 degrees F (38 degrees C) or ambient temperature is greater than 90 degrees F (32 degrees C) with wind velocity greater than 8 mph (13 km/h).

PART 2 - PRODUCTS

2.1 MORTAR

A. Manufacturers:

1. CTS Cement Manufacturing Corporation.
2. Glen-Gery Corporation.
3. Holcim (US) Inc.
4. Lafarge North America Inc.
5. Lehigh Hanson; HeidelbergCement Group.
6. QUIKRETE.
7. Solomon Colors Inc.
8. Southern Grouts & Mortars, Inc.

B. Substitutions: As specified in Section 016000 - Product Requirements

2.2 MATERIALS

A. Portland Cement:

1. Comply with ASTM C150 (C150M), Type I
2. Color: to be determined

B. Calcium Chloride: Not allowed.

2.3 MIXES

A. Mortar Mixes:
1. Mortar for Structural Masonry: Comply with ASTM C270, Type **N** using property specification.
2. Pointing Mortar: Comply with ASTM C270, Type N using property specification.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.

B. Apply bonding agent to existing masonry surfaces.

C. Mortar Mixing:

1. Thoroughly mix mortar ingredients according to ASTM C270 in quantities needed for immediate use.
2. Achieve uniformly damp sand immediately before mixing process.
3. Add mortar color to achieve uniform mix and coloration.
4. Retemper only within two hours of mixing.

3.2 INSTALLATION

A. According to ACI 530/530.1.

3.3 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Testing:

1. Frequency: One set of specified tests for every 5,000 sq. ft. of completed wall area.

2. Mortar Mix: Comply with ASTM C780 for aggregate ratio and water content, air content, consistency, and compressive strength.

3. Flexural Bond Strength of Mortar and Masonry Units:
   a. Comply with ASTM C1357.
   b. Test in conjunction with applicable masonry unit Sections.

4. Compressive Strength of Mortar and Masonry:
   a. Comply with ASTM C1314.
   b. Test in conjunction with applicable masonry unit Sections.

3.4 ATTACHMENTS

A. Exterior Masonry Wall: Type N pointing mortar.

END OF SECTION 04 05 13

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Attention is directed to Bidding and Contract Requirements, and to General and Supplemental Conditions, hereby made a part of this Section.

1. Section includes:

a. Custom cast stone

1. 2 RELATED SECTIONS:

A. Section 04 05 13 – Masonry Mortaring
B. Section 07 92 00 – Joint Sealers

1.3 REFERENCES:

A. ASTM A 615/A 615 M – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
B. ASTM A 767/A767M – Zinc-Coated (galvanized) Steel Bars for Concrete Reinforcement.
C. ASTM C 33 – Concrete aggregates.
D. ASTM C 39 – Compressive strength of concrete cylinders.
E. ASTM C 90 – Loadbearing Concrete Masonry Units
F. ASTM C 140 – Sampling and Testing Concrete Masonry Units and Related Units
G. ASTM C 150 – Portland Cement
H. ASTM C 270 – Mortar for Unit Masonry
I. ASTM C 426 – Linear Drying Shrinkage of Concrete Masonry Units
J. ASTM C 494 – Chemical Admixtures for Concrete
K. ASTM C 666 – Resistance of Concrete to Rapid Freezing and Thawing
L. ASTM C 979 – Pigments for Integrally Colored Concrete
M. ASTM C 1194 – Compressive Strength of Architectural Cast Stone
N. ASTM C 1195 – Absorption of Architectural Cast Stone
O. ASTM C 1364 – Architectural Cast Stone
P. Cast Stone Institute Technical Manual (current ed.)

1.4 DEFINITIONS:

A. Cast Stone: An architectural masonry unit manufactured to copy fine grain texture and color of natural cut stone.

B. Dry Cast Concrete Products: Manufactured from zero-slump concrete.

C. Machine Casting Method: Vibratory compaction by machine of earth-moist, zero-slump concrete against rigid mold until it is densely compacted.

D. Vibrant Dry Hand Tamp Casting Method: Vibratory compaction by hand tamp of earth-moist, zero-slump concrete against rigid mold until it is densely compacted.

1.5 SUMBITTALS:

A. Comply with Division 1 – Section 01340 “Shop Drawings, Product Data and Samples” for submittal requirements.

B. Product Data: Submit manufacturer’s Product Data

C. Shop Drawings: Submit manufacturer’s shop drawings, including profiles, cross sections, modular unit lengths, reinforcement if required, exposed faces, anchors and anchoring method recommendations if required and annotation of cast stone types and location.

D. Samples: Submit pieces of manufacturer’s cast stone units that represent general range of texture and color proposed to be furnished for project.

E. Test Results:
1. Submit manufacturer’s test results from cast stone units previously made by manufacturer using materials from same sources proposed for use in project.
2. Submit manufacturer’s test results from plant production testing.

F. Warranty: Submit manufacturer’s standard warranty.

1. 6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Sufficient plant facilities to provide quality, shapes, quantities, and sizes of cast stone units required without delaying progress of the work.

2. Minimum of 10 years experience in producing masonry units or cast stone.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver cast stone units secured to shipping pallets and protected from damage and discoloration.
2. Provide itemized shipping list.
3. Number each piece individually, as required, to match shop drawings and schedules.

B. Storage
1. Store cast stone units and installation materials in accordance with manufacturer's instructions.
2. Store cast stone units on pallets with non-staining, waterproof covers.
3. Do not double stack pallets.
4. Ventilate units under covers to prevent condensation.
5. Prevent contact with dirt and splashing.

C. Handling:
1. Protect cast stone units, including corners and edges, during storage, handling, and installation to prevent chipping, cracking, staining, or other damage.
2. Handle long units at center and both ends simultaneously to prevent cracking.

1.8 SCHEDULING

A. Schedule and coordinate production and delivery of cast stone units with unit masonry work.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. RockCast, Division of Reading Rock Inc., 4600 Devitt Drive, Cincinnati, OH 45246. Toll Free (800)482-6466. Phone (513)874-2345. Fax (513)874-2520. Web Site: www.rockcast.com. E-mail: info@rockcast.com

B. Custom Cast Stone Inc., 734 E. 169th Street, Westfield, Indiana 46074, toll free (888)776-9960 phone (317)896-1700 Fax (317)896-1701

1. C. Custom Stone Works, 32910 Plymouth Road, Livonia, MI 48150 Phone:(734) 427-8158 Fax:(734) 427-8178 Toll free:(877)40-GRANITE.

C. Royal Stone, 3014 Dietz Road, Williamston, MI 48895. Phone: 517-655-5150, Fax: 517-655-2027, Email: jameyp@royalstoneinc.com

D. Or Equal as approved by Architect/Owner.

2.2 CUSTOM CAST STONE UNITS

A. Custom Cast Stone Units; RockCast Custom Cast Stone Series or Custom stone units.

B. Compliance: ASTM C 1364.

C. Casting Method: Vibrant dry hand tamp.

D. Texture: Smooth.

E. Color: As selected by Architect/Owner from manufacturer's full selection of colors.

F. Units: As indicated on drawings.

G. Profiles: As indicated on drawings.

H. Test Results:
1. Compressive Strength, ASTM C 1194: Greater than 6,500 psi at 28 days.
2. Absorption: ASTM C 1195: 6.0 percent max at 28 days.
3. Linear Shrinkage, ASTM C 426: Less than 0.065 percent.
4. Density, ASTM C 140: Greater than 120 pounds per cubic foot.
5. Freeze-Thaw, ASTM C 666: Less than 4.0 percent.

I. Curing: Cure in enclosed chamber at 95 percent relative humidity for 24 hours or yard cure for 350° days (i.e. 7 days @ 50°F or 5 days @ 70°F) prior to shipping.

J. Cast Stone type units, as indicated on drawings.

2.3 CAST STONE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II. White and/or gray as required to match specified color.

B. Coarse Aggregate: ASTM C 33, except for gradation. Granite, quartz, or limestone.

C. Fine Aggregates: ASTM C 33, except for gradation. Manufactured or natural sands.

D. Pigments: ASTM C 979, except do not use carbon black pigments. Inorganic iron oxide pigments.

E. Water reducing, retarding, and accelerating admixtures: ASTM C 494.

F. Water: Potable.

G. Reinforcing Bars: ASTM A 615, deformed steel bars. Galvanized when covered with less than 1 ½ inches of material.

H. Galvanized Coating: ASTM A 767

2.4 TEXTURE AND COLOR

A. General: Match texture and color of full-size sample on file with Architect.

B. Texture of surfaces exposed to view:
1. Fine-grained texture similar to natural stone.
2. Approximately equal to approved sample when viewed in direct daylight at 20 feet.

C. Surface Voids:

1. Size: Maximum 1/32 inch.

2. Density: Less than 3 occurrences per any 1 square inch.

3. Viewing Conditions: Not obvious under direct daylight at 20 feet.

D. Minor Chipping:

1. Minor chipping resulting from shipping and delivery shall not be grounds for rejection of cast stone units.

2. Minor chips shall not be obvious under direct daylight at 20 feet, as determined by Architect.

E. Color Variation

1. Viewing Conditions: Compare in direct daylight at 20 feet, between cast stone units of similar age, subjected to similar weathering conditions.

2.5 MORTAR

A. Mortar: ASTM C 270, Type N, as specified in Section 04100 Mortar & Grout.

2. 6 ACCESSORIES

A. Anchors: Type 304 stainless steel.

B. Sealant: As specified in Section 07920.

C. Cleaner: Prosoco Sure Klean 600 Detergent, or Prosoco Sure Klean Vana Trol as required per brick type.

2. 7 FABRICATIONS

A. Shapes: Unless otherwise indicated on drawings, provide:
   1. Suitable wash on exterior sills, copings, projecting courses and units with exposed top surfaces.
   2. Drips on projecting units, wherever possible.

B. Reinforcement: As required to withstand handling stresses.

2. 8 TOLERANCES

A. General: Manufacture cast stone units within tolerances in accordance with Cast Stone Institute Technical Manual, unless otherwise specified.

B. Cross Section Dimensions: Do not deviate by more than plus or minus 1/8 inch from approved dimensions.

C. Length of Units: Do not deviate by more than length/360 or plus or minus 1/8 inch, whichever is greater, not to exceed plus or minus ¼ inch.

D. Warp, Bow or Twist: Do not exceed length/360 or plus or minus 1/8 inch, whichever is greater.

2. 9 PRODUCTION QUALITY CONTROL

A. Mix Designs: Test new and existing mix designs for compressive strength and absorption before manufacturing cast stone units.

B. Plant Production Testing: Test compressive strength and absorption from specimens selected at random from plant production. Obtain samples every 500 cubic feet of product produced.

C. Custom Cast Stone Units: Test in accordance with ASTM C 1194 and C 1195.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine construction to receive cast stone units. Notify Architect and the General Contractor in writing if construction is not acceptable. Do not begin installation until unacceptable conditions have been corrected.

B. Examine cast stone units before installation. Do not install unacceptable units.

3.2 INSTALLATION

A. Install cast stone units in conjunction with masonry, as specified in Section 04300 “Unit Masonry Work”.

B. Pull units from multiple cubes during installation to minimize variation in color.

C. Cut units using motor-driven masonry saws.

D. Do not use pry bars or other equipment in a manner that could damage cast stone units.

E. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

F. Set cast stone units in full bed of mortar, unless otherwise indicated on the drawings.

G. Fill vertical joints with mortar.

H. Make joints 3/8 inch, unless otherwise indicated on the drawings.

I. Leave head joints in copings and similar units upon for sealant.

J. Rake mortar joints 3/4 inch for pointing.

K. Tuck point mortar joints to slight concave profile.

L. Remove excess mortar immediately.

M. Remove mortar fins and smears before tooling joints.

N. Sealant Joints:

1. As specified in Sections 07910 “Joint Fillers and Gaskets” and 07920 “Sealants and Caulking”.

O. Prime ends of cast stone units, insert properly sized backing rod, and install sealant.

P. Provide sealant joints at following locations:

1. Cast stone units with exposed tops.

2. Joints at relieving angles.

3. Control and expansion joints.

4. As indicated on the drawings.

3.3 TOLERANCES

A. Installation Tolerances: Comply with Cast Stone Institute Technical Manual.

1. Variation from Plumb: Do not exceed 1/8 inch in 5 feet or 1/4 inch in 20 feet or more.

2. Variation from Level: Do not exceed 1/8 inch in 5 feet, 1/4 inch in 20 feet, or 3/8 inch maximum.

3. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch or 1/4 of nominal joint width, whichever is greater.

4. Variation in Plane Between Adjacent Surfaces: Do not exceed 1/8-inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 CLEANING

A. Clean exposed units after mortar is thoroughly set and cured.

B. Wet surfaces before applying cleaner.

C. Apply cleaner to cast stone units in accordance with cleaner manufacturer’s instructions.

D. Perform test of cleaner on small area and receive approval by Architect before full cleaning.

E. Do not use the following to clean cast stone units:

1. Muriatic acid.

2. Power washing.

3. Sandblasting.

F. Harsh cleaning materials or methods that would damage or discolor surfaces.

3.5 REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

B. Repair with touchup materials provided by manufacturer in accordance with manufacturer's instructions.

C. Repair methods and results to be approved by Architect.

3. 6 INSPECTION AND ACCEPTANCE

A. Inspect completed installation in accordance with Cast Stone Institute Technical Manual.

3. 7 PROTECTION

A. Protect installed cast stone from splashing, stains, mortar, and other damage.

END OF SECTION 04 72 00

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SECTION 07 31 00 - SHINGLE ROOFING

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Roof shingles
   2. Related metal flashing
   3. Edge Drips

1.2 QUALITY ASSURANCE:

A. Installer: A firm with (3) years of prior successful experience with installation of roofing of type and scope equivalent to work of this section.

B. Comply with the requirements of local and state building codes.

C. SMACNA Details: Except as otherwise shown or specified, comply with applicable recommendations and details of "Architectural Sheet Metal Manual" by SMACNA. Conform to dimensions and profiles shown.

1.3 SUBMITTALS:

A. Product Data:

   1. Submit (2) sets of samples to show the full range of exposed color and texture to be expected in the completed work. Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Store and handle in accordance with manufacturer's recommendations.

1.5 JOB CONDITIONS:

A. Do not apply roofing including felt when substrate is wet.

B. Do not apply shingles when air temperature is below 40 degrees F.

1.6 WARRANTY:

A. Certain Teed Landmark Pro Lifetime Limited Warranty.

1.7 UNIT PRICES

A. Quote unit prices for the removal and replacement of damaged exterior roof sheathing - $/sheet.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Roof Shingles:

1. Three-Dimensional Glass fiber mat base Shingles: ceramically colored algae resistant granules across entire face, two-piece laminated shingles complying with ASTM D 3018, Type 1 and D3462. Provide shingles bearing UL790 Class “A” external fire exposure label and Wind Resistant test requirements of ASTM D3161 (Type 1)/UL 997. Color as selected by Architect from manufacturer’s full color range.

2. Products: Subject to compliance with requirements, provide the following:
   a. CertainTeed Landmark Pro

B. Ridge Shingles:

1. Use factory precut units that corresponds to shingles being installed.

C. Felt:

1. Provide (2) layers of 15 pound asphalt saturated, organic, un-perforated, ASTM D 226-81.

D. Fasteners:

1. Nails: Hot galvanized or aluminum 11 or 12 ga. barbed shank, 3/8" head, sharp pointed conventional, or sufficient length to penetrate through plywood sheathing. Staples will not be allowed.

E. Flashing:

1. Zinc-Coated Steel: Provide commercial quality carbon steel sheets with minimum of 0.20% copper complying with ASTM A 526, except provide ASTM A 527 where lock- forming is required; hot-dip galvanized to comply with ASTM A 525, designation G90. Use for counter flashing and closure.

2. Sheet Aluminum: Except as otherwise indicated, provide manufacturer's standard aluminum sheet recommended for general flashing applications ASTM B209; alloy 3003; temper H14; thickness indicated or, if not otherwise indicated, 0.032" (20 B & S gage);

a. Form flashing (to profiles indicated on drawings, and) to protect roofing materials from physical damage and shed water.

b. Provide drip edge flashing where indicated and where required, preformed of .032 inch aluminum.

1. Color finish: Metal shall be thoroughly cleaned and pretreated before application. Exposed to view surfaces shall be finished with fluorocarbon coating containing a minimum of 70 percent Kynar 500 resin, 1 mil thick. Custom color shall be Architect selected. A 20-year limited warranty against failure of the finish shall begin when the job is complete.

F. Aluminum Slant Back Roof Exhaust Vent

1. Provide Certainteed aluminum slant back roof, or similar approved by architect, in locations and quantities shown on drawings.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect the roof to ensure that work penetrating roof surface has been completed to the extent that roofing can be applied.

B. Examine surfaces to receive tiles to assure they are rigidly supported, even and clean.

C. Do not apply materials over wet roof sheathing.

D. Do not proceed with installation until defects are corrected.

3.2 INSTALLATION:

A. Ice & Water Shield: Apply 40 mil meeting ASTM D3767 Method A thick membrane minimum tensile strength 250 psi, per ASTM D412 (die C modified), 250% elongation per ASTM D414 (die C modified) minimum 36" wide Grace Ice & Water Shield as manufactured by GCP Applied Technologies or Architect approved equal. Install per manufacturers specifications.

E. Felt:

1. Apply two layers of felt parallel with eaves, laying first 19" as starter course, overlapping with 36" second layer.

2. Cover roof with 36" sheets of felt overlapping preceding layer by 19" exposing 17" of underlying sheet.

3. Secure underlayment to deck with sufficient fasteners to hold in place until shingles are applied.

F. Flashing:

1. Provide metal drip edge at all edges of roof.

G. Roof Shingles:

1. First Course: Start with a full shingle even with starter course.

2. Second Course: Offset second shingle to the 4-1/2" alignment notch in the first course shingle.

3. Third Course: Offset third shingle to the 7-1/2" alignment notch in the second course shingle.

4. Succeeding Courses: Continue this pattern, or any combination of these offsets, to achieve a random appearance.

5. For horizontal alignment, place butt of above shingle at top of 6" horizontal cut out.

6. Fastening Instructions: Place one fastener 1" from each end of shingle and one 12" from each end, four fasteners in each shingle. <u>All four fasteners must be placed in the fastening line.</u>

END OF SECTION 07 31 00

FIRE STATION NO. 4 BUILDING IMPROVEMENTS
PROJECT NO. P26-0010

SECTION 07 71 23 – COMMERCIAL GUTTER SYSTEM

PART I GENERAL

1.1 RELATED DOCUMENTS

A. The provisions included under Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements are included as part of this section as though bound herein.

1.2 SUMMARY

A. Provide labor, material, and equipment necessary for furnishing a complete installation of industrial series commercial gutter system.

1.3 SUBMITTALS

A. Product Data: Each type of product specified. Submit manufacturer's detailed technical product data, installation instructions and recommendations, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: Show fabrication and installation of industrial series commercial gutter system including fully dimensioned roof plans, expansion joint locations, sections and details of components and other related trims.

C. Finish & Color Selection: Furnish manufacturer's technical data for custom colors.

1.4 QUALITY ASSURANCE

A. Where pre-engineered manufactured products are specified, other field fabricated or shop/field fabricated substitutions will not be accepted. However, where shop/field fabrications are indicated pre-engineered systems will be considered with Architect approval.
B. Obtain all components and related accessories from one single source manufacturer.
C. Follow manufacturer's printed instructions for installing commercial

gutter system. Follow primary roofing manufacturer's printed instructions for installing associated roof material for flashing gutter system to roof.

1.5 DELIVERY, STORAGE & HANDLING

A. All products delivered shall be stored in a clean dry location prior to installation.
B. Products furnished with strippable protective masking shall not be exposed to direct sunlight for more than 30 minutes without removing masking.
C. Do not install finished materials with scars or abrasions.

1.6 PRODUCT CONDITIONS

A. Coordinate work of this Section with adjoining work for proper sequencing to ensure protection from inclement weather and to protect materials and their finish against damage.
B. Do not install commercial gutter system during inclement weather. When installing in cold climates, warm adhesives, caulks, and primers to at least 50 degrees Fahrenheit prior to application.

1.7 DESIGN PERIMETERS

A. Commercial Gutter System shall conform to all local building codes and SMACNA design perimeters for architectural sheet metal.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide commercial gutter system, accessories, and drainware as manufactured by Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc. 143 Charlotte, Suite 102, Sanford, North Carolina 27330, 1-800-334-9823.

2.2 TYPE

A. Provide Perimeter Systems' Industrial Series Commercial Gutter System "Profile G4", 6" size, Model Number G4-R6 or equal approved by architect.

2.3 MATERIALS & FABRICATION

A. Gutter shall be manufactured from .063" Kynar color to match standing seam roofing system in 10'-0" lengths.

B. Gutter shall be:

1. Manufactured with 1" telescoping and notched end.
2. Factory punched with fastening holes elongated to allow for thermal movement.
3. Press formed on a CNC press to provide repeated true and accurate profiles.

C. Support Brackets shall be manufactured from 0.125"x1.00" factory extruded aluminum bar punched for fasteners.

D. Interior Straps shall be manufactured from 0.125"x 1.00" extruded aluminum (mill finish).

2.4 ACCESSORIES

A. Mitered Corners, provide factory-mitered corners.

B. Sculptured End Caps, provide factory end caps at all gutter ends and wall abutments.

C. Gutter Expansion Joint, provide manufacturer's elastomeric expansion joints with exterior cover plates at 40' intervals or as shown on drawings.

2.5 DRAINWARE

A. Downspout & Elbows, connect to existing. Where existing is damaged or infeasible, provide rectangular extruded downspout Model Number DS-EX in sizes and locations as indicated on plans. Downspouts shall be manufactured from 1/25 aluminum custom Kynar finished to match gutter fascia. Downspout elbows shall have helliarc welded joints.

B. Outlets, at all downspout locations provide aluminum outlets to connect liner to downspout.

C. Wall Brackets, provide Style 1 Wall brackets at 30” maximum spacing (minimum 2 brackets). Brackets shall be manufactured from 0.125”x1.00” extruded aluminum bar, finished to match downspout.

2.7 FINISHES

A. General: Apply coatings to exposed aluminum components after fabrication for maximum coating performance and to prevent crazing, abrasion, and damage to finish surfaces.

B. Pretreatment: Aluminum components shall be pretreated with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by chrome phosphate conversion coating to which organic coatings will firmly adhere.

C. Coating Type: High Performance Coating, two-coat, shop applied, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem, Inc. Kynar 500 or Ausimont U.S.A., Inc. Hylar 5000 resin, meeting AAMA 2605 specification.

D. Color: to be determined from manufacturer’s standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. The installer must examine substrates and conditions under which commercial gutter system will be installed. All wood plates and/or fascia boards shall be installed true, straight, and free of splits, cracks, or other irregularities. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Prior to the installation of the industrial series commercial gutter system, soffits, extenders, and associated trims shall be installed.

B. Installer shall thoroughly read and follow manufacturer's installation instructions before proceeding with installation.

3.3 INSTALLATION

A. General: The industrial series commercial gutter system shall be installed in strict accordance with manufacturer's printed instructions. Deviations from the instructions are not allowed.

B. Support Brackets: Layout support brackets to provide ½" slope in 40 linear feet. Install support brackets with #10 x 2" stainless steel wood screws.

C. Gutter: Install gutter onto support brackets and fasten to substrates with 1-1/2" aluminum or stainless steel nails. Rivet and seal gutter joints with high grade exterior sealant as recommended by gutter manufacturer.

D. Expansion Joints: Install elastomeric expansion joints as shown on plans and/or shop drawings. Maximum expansion joint spacing shall be 40' centers.

E. Install interior straps by fully engaging them into liner and fascia, complete by securely riveting.

END OF SECTION 07 71 23

SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Attention is directed to Division 0, Bidding and Contract Requirements, and to Division 1, General Requirements, which are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK:

A. The extent of each type of sealant and caulking work is indicated on the drawings and by provisions of this section.

B. The required applications of sealants and caulking include, but are not necessarily limited to, the following general locations:
   1. Flashing reglets and retainers.
   2. Masonry control joints, exterior and interior.
   3. Interior sound-sealed and air-sealed joints.
   4. Flooring joints.
   5. Isolation joints, between structure and other elements.
   6. Joints at penetrations of walls, decks and floors by piping and other services and equipment.
   7. Joints between items of equipment and other construction.
   8. Joints between dissimilar materials.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms with not less than 5 years of successful experience in production of types of sealants and caulking compounds required for this project.
   1. Obtain elastomeric sealants from a manufacturer which will, upon request, send a qualified technical representative to the project site for purpose of advising installer on proper procedures for use of products.

B. Installer: A firm with a minimum of 5 years of successful experience in application of types of materials required.

1.04 SUBMITTALS:

A. Product Data:
   1. Submit manufacturer's specifications, recommendations and installation and instructions for each type of sealant, caulking compound and associated miscellaneous material required.

B. Samples:
   1. Submit three, 12" long samples of each color required (except black) for each type of

sealant and caulking compound exposed to view. Install sample between two strips of material similar to or representative of typical surfaces where compound will be used, held apart to represent typical joint widths.

1.05 JOB CONDITIONS:

A. Pre-Installation Meeting: At General Contractor’s direction, installer, sealant manufacturer's technical representative, and other trades involved in coordination with sealant work shall meet with General Contractor at project site to review procedures and time schedule proposed for installation of sealants in coordination with other work. Review each major sealant application required on project.

B. Weather Conditions: Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended temperature range for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Where joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of the manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule with General Contractor to avoid delay of project.

C. Statement of Non-Compliance: Where it is necessary to proceed with installation of sealants or caulking compound under conditions which do not fully comply with requirements (because of time schedule or other reasons which the General Contractor determines to be crucial to project), prepare written statement for Owner's record (with copy to Architect) indicating the nature of non-compliance, reasons for proceeding, precautionary measures taken to ensure best possible work and names of individuals concurring with decision to proceed with installation.

1.06 SPECIAL PROJECT WARRANTY (GUARANTEE):

A. Sealant Warranty: Provide written warranty, signed by the contractor/installer, agreeing to, within warranty period of 10 years (or maximum warranty provided by manufacturer for polyurethane sealants) after date of substantial completion, replace/repair defective materials and workmanship defined to include: Instances of significant leakage of water or air; failures in joint adhesion, material cohesion, abrasion resistance, strain resistance or general durability; failure to perform as required and the general appearance of deterioration in any other manner not clearly specified in manufacturer's published product literature as an inherent characteristic of the sealant material. Warranty includes responsibility for removal and replacement of other work (if any) which conceals or obstructs the replacement of sealants.

PART 2 – PRODUCTS

2.01 MATERIALS, GENERAL:

A. Colors: Provide black or other natural color where no other standard or custom color is available. Where material is not exposed to view, provide manufacturer's standard color which has best overall performance characteristics for application shown.
   1. Provide manufacturer's standard colors as selected by Architect from manufacturer's standard colors.

B. Hardnesses shown and specified are intended to indicate general range necessary for overall performance. Consult manufacturer’s technical representative to determine actual hardness recommended for conditions of installation and use. Upon request, Architect will furnish information concerning anticipated joint movement related to actual joint width and installation temperature. Except as otherwise indicated or recommended, provide compounds within the following range of hardness (Shore A, fully cured, at 75 degrees F.).
   1. 5 to 20 for high percentage of movement and minimum exposure to weather and abrasion (including no exposure to vandalism).
   2. 15 to 35 for moderate percentage of movement and moderate exposure to weather and abrasion.
   3. 30 to 60 for low percentage of movement and maximum exposure to weather and abrasion (including foot traffic on horizontal joints).

C. Modulus of Elasticity: For joints subjected to movement, either thermal expansion of dynamic movement, select sealants from among available variations which have lowest modulus of elasticity which is consistent with exposure to abrasion or vandalism. For horizontal joints subject to traffic, select sealants with high modulus of elasticity as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations where no other requirements are indicated.

D. Compatibility: Before selection and purchase of each specified sealant, investigate its compatibility with joint surfaces, joint fillers and other materials in joint system. Provide only materials (manufacturer's recommended variation of specified materials) which are known to be fully compatible with actual installation conditions as shown by manufacturer's published data or certification.

2.02 SEALANTS:

A. One Part Elastomeric Sealant (Silicone)
   1. One component elastomeric sealant, complying with ASTM C 920, Class 25, Type NS (nonsag), unless Type S (self-leveling) recommended by manufacturer for the application shown.
      a. Acceptable Standard
         1. "Pecora 864 Architectural Silicone Sealant; Pecora Corp.
         2. Dow Corning 791; Dow Corning Corp.

3. Silpruf; General Electric
4. Omniseal; Sonneborn Building Products, Inc.
5. Spectrem 2; Tremco Mfg. Co.

2. One-Component mildew resistant silicone sealant: (Around countertops and backsplashes and other wet interior locations).
   a. Acceptable Standard
      1. Rhodorsil 6B white; Rhone-Poulenc Inc.
      2. Dow Corning 786; Dow Corning Corp.
      3. Sanitary 1700; General Electric

3. One Component high movement joints (+100/-50): Where locations of high movement are indicated.
   a. Dow Corning 790; Dow Corning Corp.,
   b. Spectrem 1; Tremco

B. Elastomeric Sealant (Polyurethane)
1. One component polyurethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25 (nonsag).
   a. Acceptable Standard
      1. Sonolastic NP 1; Sonneborn Building Products Inc.
      2. Dymonic; Tremco Mfg. Co.
      3. Dynatrol I; Pecora Corp.
      4. Vulkem 921; Mameco
      5. CS 2130; Hilti
      6. Sikaflex 1A; Sika Corp.
      7. Sikaflex 15LM; Sika Corp.

2. Two Component polyurethane sealant, complying with ASTM C 920, Type M, Grade NS, Class 25 (nonsag).
   a. Acceptable Standard
      1. Sonolastic NP 2; Sonneborn Building Products Inc.
      2. Dymeric; Tremco Mfg. Co.
      3. Dynatrol II; Pecora Corp.
      4. Vulkem 922; Mameco
      5. Sikaflex LCNSEZ; Sika Corp.

C. One-part self-leveling polyurethane sealant (for traffic areas).
1. One Component polyurethane self-leveling sealant, complying with ASTM C 920, Type S, Grade P, Class 25.
   a. Acceptable Standard
      1. Sonolastic SL 1; Sonneborn Building Products Inc.
      2. NR-201 Urexpan; Pecora Corp.
      3. Vulkem 45; Mameco
      4. Sikaflex 1CSL; Sika Corp.

2. Two-component polyurethane self-leveling sealant, complying with ASTM C 920, Type M, Grade P, Class 25.
   a. Acceptable Standard
      1. Sonolastic SL 2; Sonneborn Building Products Inc.
      2. NR-200 Urexpan; Pecora Corp.
      3. Vulkem 245; Mameco
      4. THC900/THC901; Tremco
      5. Sikaflex 2CSL; Sika Corp.

D. Security Sealant (Polyurethane)
1. One component or two component polyurethane sealant, complying with ASTM C 920, Grade NS, Class 12.5, with a Shore A Hardness of 55.
   a. Acceptable Standard
      1. Dynaflex; Pecora Corp.
      2. Ultra; Sonneborn Building Products, Inc.

2.04 CAULKING COMPOUNDS:

A. Caulking Compounds: (Acrylic Latex Sealant)
1. Latex rubber modified, acrylic emulsion polymer sealant compound; manufacturer's standard, one part, nonsag, mildew resistant, acrylic emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior locations involving joint movement of not more than plus or minus 5 percent.

2. Acceptable Standard
   a. Sonolac, Sonneborn Building Products Inc.
   b. Acrylic Latex Caulk 834, Tremco Inc.
   c. Acrylic Latex Caulk with Silicone, DAP
   d. AC-20, Pecora Corp.

2.05 MISCELLANEOUS MATERIALS:

A. Joint Cleaner: Provide type of joint cleaning compound recommended by sealant or caulking compound manufacturer, for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Provide type of joint primer/sealer recommended by sealant manufacturer, for joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam butyl rubber foam, neoprene foam or other flexible,

permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer.

E. Provide size and shape of rod which will control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

PART 3 – EXECUTION

3.01 EXAMINATION:

A. The installer must examine joint surfaces, backing and anchorage of units forming sealant rabbet and condition under which sealant work is to be performed and notify the General Contractor in writing of conditions detrimental to proper completion of the work and performance by sealants. Do not proceed with sealant work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 SELECTION OF MATERIAL

A. Caulking compounds shall be used for interior nonmoving joints and at locations indicated.

B. One component elastomeric silicone sealants shall be used at exterior and interior joints where thermal or dynamic movement is anticipated including, but not limited to, the following locations:
1. Metal to metal joints.
2. Sheet metal flashing, coping, preformed metal caps, fascias, extenders, trim and panels.

C. One or two component elastomeric polyurethane sealants shall be used at exterior and interior joints where weatherproofing or waterproofing is required and at exterior joints between dissimilar materials including, but not limited to, the following locations:
1. Expansion and control joints.
2. Exterior side of hollow metal frames to adjacent materials.
3. Exterior side of aluminum frames to adjacent dissimilar materials.
4. Lintels and shelf angles to masonry construction.
5. Louvers to adjacent construction.
6. Vertical interior expansion joints and horizontal interior and exterior control joints and expansion joints in the building.
7. Joints in concrete site improvements (sidewalks, ramps, retaining walls) and the joint between the concrete slabs and dissimilar materials.
8. Sealant in pipe sleeves where materials must perforate the floor slab.
9. Perimeter of floor slabs or concrete curbs which abut vertical surfaces.

10. Exterior joints between dissimilar materials where the joining of the two surfaces leaves a gap between the meeting materials or components as may be dictated by the various methods of construction to make watertight.
11. Exterior locations which are noted "caulked" or "sealant" and not specifically listed herein or included in the work of other sections of the Specifications.
12. Interior joints between dissimilar materials where the joining of the 2 surfaces leave a gap between the meeting materials and components.

D. One or two part self-leveling polyurethane sealants shall be used for exterior and interior horizontal joints subject primarily to pedestrian traffic and light and moderate vehicular traffic.

E. Security sealant shall be used in vertical control joints in the interior side of building.

3.03 JOINT SURFACE PREPARATION:

A. Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

B. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with a water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with paragraph 4.3.9. of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

D. Roughen joint surfaces on vitreous coated and similar non-porous materials, where sealant manufacturer's data indicated lower bond strength than for porous surfaces. Rub with fine abrasive to produce a dull sheen.

3.04 INSTALLATION:

A. Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

B. Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

C. Install sealant backer rod for liquid sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for the application shown.

D. Install bond breaker tape where shown and where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

F. Install sealants to depths as shown or if not shown as recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead.
   1. For sidewalks, pavement and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width and neither more than 5/8" deep nor less than 3/8" deep.
   2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.
   3. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75% to 125% of joint width.

G. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces including exposed aggregate panels and similar rough textures. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces but either primer/sealer or the sealant/caulking compound.

H. Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage without damage to adjoining surfaces or finishes.

3.04 CURE AND PROTECTION:

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner which would significantly alter materials modulus of elasticity or other characteristics.

B. Installer shall advise the General Contractor of procedures required for curing and protection of sealants and caulking compounds during construction period, so that

they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END OF SECTION 07 92 00

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: High-performance coatings and special preparation of surfaces. Epoxy Coating systems for concrete floors with decorative chips.

B. Related Requirements:

1. Section 09 91 00 - Painting and Coating: Preparing, priming, painting, and staining of surfaces.

1.2 REFERENCE STANDARDS

A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer and Related Products.

B. SSPC-SP 2 - Hand Tool Cleaning.

C. SSPC-SP 3 - Power Tool Cleaning.

D. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.

E. SSPC-SP 11 - Power Tool Cleaning to bare metal.

F. SSPC-SP 13/NACE 6 Surface Preparation of Concrete

G. ICRI – Concrete Surface Preparation Standards

1.3 PREINSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum two week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures

B. Product Data: Submit manufacturer's product data for each coating, including generic description, complete technical data, surface preparation and application instructions.

C. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

D. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

E. Applicator’s Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:

1. Project name and location.

2. Name of owner.

3. Name of contractor.

4. Name of architect.

5. Name of coating manufacturer.

6. Approximate area of coatings applied.

7. Date of completion.

F. Warranty: Submit manufacturer’s standard warranty.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Submit maintenance and cleaning requirements for coatings, repair and patching techniques.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials:

1. Furnish 1 gal. of each color specified, for Owner's maintenance use.
2. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Container Labeling: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Inspection:

1. Accept materials on Site in manufacturer's sealed and labeled containers.
2. Inspect for damage and to verify acceptability.

D. Store materials in ventilated area and otherwise according to manufacturer instructions.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.8 AMBIENT CONDITIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Minimum Conditions: Do not install materials when temperature is below 55 degrees F or above 90 degrees F

C. Subsequent Conditions: Maintain above temperature range, 24 hours before, during, and 72 hours after installation of coating.

D. Provide lighting level of 80 fc measured mid-height at substrate surface.

E. Restrict traffic from area where coating is being applied or is curing.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Sherwin Williams High Performance Flooring, Phone (866) 540-6180; Email: coatings@sherwin.com; website: https://industrial .sherwin-williams.com/na/us/en/resin-flooring.html. Contact: Mike Fortman, (734) 890-2109, mike.fortman@sherwin.com

B. PPG High Performance Coatings, 23361 Telegraph Road, Southfield, MI 48034 Contact: Robert Zaleski, Phone: (734) 564-3105. Web Site: www.ppghpc.com

C. Tnemec Company Incorporated, 6800 Corporate Drive, Kansas City, Missouri 64120-1372. Toll Free (800) 863-6321. Phone (816) 483-3400. Fax (816) 483-3969. Web Site www.tnemec.com. Contact: Trent McNutt, cell (419)346-8795 office (614) 850-8160

2.2 COATING SYSTEMS FOR CONCRETE FLOORS (DECORATIVE CHIP)

A. Manufacturers:
   1. Basis of Design: Torginol
      a. Colors to be determined by owner and architect.
   2. Substitutions: Section 016000 - Product Requirements .
   3. Chemical Exposure, Physical Abuse:
      a. System Type: Modified polyamine epoxy.
      b. Surface Preparation: SSPC-SP 13/ICRI-CSP 3-5.

B. Sherwin Williams
   1. Prime Coat: Resuprime 3579 at 250-300 sq. ft. per gallon.
   2. Body Coat: Resuflor 3746 at 133-160 sq. ft. per gallon.
   3. Broadcast: Decorative Flakes 6750 or 6755 to excess at 100-200 lbs. per 1,000 sq. ft.
   4. Two Seal Coat: Accelera 4850 at 500-535 sq. ft. per gallon.

C. PPG
1. Prime Coat: MegaSeal HSPC 99-12700 at 8.0 to 10.0 mils
2. Intermediate Coat: MegaSeal SL 99-12600 15.0 to 20.0 mils DFT with complete broadcast to refusal of MegaSeal FLK decorative flake.
3. Finish Coat: MegaSeal SL 99-12600 10.0 to 20.0 mils DFT.

D. Tnemec
1. Surface Preparation: SSPC-SP 13/ICRI-CSP 3-5.
2. Prime Coat: Tnemec Series 237 Power-Tread at 8.0 to 10.0 mils DFT with complete broadcast to refusal of Tnemec Series 224C decorative flake.
3. Intermediate Coat: Tnemec Series 284 deco-clear at 10.0 to 20.0 mils DFT.
4. Finish Coat: Tnemec Series 248 Everthane at 2.0 to 3.0 mils DFT.

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2.3 COATING SYSTEMS FOR EXTERIOR STEEL - MODERATE EXPOSURE

A. Sherwin Williams Atmospheric, Chemical, or UV Exposure, Physical Abuse:
1. System Type: Epoxy/urethane.
2. Surface Preparation: Abrasive blast and/or chemically clean.
3. Shop or Field Primer: Macropoxy 646 FC Epoxy Coating DFT 4.0 to 7.0 mils.
4. Field Intermediate Coat: Macropoxy 646 FC Epoxy coatings DFT 4.0 to 7.0 mils.
5. Field Finish Coat: Hi Solids 250 Urethane. DFT 3.0 to 5.0 mils.
6. Total DFT: 11.0 to 19.0 mils.
7. Finish Color: As selected by Architect from manufacturer’s standard colors.

B. PPG Atmospheric, Chemical, or UV Exposure, Physical Abuse:
1. System Type: Epoxy/urethane.
2. Surface Preparation: Abrasive blast and/or chemically clean.
3. Shop or Field Primer: Series 97-946 PITT-GUARD® All Weather Direct-To-Rust Epoxy Coatings. DFT 4.0 to 7.0 mils.
4. Field Intermediate Coat: Series 97-946 PITT-GUARD® All Weather Direct-To-Rust Epoxy Coatings. DFT 4.0 to 7.0 mils.
5. Field Finish Coat: Series 95-3300 DURETHANE® DTM Urethane Mastic. DFT 3.0 to 5.0 mils.
6. Total DFT: 11.0 to 19.0 mils.
7. Finish Color: As selected by Architect from manufacturer’s standard colors.

C. Tnemec Atmospheric, Chemical, or UV Exposure, Physical Abuse:
1. System Type: Epoxy/urethane.
2. Surface Preparation: SSPC-SP 6/NACE 3.
3. Shop or Field Primer: Series N69 Hi-Build Epoxoline II. DFT 4.0 to 6.0 mils.
4. Field Intermediate Coat: Series N69 Hi-Build Epoxoline II. DFT 2.0 to 3.0 mils.
5. Field Finish Coat: Series 1075 Endura-Shield. DFT 2.0 to 3.0 mils.
6. Total DFT: 8.0 to 12.0 mils.
7. Finish Color: As selected by Architect from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application examination.

B. Substrates:

1. Verify that substrate surfaces are ready to receive Work of this Section as indicated by coating manufacturer.
2. Obtain and follow manufacturer instructions for examination and testing of substrates.
3. Repair cracks and spalling prior to finishing floor.
4. Cementitious Substrates: Do not begin application until substrate has cured minimum 28 days and measured moisture content is not greater than 16 percent.

C. Masonry: Verify that masonry joints are struck flush.

3.2 PREPARATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for application preparation.

B. Clean surfaces of loose foreign matter.

C. Remove all surface contamination such as grease and oil from substrate.

D. Remove substances that would bleed through finished coatings; if removal is not possible, seal surface with shellac.

E. Remove finish hardware, fixture covers, and accessories and store.

F. Existing Painted and Sealed Surfaces:

1. Strip existing paint and coatings from surface.

G. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent.

H. Ferrous Metal:

1. Solvent clean.
2. Remove loose rust, loose mill scale, and other foreign substances.
3. Hand Tools: Comply with SSPC-SP 2.
4. Power Tools: Comply with SSPC-SP 3.
5. Blasting: Comply with SSPC-SP [6] [7].

3.3 APPLICATION

A. Comply with MPI - Architectural Painting Manual.

B. Apply primer to each surface, unless specifically not required by coating manufacturer.

C. Wood: Prior to priming patch with filler to produce smooth, even surface.

D. Concrete:

1. Repair cracks and concrete spalls with manufacturer's recommended repair materials as required to produce smooth surface.

E. Apply coatings to specified thicknesses.

F. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish.

1. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.4 FIELD QUALITY CONTROL

A. Inspector's Services:

1. Verify coatings and other materials are as specified.

2. Verify surface preparation and application are as specified.

3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.

4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

a. Check for holidays on interior steel immersion surfaces using holiday detector.

B. Report:

1. Submit written reports describing inspections made and actions taken to correct nonconforming work.

2. Report nonconforming work not corrected.

3. Submit copies of report to Architect, Owner's Representative and Construction Manager.

C. Manufacturer's Field Services: Manufacturer's representative shall provide technical assistance and guidance for surface preparation and application of coating systems.

3.5 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for cleaning.

B. Collect waste material that may constitute fire hazard, place in closed metal containers, and remove daily from Site.

C. Clean surfaces immediately of overspray, splatter, and excess material.

D. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 PROTECTION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces and materials not receiving coating from overspray.

C. Mask when necessary to provide adequate protection and repair damage.

3.7 ATTACHMENTS

A. Colors: Architect to select from manufactures full range of stand flake colors.

B. Concrete Floors in Apparatus Bay: Clear epoxy floor coating, non-skid finish.

C. Exterior Steel at Apparatus Bay Door Jambs.

END OF SECTION 09 96 00

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SECTION 31 14 00 - EARTH STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.01 SUMMARY

A. Provide facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings. Work performed under this section includes but is not necessarily limited to:
   1. The removal, hauling, and stockpiling of suitable excavated materials for subsequent use in the work. Stockpiling shall include protection to maintain materials in a workable condition.
   2. Rehandling, hauling, and placing of stockpiled materials for use in refilling, filling, backfilling, grading, and such other operations.
   3. Protect and preserve all existing buildings, pavements, and utilities to remain.
   4. Environmental controls.
   5. Obtain all required permits, licenses, and approvals of appropriate municipal and utility authorities, prior to commencing the work of this Section, and pay costs incurred.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item, refer to Section 01 22 00 – Unit Prices – Measurement and Payment.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. MDOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.
   2. St. Clair County Road Commission (SCCRC) Requirements.
   3. The City of Port Huron Requirements.
   4. Office of St. Clair County Public Services Requirements.

1.04 DEFINITIONS

A. Terms:
   1. Driving Surface: A pavement, curb, or sidewalk.
   2. Excavation:

a. Removing the following materials from their present location:
   1) Native below-grade material such as soil, boulders less than 1/2 cubic yard in volume, and buried trees.
   2) Man-made items such as, but not necessarily limited to:
      a) Bituminous and concrete paving.
      b) Curbs.
      c) Riprap.
      d) Head walls.
      e) Underground utilities.
      f) Manholes and catch basins.
      g) Foundations.
      h) Sidewalks.

3. Imported Material: Soil material which is purchased by CONTRACTOR and hauled onto the Site.
4. Native Material: Soil and other natural earth materials, except rock and boulders of 1/2 cubic yard or more in volume, which are existing on the Site prior to the start of Work.
5. Suitable Material:
   a. Native material excavated from the trench and approved as backfill by ENGINEER.
   b. Not used under or within 1 on 1 slope of driving surfaces or structures.
   c. Placed between the top of the bedding or trench backfill as indicated on the Drawings and the bottom of the surface restoration.
6. Other Definitions: Other earthwork terms not defined herein or in the Contract Documents shall be as defined in MDOT Standard Specifications for Construction.

1.05 QUALITY ASSURANCE

A. Material tests and inspection may be made by the ENGINEER or his authorized representative in accordance with Section 01 40 00 “Quality Requirements.”

1.06 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near off-site borrow areas if such dust is caused by CONTRACTOR's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
   3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every afternoon, or more as necessary if directed by ENGINEER. Utilize vacuum if dust from brooming is excessive in opinion of ENGINEER.

B. Existing Structures, Utility Structures, and Utilities:
   1. Call MISS DIG to locate existing underground utilities prior to starting excavation.
   2. Where utilities, utility structures or structures are encountered which are in active use:
      a. Provide adequate protection.
      b. Be responsible for their damage.
   3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
   4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours' notice to the affected occupants of the time and duration of the anticipated shutoff.
   5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
   6. Raise, lower, or move underground utilities, utility structures or structures which interfere with the utility or utility structure being constructed as part of this Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil shall meet the requirements of Section 31 22 00 "Grading."

B. Erosion and sedimentation control for stockpiles shall meet the requirements of Section 31 25 00 "Erosion and Sedimentation Control."

PART 3 - EXECUTION

3.01 STRIPPING

A. Strip all sod, topsoil, subsoil, and other unsuitable soil to its full depth within the Contract limits as shown on the Drawings.

B. Removal of Sod: Cut to a straight line at the expected excavation limits with sod cutter.

C. Under pavement areas, unsuitable materials shall be removed and disposed of by the CONTRACTOR in an approved location, or if no approved location exists on site, to an approved off-site location and replaced with structural fill.

D. Existing onsite material shall be processed to remove all roots, rocks larger than ¾ inch in diameter, and other deleterious materials.

E. Protect the topsoil from contamination by other materials.

3.02 STOCKPILE

A. After screening, stockpile the topsoil and subsoil material separately. The material shall be stored in locations, and in a manner, approved by the ENGINEER.

B. No soil stockpile shall exceed fifteen (15) feet in height.

C. All stockpiles shall be protected from sediment transport by surface roughening, watering, and perimeter silt fencing.

D. Any topsoil stockpile remaining longer than 30 days shall be seeded to form a temporary cover.

E. Upon completion of Project or as approved by ENGINEER, remove surplus subsoil and topsoil from the site. Grade stockpile area as necessary for planting and seeding.

END OF SECTION 31 14 00

SECTION 31 22 00 - GRADING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers grading for roadways, driveways, sidewalks, and curbs. This section includes the furnishing and installation of the major items listed below:
   1. Excavation in earth and rock.
   2. Cutting and filling to balance the work area.
   3. Rough and finish grading.
   4. Disposal of items from clearing and unsuitable or excess excavated materials.
   5. Topsoil.
   6. Excess water control.
   7. Pavement subgrade preparation.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Pavt, Rem:
      a. Basis of Measurement: Square yard (SY).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including sawcutting, full depth removal, and disposal of existing bituminous, concrete, composite pavement materials, and aggregate base and subbase materials.
   2. Gravel, Rem:
      a. Basis of Measurement: Square yard (SY).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including removal of gravel surface from the project site at depths and profiles indicated on the Drawings, and disposing of gravel material in the appropriate manner.
   3. Curb and Gutter, Rem:
      a. Basis of Measurement: Linear foot (Ft).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including sawcutting, removal, and disposal of existing concrete curbs, integral curb and gutter, and gutter pans. Also includes removal and disposal of base materials.
   4. Sewer, Rem, Less than 24 inch & Dr Structure, Rem:

a. Basis of Measurement: Sewer, Rem: Linear foot (Ft).
b. Basis of Measurement: Dr Structure, Rem: Each (Ea).
c. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including sawcutting, removal, and disposal of existing concrete curbs, integral curb and gutter, and gutter pans. Also includes removal and disposal of base materials.

5. Undercut:
   a. Basis of Measurement: By cubic yard (CY).
   b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including excavating, hauling, and disposing of the undercut excavated material including the cost of obtaining disposal areas and placing and grading the excavated material on the disposal area.
6. Landscape, Rem:
   a. Basis of Measurement: Lump Sum (LS)
   b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including excavating, hauling, and disposing of all topsoil, mulch, rocks, plant material, and any other material within the landscape removal limits.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AOAC - Association of Official Agricultural Chemists: Methods of Testing.
   2. ASTM Standards:
      a. D422 - Method for Particle-Size Analysis of Soils.
      b. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort.
      c. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
      d. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      e. D2487 - Classification of Soils for Engineering Purposes.
      f. D6938 - In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.
   3. MDOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.
   4. St. Clair County Road Commission (SCCRC) Requirements..
   5. The City of Port Huron Requirements.
   6. St. Clair County Public Services Office Requirements.

1.04 DEFINITIONS

A. Terms:
1. Driving Surface: A pavement, curb, or sidewalk.
2. Excavation:
   a. Removing the following materials from their present location:
      1) Native below-grade material such as soil, boulders less than 1/2 cubic yard in volume, and buried trees.
      2) Man-made items such as, but not necessarily limited to:
         a) Bituminous and concrete paving.
         b) Curbs.
         c) Riprap.
         d) Head walls.
         e) Underground utilities.
         f) Manholes and catch basins.
         g) Foundations.
         h) Sidewalks.
3. Fill: Soil, native material, imported material or other material which is placed over the subgrade, or excavated areas; under roadways, parking areas, walks, buildings, or structures; and anywhere else on the Site.
4. Grading: The act of moving soil from one location on the Site to another to achieve the contours and elevations as indicated on the Drawings and as herein specified.
5. Hardpan:
   a. Cemented soil layers.
   b. Is not hard clay layers that are not cemented.
6. Imported Material: Soil material which is purchased by CONTRACTOR and hauled onto the Site.
7. Native Material: Soil and other natural earth materials, except rock and boulders of 1/2 cubic yard or more in volume, which are existing on the Site prior to the start of Work.
8. Pavement: Any combination of subbase, base course and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, sidewalks, and bituminous seal coat.
9. Rock: igneous, metamorphic, or sedimentary rock; hardpan; or other solid material which does not soften when wet; or cannot be excavated without continuous drilling, sawing, blasting, or continuous use of a ripper or other special equipment. This includes all boulders of one-half (1/2) cubic yard or more in volume.
10. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.
11. Subbase: The layer of material placed on the subgrade as part of the pavement structure.
12. Subgrade:
    a. Below structures and below fill on the Site: The top elevation of the undisturbed native material after all topsoil is stripped off and excavation is completed.

b. Below driving surfaces: The bottom elevation of the subbase.

13. Surface Improvement: All improvements beyond what might be encountered in an open unimproved field.
14. Undercut: Excavation of native material from below the bottom of footings, floors, structures, and subbases.
15. Utility Structure: Manhole, catch basin, pump station, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
16. Other Definitions: Other earthwork terms not defined herein or in the Contract Documents shall be as defined in MDOT Standard Specifications for Construction.

1.05 QUALITY ASSURANCE

A. Testing will be performed in accordance with Section 01 40 00 "Quality Requirements."

B. Compaction:
1. Predominately Granular Soils:
a. Density shall be determined by using the modified Proctor method, ASTM D1557.
b. Compact fill to at least 95% maximum density.
c. The first 12 inches of subgrade below all driving surfaces, structures, utility structures, and fill on the Site:
1) Shall be tested for density.
2) Compact to at least 95% maximum density if the existing density is below 95%.
2. Predominately Cohesive Soils:
a. Density shall be determined by using the standard Proctor method, ASTM D698.
b. Compact fill to at least 95% maximum density.
c. The first 12 inches of subgrade below all driving surfaces, structures, utility structures, and fill on the Site:
1) Shall be tested for density.
2) Compact to at least 95% maximum density if the existing density is below 95%.

1.06 SUBMITTALS

A. Action Submittals: For imported materials:
1. Source.
2. MDOT classification.
3. Sieve Analysis.

1.07 PROJECT CONDITIONS

A. Dust Control:
1. Use all legal means necessary to control dust on and near the Work and on and near all off-site borrow areas if such dust is caused by CONTRACTOR's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
2. Treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every afternoon, or more often as necessary if directed by ENGINEER. Utilize vacuum if dust from brooming is excessive in opinion of ENGINEER.

B. Existing Structures, Utility Structures, and Utilities:
1. Call MISS DIG to locate all existing underground utilities prior to starting excavation.
2. Where utilities, utility structures, or structures are encountered which are in active use:
a. Provide adequate protection.
b. Be responsible for repairing any damages to them.
3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours' notice to the affected occupants of the time and duration of the anticipated shut off.
5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
6. Raise, lower, or move underground utilities, utility structures, or structures which interfere with the utility, utility structure, or structure being constructed as part of this Work.

C. Special Filling Requirements:
1. Comply with the regulations of the MDOT, SCCRC, St. Clair County Public Services Office, and railroad company engineering departments with regard to placing fill and compaction in their respective rights-of-way.
2. Obtain necessary permits for filling activities off Site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
1. Approval Required: All material shall be subject to the approval of the ENGINEER.

2. Notification: For approval of imported material, notify ENGINEER at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit ENGINEER or his authorized representative to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
   1. Imported Material:
      a. Fill in undercut.
      b. Fill below structures, utility structures, or driving surfaces.
      c. Stone stabilization course.
      d. Fill for special soil construction such as earth berms, earth ponds, soil liners.
   2. Native material, unless quantity is not sufficient; then shall be imported material.
      a. Fill not below structures, utility structures, or driving surfaces.
      b. Topsoil.

C. Fill In Undercut: MDOT 902, Granular Material Class II or MDOT 902 Dense Graded Aggregate 21AA Limestone.

D. Fill below structures, utility structures, or driving surfaces: MDOT 902, Granular Material Class II.

E. Stone Stabilization Course:
   1. Crushed Stone: 1-1/2 inches maximum size.
   2. Filter Fabric:
      a. By Mirafi; Amoco; Exxon; Nicolon; or equal.
      b. Monofilament polypropylene woven fabric.
      c. Equivalent opening size of 70.

F. Fill Not Below Structures, Utility Structures, or Driving Surfaces:
   1. Native material.
   2. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
   3. Containing no rocks or lumps over 3 inches in greatest dimension.
   4. Obtain approval for using native material as fill from ENGINEER.

G. Topsoil:
   1. Fertile, friable soil, containing a minimum of 2.5% and maximum 12% of organic matter as determined by the Loss on Ignition Test, AOAC, with not more than 50% clay and not more than 55% sand as determined in accordance with ASTM D422.
   2. At least 90% of the material shall pass the No. 10 sieve and shall be free of refuse or all material toxic to plant growth, free of subsoil and stumps, roots, brush, stones or similar objects larger than 1-inch diameter.

3. Ordinary sods and herbaceous growth, like grass, need not be removed, but shall be thoroughly broken up and intermixed with soil during handling operations.
4. Topsoil, unless otherwise specified or approved, shall have, according to Methods of Testing by the AOAC, acidity range of approximately 5.5 pH to 7.6 pH or as approved by ENGINEER prior to delivery.

H. Fill for Special Soil Construction, Such as Earth Berms, Earth Ponds, Soil Liners, Etc:
1. Clay with a unified soil classification of ML, CL or CH in accordance with ASTM D2487.
2. Compacted to permeability of 1 x 10-7 cm/sec.

2.02 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by CONTRACTOR subject to the approval of ENGINEER.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Topsoil:
1. Remove all topsoil to depth at which subsoil is encountered, from all areas under buildings, driving surfaces, and from all areas which are to be cut to lower grades or filled.
2. With ENGINEER's approval, topsoil to be used for finish grading may be stored on the Site.
3. Other topsoil may be used for fill in noncritical areas with approval of ENGINEER.

B. Obstructions:
1. Remove and dispose of buried trees, boulders less than 1/2 cubic yard in volume, driving surfaces, pipes and the like, as required for the performance of the Work.
2. Exercise care in excavating around catch basins, inlets, and manholes.
3. Avoid removing or loosening castings or pushing dirt into utility structures.
4. Repair or replace damaged or displaced castings; remove dirt entering utility structures during the performance of the Work at no additional cost to OWNER.

C. Cutting Paved Surfaces and Similar Improvements:

1. All cuts shall be a minimum of 1-foot wider than trench on each side. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
2. Before removing pavement, mark the pavement removal area. The pavement removal shall always be perpendicular and/or parallel to the existing pavement joints.
3. Concrete:
   a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
   b. Sidewalks: Remove to joints.
   c. Curb and gutter: Remove to joints.
4. Final surface Course Bituminous: Saw cut joints unless otherwise approved by ENGINEER.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
6. CONTRACTOR may tunnel under curbs that are encountered. Replace curb disturbed by construction.
7. Dispose of materials removed.

D. Utilities To Be Abandoned:
1. When pipes, conduits, sewers, or other utilities or utility structures are removed from the excavation leaving dead ends in the ground, fully plug such ends with brick and mortar.
2. Entirely remove and dispose of abandoned utility structures not identified to be salvaged, unless otherwise specified or indicated on the Drawings.
3. Remove from the excavation all materials which can be readily salvaged and store at a location designated by OWNER.
4. All salvageable materials will remain the property of OWNER unless otherwise indicated by OWNER.

E. Undercut:
1. If soft material, which in the opinion of ENGINEER is not suitable, is encountered below a structure, utility structure, or driving surface, ENGINEER may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the structure, utility structure, or driving surface.
2. All undercutting made at the order of ENGINEER will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
3. No extra payment will be made if removal is required as a result of poor dewatering techniques.
4. Undercutting which is specifically indicated on the Drawings or herein specified, shall be included in the base Bid.
5. Soil removed may be used as fill in areas not below driving surfaces, structures, or utility structures.
6. Compact subgrade at bottom of undercut prior to placing fill.

7. Place and compact specified fill in undercut.
8. Lateral extent of undercut shall be a horizontal distance equal to the depth of undercut below structure, utility structure, or driving surface.

F. Excavating:
1. All excavation shall be by open cut from the surface except as herein specified or as indicated on the Drawings.
2. If required because of excess water conditions, place stone stabilization course prior to proceeding with construction. Place filter fabric over stone stabilization course.

G. Rock Removal:
1. Where rock is encountered within the excavation, expose the surface of the rock sufficient to permit adequate measurements to be taken before the rock excavation is started.
2. Notify ENGINEER prior to removal if rock is encountered.
3. Blasting will not be allowed.
4. Rock removal shall be paid under separate Change Order unless a specific item appears in the Bid.

3.02 FILL

A. General:
1. Do not place fill until the subgrade has been examined by ENGINEER.
2. Place fill in even layers not exceeding 6 inches in depth and thoroughly compact as herein specified.
3. Do not place additional fill until compaction on a lift complies with specification requirements.
4. If an analysis of the soil being placed shows a marked difference from 1 location to another, the fill being placed shall not be made up of a mixture of these materials.
5. Handle each different type of material continuously so that field control of moisture and density may be based upon a known type of material.
6. Do not place fill following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
7. Do not place fill on frozen subgrade.

B. Compaction:
1. Select compaction equipment to achieve the required compaction without damaging adjacent structures, utility structures, or driving surfaces.
2. Suggested Equipment Selections:
   a. If soil is predominantly granular, use pneumatic tired or vibratory drum rollers loaded to not less than 325 pounds in accordance with rated inch of tire width.
   b. For clay fills, compact each layer with sheepsfoot rollers. Rollers shall have staggered rows of feet projecting not less than 7 inches

from drum and shall be loaded to produce at least 200 pounds per square inch of tamping area in contact with the ground.

c. Compact around structures and utility structures with hand operated vibrating compactors for granular soils and Barco rammer type compactors for clay soils.

C. Moisture:
1. Compact all fill with the moisture content as specified.
2. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
3. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.03 GRADING

A. General:
1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of ± 0.10 feet.
3. Perform finish grading to an accuracy of ± 0.05 feet.
4. Comply with all excavating and fill requirements specified herein during grading operations.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other Site features.

C. Treatment After Completion of Grading:
1. After grading is completed, permit no further excavation, filling, or grading, except with the approval of ENGINEER.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. Topsoil: All graded areas, outside of buildings and driving surfaces, shall receive 4 inches of topsoil.

3.04 EXCESS WATER CONTROL

A. Regulations and Permits: Comply with soil erosion control permits in accordance with Mich. P.A. 451, Part 91 of 1994, the Natural Resource and Environmental Protection Act, and all pertinent rules, laws, and regulations.

B. Unfavorable Weather:
1. Do not place, spread, or roll any fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to ENGINEER.

C. Pumping and Drainage:
   1. Provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.
   2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil. Use wells, portable pumps, temporary underdrains or other methods as is necessary.
   3. Perform Pumping and Drainage:
      a. In such a manner to cause no damage to property or structures and without interference to the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other CONTRACTORS.
      b. In accordance with all pertinent laws, rules, ordinances and regulations.
   4. Do not overload or obstruct existing drainage facilities.
   5. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

3.05 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General:
   1. Remove and properly dispose of all excavated material not needed to complete filling and grading.
   2. Dispose of excess excavated material at a location off the Site.
   3. Dispose of excess topsoil at a location off the Site.
   4. Disposal of all materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
   5. Provide adequate controls to maintain disposal sites in a neat and safe condition by periodic leveling of material and such other practices as are necessary.
   6. Provide all soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low lying areas.

3.06 CLEANUP

A. Upon completion of the work of this Section, remove all excess excavated material, trash, and debris resulting from construction operations. Remove equipment and tools. Leave the Site in a neat and orderly condition acceptable to ENGINEER, and in accordance with Section 01 70 00 “Execution and Closeout Requirements.”

END OF SECTION 31 22 00

SECTION 31 23 03 – EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers excavation and backfill for the installation of water, storm, sanitary, and other utility systems including pipes and utility structures. This section includes the furnishing and installation of the major items listed below:
   1. Excavation and trenching in earth and in rock.
   2. Disposal of items from clearing and unsuitable or excess excavated materials.
   3. Complete drainage of excavations.
   4. Temporary or permanent sheeting, bracing and shoring of excavations.
   5. Installation of normal and special foundations, bedding and backfill materials.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Undercut:
      a. Basis of Measurement: By cubic yard (CY).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including excavating, hauling, and disposing of the undercut excavated material including the cost of obtaining disposal areas and placing and grading the excavated material on the disposal area.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard Specifications:
      a. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort
      b. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
      c. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      d. D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

e. D6938 - In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.

2. MDOT Current Standards:
   a. Specifications for Construction.
   b. Standard Plans.
3. St. Clair County Road Commission (SCCRC) Requirements.
4. The City of Port Huron Requirements.
5. St. Clair County Public Services Office Requirements.

1.04 DEFINITIONS

A. Terms:
1. Driving Surface: A pavement, curb, or sidewalk.
2. Excavation:
   a. Removing the following materials from their present location:
      1) Native below-grade material such as soil, boulders less than 1/2 cubic yard in volume, and buried trees.
      2) Man-made items such as, but not necessarily limited to:
         a) Bituminous and concrete paving.
         b) Curbs.
         c) Riprap.
         d) Head walls.
         e) Underground utilities.
         f) Manholes and catch basins.
         g) Foundations.
         h) Sidewalks.
3. Fill: Soil, native material, imported material or other material which is placed over the subgrade, or excavated trench areas; under roadways, parking areas, walks, buildings, or structures; and anywhere else on the Site.
4. Grading: The act of moving soil from one location on the Site to another to achieve the contours and elevations as indicated on the Drawings and as herein specified.
5. Hardpan:
   a. Cemented soil layers.
   b. Is not hard clay layers that are not cemented.
6. Imported Material: Soil material which is purchased by CONTRACTOR and hauled onto the Site.
7. Native Material: Soil and other natural earth materials, except rock and boulders of 1/2 cubic yard or more in volume, which are existing on the Site prior to the start of Work.
8. Pavement: Any combination of subbase, base course and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, sidewalks, and bituminous seal coat.
9. Rock: igneous, metamorphic, or sedimentary rock; hardpan; or other solid material which does not soften when wet; or cannot be excavated without

continuous drilling, sawing, blasting, or continuous use of a ripper or other special equipment. This includes all boulders of one-half (1/2) cubic yard or more in volume.

10. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.
11. Subbase: The layer of material placed on the subgrade as part of the pavement structure.
12. Subgrade:
    a. Below structures and below fill on the Site: The top elevation of the undisturbed native material after all topsoil is stripped off and excavation is completed.
    b. Below driving surfaces: The bottom elevation of the subbase.
13. Bedding: The material placed around a utility between 4 inches below to 12 inches above the utility the full width of the trench.
14. Normal Trench Bottom: The surface of the undisturbed native material at an elevation 4 inches below the bottom of the utility.
15. Special Foundations:
    a. Specially constructed systems for support of underground utilities such as timber piling, concrete foundations and surcharge techniques.
    b. Undercutting and placing imported or native materials are not special foundations.
16. Suitable Material:
    a. Native material excavated from the trench and approved as backfill by ENGINEER.
    b. Not used under or within 1 on 1 slope of driving surfaces or structures.
    c. Placed between the top of the bedding or trench backfill as indicated on the Drawings and the bottom of the surface restoration.
17. Trench Backfill:
    a. The material placed between the top of bedding and either the bottom of suitable material or the bottom of pavement/surface restoration, as indicated on the Drawings.
    b. Used under and within 1 on 1 slope of driving surfaces or structures.
18. Undercut: Excavation of native material from below the normal trench bottom.
19. Utility Structure: Manhole, catch basin, pump station, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
20. Other Definitions: Other earthwork terms not defined herein or in the Contract Documents shall be as defined in MDOT Standard Specifications for Construction.

1.05 DESIGN AND PERFORMANCE REQUIREMENTS

A. Trench Bottom Suitability:

1. Be responsible for the suitability of the normal trench bottom in supporting the utility, bedding and backfill.
2. Notify ENGINEER and await ENGINEER's decision if a possible unsuitable condition exists.
3. Poor dewatering techniques or lack of excess water control shall not be a reason for additional payment for remedial measures.

B. Trench Wall Stability:
1. Be responsible for the trench configuration, including sheeting, shoring and bracing necessary to support trench side walls from collapsing.
2. Be responsible for the structural design and stability of a pipe-laying box if utilized on the Project to prevent trench walls from collapsing.

1.06 QUALITY ASSURANCE

A. Testing will be performed in accordance with Section 01 40 00 "Quality Requirements."

B. Compaction:
1. Predominately Granular Soils:
a. Determine density by the modified Proctor method, ASTM D1557.
b. Compact trench backfill and bedding to at least 95% maximum density.
c. Compact suitable material to at least 95% maximum density.
d. The first 12 inches of native material at the bottom of utility trenches:
1) Test for density.
2) Compact to at least 95% maximum density if the existing density is below 95%.
2. Predominately Cohesive Soils:
a. Density shall be determined by using the standard Proctor method, ASTM D698.
b. Compact fill to at least 95% maximum density.
c. The first 12 inches of native material at the bottom of utility trenches:
1) Test for density.
2) Compact to at least 95% maximum density if the existing density is below 95%.

1.07 SUBMITTALS

A. Action Submittals: For imported materials:
1. Source.
2. MDOT classification.
3. Sieve Analysis.

1.08 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near off-site borrow areas if such dust is caused by CONTRACTOR's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
   3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every afternoon, or more as necessary if directed by ENGINEER. Utilize vacuum if dust from brooming is excessive in opinion of ENGINEER.

B. Existing Structures, Utility Structures, and Utilities:
   1. Call MISS DIG to locate existing underground utilities prior to starting excavation.
   2. Where utilities, utility structures or structures are encountered which are in active use:
      a. Provide adequate protection.
      b. Be responsible for repairing any damages to them.
   3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
   4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours' notice to the affected occupants of the time and duration of the anticipated shutoff.
   5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
   6. Raise, lower, or move underground utilities, utility structures or structures which interfere with the utility or utility structure being constructed as part of this Work.

C. Special Backfilling Requirements:
   1. Comply with the regulations of the MDOT, SCCRC, St. Clair County Public Services Office, and railroad company engineering departments with regard to filling, backfilling and compaction in their respective rights-of-way.
   2. Obtain all necessary permits for filling off Site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. Approval Required: Material shall be subject to the approval of ENGINEER.
   2. Notification: For approval of imported material, notify ENGINEER at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit ENGINEER or his authorized representative to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
   1. Imported Material:
      a. Fill in undercut.
      b. Bedding.
      c. Trench backfill.
   2. Native material unless quantity is not sufficient; then shall be imported material: Suitable material.

C. Fill in Undercut: MDOT 902 Dense Graded Aggregate 21AA Limestone.

D. Bedding:
   1. For Pipes :
      a. MDOT 902 Granular Material Class II, or
      b. MDOT 902 Dense Graded Aggregate 21AA Limestone.
   2. For Utility Structures:
      a. MDOT 902 Dense Graded Aggregate 21AA Limestone.

E. Trench Backfill: MDOT 902 Granular Material Class II below pavement cross section or up to one on one influence zone from edge of pavement followed by suitable excavated material to the surface.

F. Suitable Material:
   1. Native Material Which is Used as Backfill:
      a. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
      b. Containing no rocks or lumps over 3 inches in greatest dimension.
      c. Having a moisture content such that material is capable of being compacted to 95% maximum density.
   2. MDOT 902 Granular Material Class II if native material is not adequate in opinion of ENGINEER.

G. Concrete Encasement of Utilities:
   1. Only as indicated on the Drawings.

2.02 OTHER MATERIALS

A. Other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by CONTRACTOR subject to the approval of ENGINEER.

PART 3 - EXECUTION

3.01 GENERAL

A. Excavating, Backfilling and Compacting:
   1. For Structures: In accordance with Section 31 23 06 "Excavation and Fill for Structures."
   2. For Utility Structures: In accordance with this Section.

B. Obstructions:
   1. Remove and dispose of buried trees, boulders less than 1/2 cubic yard in volume, driving surfaces, pipes and the like, as required for the performance of the Work.
   2. Exercise care in excavating around catch basins, inlets and manholes.
   3. Avoid removing or loosening castings or pushing dirt into utility structures.
   4. Repair or replace damaged or displaced castings; remove dirt entering utility structures during the performance of the Work at no additional cost to OWNER.

C. Cutting Paved Surfaces and Similar Improvements:
   1. Cut pavement prior to excavating.
   2. All cuts shall be a minimum of 1-foot wider than trench on each side. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
   3. Before removing pavement, mark the pavement removal area. The pavement removal shall always be perpendicular to the roadway.
   4. Concrete:
      a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
      b. Sidewalks: Remove to joints.
      c. Curb and Gutter: Remove to joints.
   5. Final Surface Course Bituminous: Saw cut joints unless otherwise approved by ENGINEER.
   6. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
   7. CONTRACTOR may tunnel under curbs that are encountered. Replace curb disturbed by construction.
   8. Dispose of materials removed.

D. Utilities to be Abandoned:
   1. When pipes, conduits, sewers or utility structures are removed from the trench leaving dead ends in the ground, fully plug such ends with brick and mortar.

2. Entirely remove and dispose of abandoned utility structures not identified to be salvaged, unless otherwise specified or indicated on the Drawings.
3. Remove from the excavation all materials which can be readily salvaged and store at a location selected by the OWNER.
4. All salvageable materials will remain the property of OWNER unless otherwise indicated by OWNER.

E. Undercut:
1. If soft material, which in the opinion of ENGINEER is not suitable, is encountered below the normal trench bottom or below a utility structure ENGINEER may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the utility or utility structure.
2. All undercutting made at the order of ENGINEER will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
3. No extra payment will be made if removal is required as a result of poor dewatering techniques.
4. Undercutting which is specifically indicated on the Drawings or herein specified, shall be included in the base Bid.
5. Place and compact specified fill in undercut.
6. Special foundations shall be determined on an individual basis by ENGINEER in cooperation with CONTRACTOR, unless otherwise provided in the Contract Documents.

3.02 EXCAVATION AND TRENCHING

A. General:
1. By open cut from surface unless designated otherwise.
2. Slope sides of trench adequately for protection of the Work and safety of workers.

B. Maximum Length of Open Trench: 100 feet.

C. Width:
1. Minimum Clearance on Each Side of Utility: 6 inches.
2. Maximum Width of Trench at Top of Bedding:
   a. Up Through 15-Inch Diameter Utility: 30 inches.
   b. Greater Than 15-Inch Diameter Utility: 4/3 inside diameter of pipe plus 15 inches.
3. Maximum Width of Trench at Ground Surface:
   a. Not outside of the property line or easement.
   b. As required for protection of the Work and safety of workers.
   c. Use sheeting, bracing and shoring if required.
4. Provide sufficient space in the trench to permit the joint to be properly made.

D. Depth:
   1. Excavate to provide the elevations, grades, and depths of cover indicated on the Drawings and herein specified.
   2. The 4 inches of required bedding material below the utility may be omitted if:
      a. Approved by ENGINEER.
      b. CONTRACTOR arranges and pays for testing of the native material.
      c. The native material complies with MDOT 902 Granular Material Class II material or MDOT 902 Dense Graded Aggregate 21AA Limestone.
      d. The material is compacted as specified herein.
   3. Excavate to the normal trench bottom elevation with an accuracy of ± 0.10 feet.

E. Rock Removal:
   1. Where rock is encountered within the excavation, expose the surface of the rock sufficient to permit adequate measurements to be taken before the rock excavation is started.
   2. Notify ENGINEER prior to removal if rock is encountered.
   3. No utility shall be within 6 inches of rock.
   4. Blasting will not be allowed.
   5. Rock removal shall be paid under separate Change Order unless a specific item appears in the Bid.

F. Bedding:
   1. Place the bedding material up to 1/8 the height of the utility. Compact as herein specified.
   2. Accurately shape the bedding material to fit the pipe shape. Recess the bedding to relieve the pressure on the bell or other projecting utility joint.
   3. After laying out the utility, tamp additional bedding in place up to the midpoint of the utility. Use hand-operated compactors to achieve the required compaction.
   4. Place additional bedding up to 12 inches above the top of the utility. Use hand operated compactors to achieve required compaction.
   5. Place bedding in maximum lifts of 6 inches.
   6. No payment shall be made for aggregate or stone bedding when used for CONTRACTOR convenience.
   7. Provide concrete encasement at utilities so indicated on the Drawings.

G. Trench Backfill in accordance with The City of Port Huron Standard Detail Drawings:
   1. Trench Detail A:
      a. Suitable material placed between the top of the bedding and the bottom of the surface restoration.

b. If trench is within 1 on 1 slope of driving surfaces or structures, place MDOT Class II sand from top of bedding to top of 1 on 1 slope influence zone, followed by suitable material to the bottom of the surface restoration.

2. Trench Detail B:
   a. MDOT Class II sand placed between the top of bedding and the bottom of pavement/surface restoration.
3. Place backfill in 6-inch lifts and compact as herein specified. ENGINEER will consider greater lifts if testing indicates that the required compaction is being achieved.

H. Utility Structures:
1. Place and compact specified bedding below utility structures.
2. Backfill around utility structures shall be in accordance with The City of Port Huron Standard Detail Drawings.
3. Place backfill in 6-inch lifts and compact as herein specified.

3.03 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General: CONTRACTOR responsibility and expense.

B. Disposal Sites:
1. Material desired by OWNER shall be disposed of by CONTRACTOR in the following priority order:
   a. At locations designated by the Contract Documents.
   b. At locations on the Project Site by written arrangement with individual property owners.
   c. OWNER may choose not to accept certain materials, including but not necessarily limited to, items from clearing, muck, peat, marl and whole or broken man-made items removed by construction.
2. Material not desired by OWNER shall be disposed of in a location determined by CONTRACTOR.
3. Disposal of materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
4. Provide adequate controls to maintain disposal sites in a neat and safe condition by periodic leveling of material, and such other practices as are necessary.
5. Provide soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low lying areas.

3.04 EXCESS WATER CONTROL

A. Regulations and Permits: Comply with soil erosion control permit in accordance with Mich. P.A. 451, Part 91 of 1994, the Natural Resource and Environmental Protection Act, and all pertinent rules, laws, and regulations.

B. Unfavorable Weather:
   1. Do not place, spread or roll fill material during unfavorable weather conditions.
   2. Do not resume operations until moisture content and fill density are satisfactory to ENGINEER.

C. Pumping and Drainage:
   1. Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of water from every source entering the excavations or other parts of the Work.
   2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil. Use wells, portable pumps, temporary underdrains, or other methods as necessary.
   3. Perform Pumping and Drainage:
      a. In such a manner to cause no damage to property or structures and without interference to the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other CONTRACTORS.
      b. In accordance with pertinent laws, rules, ordinances, and regulations.
   4. Do not overload or obstruct existing drainage facilities.

D. General:
   1. Keep excavations dry during construction.
   2. Remove water by use of wells, well points, portable pumps, bailing, drains, underdrains or other acceptable methods.
   3. Provide crushed stone or gravel as required to aid dewatering operations.
   4. Divert or temporarily reroute existing sewers and drainage of discharge lines to adequate and acceptable outlets during construction. CONTRACTOR responsible to ascertain availability of outlets.
   5. Divert surface water from entering excavations by construction and maintenance of channels or berms.
   6. Sediment traps and other soil erosion control measures shall prevent soil particles from entering any sewer, watercourse or similar conveyance.
   7. Protect utilities, utility structures, and structures, existing and new, from hydrostatic uplift.

3.05 SHEETING, SHORING AND BRACING EXCAVATIONS

A. General:
   1. Furnish, put in place and maintain sheeting, bracing and shoring as may be required to properly support the sides of excavations and to prevent movement of earth which could in any way injure the Work or adjacent property. Shoring and bracing must be designed by an engineer licensed in the State of Michigan.

2. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the Work and adjacent property.
3. A pipe-laying box may be used in lieu of sheeting.

B. Sheeting:
1. Do not install by jetting.
2. Remove as backfilling proceeds, unless ordered left in place by ENGINEER. Use care to fill and compact voids created by removal, especially below mid-height of utility.
3. Sheeting Left in Place:
a. Requires written approval of ENGINEER.
b. Cut off minimum of 2 feet below finished grade.

3.06 CLEANUP

A. Upon completion of the work of this Section, remove all excess excavated material, trash, and debris resulting from construction operations. Remove equipment and tools. Leave the Site in a neat and orderly condition acceptable to ENGINEER, and in accordance with Section 01 70 00 “Execution and Closeout Requirements.”

END OF SECTION 31 23 03

SECTION 31 23 06 – EXCAVATION AND FILL FOR STRUCTURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section covers excavation and backfill for the construction of buildings, retaining walls, footings, slabs, and other below ground structures. This Section includes the furnishing and installation of the major items listed below:
   1. Excavation in earth and rock.
   2. Disposal of items from clearing and unsuitable or excess excavated materials.
   3. Complete drainage of excavations.
   4. Temporary or permanent sheeting, bracing, and shoring of excavations.
   5. Installation of backfill materials.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Undercut:
      a. Basis of Measurement: By cubic yard (CY).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described including excavating, hauling, and disposing of the undercut excavated material including the cost of obtaining disposal areas and placing and grading the excavated material on the disposal area.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standards:
      a. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort.
      b. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
      c. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      d. D6938 - In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods.
   2. MDOT Current Standards:
      a. Specifications for Construction.

b. Standard Plans.
3. St. Clair County Road Commission (SCCRC) Requirements.
4. The City of Port Huron Requirements.
5. St. Clair County Public Services Office Requirements.

1.04 DEFINITIONS

A. Terms:
1. Driving Surface: A pavement, curb, or sidewalk.
2. Excavation:
a. Removing the following materials from their present location:
1) Native below-grade material such as soil, boulders less than 1/2 cubic yard in volume, and buried trees.
2) Man-made items such as, but not necessarily limited to:
a) Bituminous and concrete paving.
b) Curbs.
c) Riprap.
d) Head walls.
e) Underground utilities.
f) Manholes and catch basins.
g) Foundations.
h) Sidewalks.
3. Fill: Soil, native material, imported material or other material which is placed over the subgrade, or excavated areas; under roadways, parking areas, walks, buildings, or structures; and anywhere else on the Site
4. Grading: The act of moving soil from one location on the Site to another to achieve the contours and elevations as indicated on the Drawings and as herein specified.
5. Hardpan:
a. Cemented soil layers.
b. Is not hard clay layers that are not cemented.
6. Imported Material: Soil material which is purchased by CONTRACTOR and hauled onto the Site.
7. Native Material: Soil and other natural earth materials, except rock and boulders of 1/2 cubic yard or more in volume, which are existing on the Site prior to the start of Work.
8. Pavement: Any combination of subbase, base course and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, sidewalks, and bituminous seal coat.
9. Rock: igneous, metamorphic, or sedimentary rock; hardpan; or other solid material which does not soften when wet; or cannot be excavated without continuous drilling, sawing, blasting, or continuous use of a ripper or other special equipment. This includes all boulders of one-half (1/2) cubic yard or more in volume.
10. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.

11. Structure Backfill: Soil or other material which is placed against walls or sides of structures.
12. Subbase: The layer of material placed on the subgrade as part of the pavement structure.
13. Subgrade:
    a. Below structures and below fill on the Site: The top elevation of the undisturbed native material after all top soil is stripped off and excavation is completed.
    b. Below driving surfaces: The bottom elevation of the subbase.
14. Undercut: Excavation of native material from below the bottom of footings, floors, structures and subbases.
15. Utility Structures: Manhole, catch basin, pump station, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
16. Other Definitions: Other earthwork terms not defined herein or in the Contract Documents shall be as defined in MDOT Standard Specifications for Construction.

1.05 DESIGN AND PERFORMANCE REQUIREMENTS

A. Excavation Side Stability: Be responsible for the structural design of all sheet piling, underpinning, shoring and bracing to prevent sides of excavation from collapsing and causing damage to adjacent structures, pavements, and materials.

1.06 QUALITY ASSURANCE

A. Testing will be performed in accordance with Section 01 40 00 “Quality Requirements.”

B. Compaction:
1. Predominately Granular Soils:
    a. Density shall be determined by using the modified Proctor method, ASTM D1557.
    b. Compact fill and backfill to at least 95% maximum density.
    c. The first 12-inches of subgrade below all structures, fill and backfill on the Site:
        1) Shall be tested for density.
        2) Compact to at least 95% maximum density if the existing density is below 95%.
2. Predominately Cohesive Soils:
    a. Density shall be determined by using the standard Proctor method, ASTM D698.
    b. Compact fill and backfill to at least 95% maximum density.
    c. The first 12-inches of subgrade below all structures, fill, and backfill on the Site:
        1) Shall be tested for density.
        2) Compact to at least 95% maximum density if the existing density is below 95%.

1.07 SUBMITTALS

A. Action Submittals: For imported materials:
   1. Source.
   2. MDOT classification.
   3. Sieve Analysis.

1.08 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near all off-site borrow areas if such dust is caused by CONTRACTOR's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
   3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every afternoon, or more often as necessary if directed by ENGINEER. Utilize vacuum if dust from brooming is excessive in opinion of ENGINEER.

B. Existing Structures, Utility Structures, and Utilities:
   1. Call MISS DIG to locate all existing underground utilities prior to starting excavation.
   2. Where utilities, utility structures, or structures are encountered which are in active use:
      a. Provide adequate protection.
      b. Be responsible for repairing any damage to them.
   3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
   4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours' notice to the affected occupants of the time and duration of the anticipated shutoff.
   5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
   6. Raise, lower, or move underground utilities, utility structures, or structures which interfere with the structure being constructed as part of this Work.

C. Special Backfilling Requirements:
   1. Comply with the regulations of the MDOT, SCCRC, St. Clair County Public Services Office, and railroad company engineering departments with regard to filling, backfilling and compaction in their respective rights-of-way.
   2. Obtain all necessary permits for filling off Site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. Approval Required: Material shall be subject to the approval of ENGINEER.
   2. Notification: For approval of imported material, notify ENGINEER at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit ENGINEER or his authorized representative to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
   1. Imported Material:
      a. Sand layers below floor slabs.
      b. Fill in structure undercut.
      c. Stone stabilization course below structures.
      d. Structure backfill.
   2. Native material unless quantity is not sufficient; then shall be imported material:
      a. Structure backfill not below driving surfaces.
   3. Native Material: Clay cap over structure backfill.

C. Granular Layer Below Floor Slabs:
   1. Choose Either of the Following:
      a. Sand-gravel fill of such gradation that 100% will pass a 1/2-inch sieve and not more than 10% by weight is lost by washing.
      b. MDOT 902, Granular Material Class II.

D. Fill In Structure Undercut: MDOT 902, Granular Material Class II or MDOT 902 Dense Graded Aggregate 21AA Limestone.

E. Structure Backfill Below Driving Surfaces: MDOT 902, Granular Material Class II.

F. Stone Stabilization Course:
   1. Crushed Stone: 1-1/2-inches maximum size.
   2. Filter Fabric:
      a. By Mirafi; Amoco; Exxon; Nicolon; or equal.
      b. Monofilament polypropylene woven fabric.
      c. Equivalent opening size of 70.

G. Structure Backfill Not Below Driving Surfaces:
   1. Native material.
   2. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
   3. Containing no rocks or lumps over 3 inches in greatest dimension.
   4. Obtain approval for using native material as backfill from ENGINEER.

2.02 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by CONTRACTOR subject to the approval of ENGINEER.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavating, Backfilling, and Compacting:
   1. For Structures: In accordance with this Section.
   2. For Utility Structures: In accordance with Section 31 23 03 "Excavation and Fill for Utilities."

B. Bracing and Sheeting:
   1. Do not install by jetting.
   2. Furnish, put in place, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth which could in any way injure the Work or adjacent property.
   3. Exercise care in the removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported and damage to the Work and adjacent property.
   4. Do not leave any sheeting or bracing in the excavation after completion of the Work, unless approved by ENGINEER.

C. Obstructions:
   1. Remove and dispose of buried trees, boulders less than 1/2 cubic yard in volume, driving surfaces, pipes, and the like, as required for the performance of the Work.
   2. Exercise care in excavating around catch basins, inlets, and manholes.
   3. Avoid removing or loosening castings or pushing dirt into utility structures.
   4. Repair or replace damaged or displaced castings; remove dirt entering utility structures during the performance of the Work at no additional cost to OWNER.

D. Utilities To Be Abandoned:
   1. When pipes, conduits, sewers, or other utilities or utility structures are removed from the excavation leaving dead ends in the ground, fully plug such ends with brick and mortar.
   2. Entirely remove and dispose of abandoned utility structures not identified to be salvaged, unless otherwise specified or indicated on the Drawings.
   3. Remove from the excavation all materials which can be readily salvaged and store at a location designated by OWNER.
   4. All salvageable materials will remain the property of OWNER unless otherwise indicated by OWNER.

E. Cutting Paved Surfaces and Similar Improvements:
   1. All cuts shall be a minimum of 1-foot wider than excavation on each side. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
   2. Before removing pavement, mark the pavement removal area. The pavement removal shall always be perpendicular and/or parallel to the existing pavement joints.
   3. Concrete:
      a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
      b. Sidewalks: Remove to joints.
      c. Curb and Gutter: Remove to joints.
   4. Final Surface Course Bituminous: Saw cut joints unless otherwise approved by ENGINEER.
   5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
   6. CONTRACTOR may tunnel under curbs that are encountered. Replace curb disturbed by construction.
   7. Dispose of materials removed.

F. Undercut:
   1. If suitable bearing for foundations is not encountered at the elevations indicated on the Drawings immediately notify ENGINEER.
   2. If soft material, which in the opinion of ENGINEER is not suitable, is encountered below a structure, ENGINEER may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the structure.
   3. All undercutting made at the order of ENGINEER will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
   4. No extra payment will be made if removal is required as a result of poor dewatering techniques.
   5. Undercutting which is specifically indicated on the Drawings or herein specified, shall be included in the base Bid.
   6. Soil removed may be used as fill in areas not below driving surfaces, structures, or utility structures.
   7. Compact subgrade at bottom of undercut prior to placing fill.
   8. Place and compact specified fill in undercut.
   9. Lateral extent of undercut shall be a horizontal distance equal to the depth of undercut below structure.

G. Excavating:
   1. All excavation shall be by open cut from the surface except as herein specified or as indicated on the Drawings.

2. All excavations for structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal of all materials excavated.
3. Excavate to the required cross section and elevation indicated in the Drawings. Subgrade shall not vary more than 0.1 feet above or below the established elevations.
4. All depressions caused by excess excavation, traffic or rolling shall be filled with MDOT 902 Granular Material Class II or approved fill and rerolled and compacted in place as specified herein.
5. If required because of excess water conditions, place stone stabilization course prior to proceeding with construction. Place filter fabric over stone stabilization course.

H. Rock Removal:
1. Where rock is encountered within the excavation, expose the surface of the rock sufficient to permit adequate measurements to be taken before the rock excavation is started.
2. Notify ENGINEER prior to removal if rock is encountered.
3. Blasting will not be allowed.
4. Rock removal shall be paid under separate Change Order unless a specific item appears in the Bid.

I. Frost Protection: Protect bottoms of excavations from frost.

3.02 SHEETING, SHORING AND BRACING EXCAVATIONS

A. General:
1. Furnish, put in place and maintain sheeting, bracing and shoring as may be required to properly support the sides of excavations and to prevent movement of earth which could in any way injure the Work or adjacent property.
2. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the Work and adjacent property.

B. Sheeting:
1. Do not install by jetting.
2. Do not leave any sheeting or bracing in the excavation after completion of the Work, unless approved by the ENGINEER.
3. Sheeting Left in Place:
   a. Requires written approval of ENGINEER.
   b. Cut off minimum of 2 feet below finished grade.

3.03 FILL

A. General:
1. Do not place fill until the subgrade has been examined by ENGINEER.
2. Place fill in even layers not exceeding 6 inches in depth and thoroughly compact as herein specified.
3. Do not place additional fill until compaction on a lift complies with specification requirements.
4. If an analysis of the soil being placed shows a marked difference from 1 location to another, the fill being placed shall not be made up of a mixture of these materials.
5. Handle each different type of material continuously so that field control of moisture and density may be based upon a known type of material.
6. Do not place fill following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
7. Do not place fill on frozen subgrade.

B. Compaction:
1. Select compaction equipment to achieve the required compaction without damaging adjacent structures.
2. Suggested Equipment Selections:
a. If soil is predominantly granular, use pneumatic tired or vibratory drum rollers loaded to not less than 325 pounds per rated inch of tire width.
b. For clay fills, compact each layer with sheepsfoot rollers. Rollers shall have staggered rows of feet projecting not less than 7 inches from drum and shall be loaded to produce at least 200 pounds per square inch of tamping area in contact with the ground.
c. Compact around structures with hand-operated vibrating compactors for granular soils and Barco rammer type compactors for clay soils.

C. Moisture:
1. Compact all fill with the moisture content as specified.
2. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
3. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.04 STRUCTURE BACKFILL

A. General:
1. Remove debris from excavations before backfilling.
2. Do not backfill against foundation walls until:

a. Approved by ENGINEER.
b. All indicated perimeter insulation is in place.

3. Protect insulation during filling operations.
4. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
5. Do not backfill on only 1 side of vertically spanning walls unless walls are adequately shored or permanent construction is in place to furnish lateral support on both top and bottom of wall.
6. Place all backfill in layers not exceeding 6 inches in depth.
7. Do not place backfill on frozen subgrade.
8. Place an 18-inch layer of clay over granular backfill to prevent surface water from saturating the granular backfill. Place 4-inches of topsoil over the clay cap.

3.05 EXCESS WATER CONTROL

A. Regulations and Permits: Comply with soil erosion control permit in accordance with Mich. P.A. 451, Part 91 of 1994, the Natural Resource and Environmental Protection Act, and all pertinent rules, laws, and regulations.

B. Unfavorable Weather:
   1. Do not place, spread, or roll any fill material during unfavorable weather conditions.
   2. Do not resume operations until moisture content and fill density are satisfactory to ENGINEER.

C. Pumping and Drainage:
   1. Provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.
   2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil. Use wells, portable pumps, temporary underdrains or other methods as is necessary.
   3. Perform Pumping and Drainage:
      a. In such a manner to cause no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other CONTRACTORS.
      b. In accordance with all pertinent laws, rules, ordinances and regulations.
   4. Do not overload or obstruct existing drainage facilities.
   5. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

3.06 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General:
   1. Remove and properly dispose of all excavated material not needed to complete filling and backfilling.
   2. Dispose of excess excavated material at a location off the Site.
   3. Disposal of all materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
   4. Provide adequate controls to maintain disposal sites in a neat and safe condition by periodic leveling of material and such other practices as are necessary.
   5. Provide all soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low lying areas.

3.07 CLEANUP

A. Upon completion of the work of this Section, remove all excess excavated material, trash, and debris resulting from construction operations. Remove equipment and tools. Leave the Site in a neat and orderly condition acceptable to ENGINEER, and in conformance with Section 01 70 00 “Execution and Closeout Requirements.”

END OF SECTION 31 23 06

SECTION 31 25 00 – EROSION & SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing, installation and maintenance of soil erosion and sedimentation control measures.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Erosion Control, Gravel Access Approach:
      a. Basis of Measurement: Each (Ea).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.
   2. Erosion Control, Sediment Filter Fence:
      a. Basis of Measurement: Each (Ea).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.
   3. Erosion Control, Inlet Protection, Fabric Drop:
      a. Basis of Measurement: Each (Ea).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.
   4. Erosion Control, Silt Fence:
      a. Basis of Measurement: Feet (Ft).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.
   5. Mulch Blanket:
      a. Basis of Measurement: Square yard (Sy).
      b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.
   6. Riprap, Plain:

a. Basis of Measurement: Square yard (Sy).
b. Basis of Payment: Furnishing all labor, equipment, and material necessary to complete the work described, per the detail on the plans and per St. Clair County Public Services Office.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
1. Soil erosion and sedimentation control rules and guidelines of the St. Clair County Public Services Office and the Michigan Department of Environment, Great Lakes and Energy (EGLE).

1.04 SUBMITTALS

A. Product Data:
1. Mulch blankets.
2. Geotextile fabric.
3. Seed mixtures.
4. Fertilizer.
5. Turbidity curtain.
6. Silt Guard.
7. Dewatering Filter Bag.
8. Enviroberm.

1.05 QUALITY ASSURANCE

A. The CONTRACTOR shall follow the procedures delineated below and construct and maintain the facilities shown on the Drawings to minimize soil erosion and off site sedimentation during construction of this Project

B. Stop Work Order:
1. OWNER reserves the right to issue a Stop Work Order if soil erosion and sedimentation controls are not properly installed or maintained.
2. Work performed under a Stop Work Order will not be considered for payment.
3. Costs resulting from delay due to issuance of a Stop Work Order shall be the responsibility of CONTRACTOR.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 - PRODUCT

2.01 SOIL EROSION AND SEDIMENTATION CONTROL MATERIALS

A. Vegetation:
   1. Temporary Vegetative Cover: Perennial ryegrass or Alfalfa. Provide mix design for hydroseed mixes.
   2. Permanent Vegetative Cover: Sod or Seed, fertilizer, and mulch blanket all disturbed areas.

B. Mulch Blanket:
   1. Biodegradable:
      a. Straw: Tensar North American Green HydraMax; or equal.
      b. Coconut: Tensar North American Green RollMax C-125; or equal.
      c. Straw and Coconut: Tensar North American Green RollMax SC-150; or equal.
   2. Non-Degradable: Polyester: Tensar North American Green EroNet P-300; or equal.
   3. Anchoring Staples or Pins:
      a. Hardwood stakes at least 6 inches long;

C. Riprap: In accordance with Section 31 37 00 “Riprap.”

D. Geotextile Fabric: Non-woven.

E. Silt Guard:
   1. Above Ground Filters:
      a. The Silt Saver by Silt Saver, Inc.; or equal approved by OWNER and agency having jurisdiction.
      b. Nonwoven polypropylene filter with needle punched holes.
      c. High density polyethylene frame.
   2. Below Ground Filters:
      a. Siltsak by ACF Environmental; or equal.
      b. Geotextile fabric silt sump.
      c. 200 gallons per minute per square foot (GPM/SF) permeability.
      d. Manufactured to meet size of inlet.

F. Dewatering Filter Bags: Made From Geotextile Fabric:
   1. Manufacturer:
      a. Ultratech International, Inc.: Ultra Dewatering Bag.
      b. Pactec: Geopac.
      c. Or equal.

G. Geotextile Silt Fence:

1. Manufacturer:
    a. Synthetic Industries, Terra Tex SC.
    b. Exxon, GTF-180.
    c. Enviroberm.
    d. Or equal.

H. Turbidity Curtain:
1. Impermeable barrier designed to control the setting of solids (silts).
2. Constructed of flexible reinforced thermoplastic material, 18oz/yd^2 minimum, yellow color.
3. Dielectrically welded or double-sewn seams upper hem of sufficient strength to contain flotation material.
4. Flotation material to be expanded polystyrene of sufficient diameter to support curtain at or above the water level.
5. Dielectically welded or double-sewn seams lower hem of sufficient strength to enclose lower ballast.
6. Lower ballast to be galvanized steel chain of sufficient strength and weight to hold curtain in vertical position.
7. Curtain to be tied to concrete anchors at both ends, top and bottom, to prevent moving.

PART 3 - EXECUTION

3.01 GENERAL

A. Standards:
1. Achieve Effective Erosion Control:
    a. Provide all materials per approved SESC plan.
    b. Promptly take actions necessary to prevent off Site sedimentation.
2. Maintain erosion controls.
3. Remove temporary soil erosion and sedimentation control measures once permanent measures are established and accepted by the ENGINEER.

B. Site Evaluation:
1. Conduct a field evaluation of the Site:
    a. Prior to start of the Work.
    b. With representatives of OWNER / ENGINEER.

C. All disturbed surface areas (including utility trenches) shall be temporarily graded and/or ditched to direct all water runoff from such areas to sedimentation control devices so as to prevent sedimentation from entering a watercourse, sewer, or adjacent lands.

D. After the Project Work has been completed, inspected, stabilized, and approved, the CONTRACTOR shall remove all sedimentation control devices, material, and their collected silt and debris and complete the Project Work in accordance with the Drawings.

E. In roadway and driveway areas temporary aggregate surfacing shall be placed immediately after the backfilling operation has been completed.

F. Dust control measures shall be taken at all times.

3.02 TEMPORARY VEGETATIVE COVER

A. General:

1. Permanent soil erosion control measures for all slopes, channels, ditches, or any disturbed land area shall be completed within 5 calendar days after final grading or the final earth change has been completed. When it is not possible to permanently stabilize a disturbed area after earth change activities ceases, temporary soil erosion control measures shall be implemented immediately. All temporary soil erosion control measures shall be maintained until permanent soil erosion control measures are implemented. All permanent soil erosion control measures will be implemented and established before a certificate of compliance is issued.

B. Seed: Apply uniformly at the application rate specified by the MDOT Standard Specifications for Construction Table 917-1 Seed Mixtures.

C. Mulch: As needed to effectively control soil erosion.

3.03 MULCH BLANKET

A. Direction of installation, staple patterns and other requirements in accordance with Manufacturer's directions and the Office of the St. Clair County Public Services Commissioner Standards.

B. Location: Where indicated on the Drawings or as directed by the ENGINEER or Office of St. Clair County Public Services Commissioner SESC department.

3.04 GEOTEXTILE SILT FENCE

A. Install silt fence in accordance with Manufacturer's instructions.

B. Location: Where indicated on the Drawings or as directed by the ENGINEER.

3.05 OPEN CHANNEL EXCAVATION

A. Power equipment such as bulldozers shall not enter the water unless approved by ENGINEER.

B. Complete excavation, clearing, grubbing, snagging, tree cutting, pulling, raking, and related work in such a way as to minimize erosion of soil in the areas in which work is completed.

C. Construct sediment basins prior to excavation.

D. Comply with measures for soil erosion and sediment control as indicated on the Drawings.

3.06 AIRBORNE SEDIMENT

A. Dust Control:

1. Use legal means necessary to control dust on and near the Work and on and near off Site borrow areas if such dust is caused by CONTRACTOR’s operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.

2. Treat haul roads, delivery roads, temporary Site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site, and as directed by ENGINEER.

3. Scrape and broom adjacent streets and paved areas daily to remove tracked dirt.

B. Wind Erosion:

1. Erect and maintain barriers to prevent migration of windblown sediment off Site.
2. Conduct operations in such a manner as to minimize the amount of Site area exposed to wind erosion.
3. Be responsible for removal of windblown sediments deposited off Site, including costs for repairs required due to sediment deposition and removal.
4. Erect and maintain snow fence windward side of earthwork.

END OF SECTION 31 25 00

SECTION 32 11 23 – AGGREGATE BASE COURSES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes furnishing and installation of the major items listed below:
   1. Aggregate Surface Course.
   2. Base course.
   3. Subbase.
   4. Temporary Maintenance Aggregate.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Aggregate Surface Course (of the thickness specified):
      a. Basis of Measurement: Square yard (SY) for the actual number of square yards of road or drive constructed.
      b. Basis of Payment: Furnishing all labor, equipment, and materials required to perform the work including, but not limited to, grading the existing surface, furnishing, placing, grading, and compacting the aggregate material to the proper profile; applying calcium chloride when required; and maintaining the surface until final acceptance.
   2. Aggregate Base (of the thickness specified):
      a. Basis of Measurement: Square yard (SY) for the actual number of square yards of aggregate base constructed.
      b. Basis of Payment: Furnishing all labor, equipment, and materials required to prepare the subbase, proof roll subgrade, supply and place the base material specified, rolling, compacting, grading, and maintaining the road until its acceptance. This item will include the cost of aggregate shoulders when required.
   3. Subbase:
      a. Basis of Measurement: Cubic yard (CY) for the actual number of cubic yards of subbase constructed.
      b. Basis of Payment: Furnishing all labor, equipment, and materials required to prepare the subgrade, proof roll subgrade, supply and place the subbase material specified, rolling, compacting, and grading to achieve the proper profile.
   4. Shoulder Aggregate Surface Course (of the thickness specified):

a. Basis of Measurement: Square yard (SY) for the actual number of square yards of road or drive constructed.
b. Basis of Payment: Furnishing all labor, equipment, and materials required to perform the work including, but not limited to, grading the existing surface, furnishing, placing, grading, and compacting the aggregate material to the proper profile; applying calcium chloride when required; and maintaining the surface until final acceptance.

5. Temporary Maintenance Aggregate:
a. Basis of Measurement: Square yard (SY) for the actual number of square yards of maintenance aggregate placed.
b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to supply, place, grade, and compact temporary maintenance aggregate. This item includes the cost of removing temporary maintenance aggregate, when no longer needed, to the depths and profiles required to restore to the designed section specified on the Drawings. This item also includes disposal of temporary maintenance aggregate material off site, if required.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:
1. ASTM Standard Test Methods:
a. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
b. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
c. D2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods.
2. MDOT Current Standards:
a. Specifications for Construction.
b. Standard Plans.
3. St. Clair County Road Commission (SCCRC) Requirements.
4. The City of Port Huron Requirements.
5. St. Clair County Department of Public Services Requirements.

1.04 DEFINITIONS

A. Terms:
1. Base Course: The layer of specified material of designed thickness placed on a subbase or a subgrade to support a surface course.
2. Pavement Structure: Combination of subbase, base course, and surface course, including shoulders, placed on a subgrade.
3. Plan Grade: Vertical control grade indicated on the Drawings.

4. Roadbed: The portion of the roadway between the outside edges of finished shoulders, or the outside edges of berms back of curbs or gutters, when constructed.
5. Roadside: The portion of the right-of-way outside of the roadway.
6. Roadway: The portion of the right-of-way required for construction, limited by the outside edges of slopes and including ditches, channels, and all structures pertaining to the Work.
7. Shoulder: The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.
8. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.
9. Subgrade: The portion of the earth grade upon which the pavement is to be placed.
10. Surface Course: The layer of specified material of designed thickness placed above a base course as a final aggregate topping course.
11. Temporary Maintenance Aggregate: The layer of specified material placed temporarily to backfill an excavated area to match surrounding grade and allow the work area to be opened to traffic.

1.05 SUBMITTALS

A. Action Submittals: For aggregate:
   1. Source.
   2. MDOT classification.
   3. Sieve analysis.

1.06 QUALITY ASSURANCE

A. Testing of Aggregate Materials: In accordance with Section 01 40 00 "Quality Requirements."

B. Compaction:
   1. Shall be in accordance with SCCRC and MDOT requirements.
   2. Determine density by the modified Proctor method, ASTM D1557.
   3. Compact subbase to at least 95% maximum density at a moisture content not greater than optimum.
   4. Compact aggregate base to at least 95% maximum density at a moisture content not greater than optimum for aggregate base under hot mix asphalt pavement.
   5. Compact aggregate base to at least 95% maximum density at a moisture content not greater than optimum for aggregate base under concrete pavement.
   6. Compact shoulders to at least 95% maximum density at a moisture content not greater than optimum.

1.07 PROJECT CONDITIONS

A. Dust Control:
   1. On a daily basis, use all legal means necessary to control dust on and near the Work and on and near off-site borrow areas if such dust is caused by CONTRACTOR's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary Site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.

B. Existing Utility Structures:
   1. Where utility structures are encountered which are in active use:
      a. Provide adequate protection.
      b. Be responsible for their damage.
   2. Adjust utility structures to meet plan grade.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. Approval Required: Material shall be subject to the approval of ENGINEER.
   2. Notification: For approval of materials, notify ENGINEER at least 1 week in advance of intention to import material, designate the proposed stockpile area, and permit ENGINEER or his authorized representative to sample as necessary from the stockpile area for the purpose of making acceptance tests to prove the quality of the material.

B. Subgrade: In accordance with Section 31 22 00 “Grading.”

C. Material Source: Imported Material:
   1. Subbase.
   2. Base course.
   3. Surface course.

D. Subbase:
   1. MDOT 902, Granular Material Class II.
   2. Thickness compacted in place: as indicated on the Drawings.

E. Aggregate Base Course:
   1. MDOT 902, Dense Graded Aggregate 21AA Limestone.
   2. Thickness Compacted in Place: as indicated on the Drawings.

F. Aggregate Shoulders and Surface Course:
   1. MDOT 902, Dense Graded Aggregate 23A Limestone.

G. Temporary Maintenance Aggregate:
1. MDOT 902, Dense Graded Aggregate 21AA Limestone.

PART 3 - EXECUTION

3.01 PREPARATION

A. Subgrade:
1. Prepared in accordance with Section 31 22 00 “Grading.”
2. Maintain in a smooth and compacted condition until the subbase or base course has been placed.
3. Proof roll subgrade prior to placing subbase or base course.
4. No base course shall be placed on the subgrade until it has been approved by ENGINEER.

3.02 INSTALLATION

A. Subbase:
1. Smooth, spread and compact.
2. Place in one layer, provided that the depth of the compacted layer does not exceed 12 inches.
3. Where the specified depth of subbase is more than 12 inches, place material in layers of approximately equal thickness.
4. Construct to the grade and cross section as indicated on the Drawings.
5. Should the subgrade at any time prior to or during the placing of subbase become soft or unstable to the extent that rutting occurs in the subgrade or to the extent that subgrade material is forced up into the subbase materials, the operation of hauling and placing subbase shall be immediately discontinued. Where subgrade material has become mixed with the subbase material, the mixed material shall be removed and disposed of. After the subgrade has been corrected to the specified condition, new subbase material shall be placed and compacted as specified above.
6. Shape to specified crown and grade within a tolerance of plus 1-inch and maintain in smooth condition.
7. Do not place on a frozen, soft, unstable or rutted subgrade.
8. Remove, dispose of and replace subbase material, at CONTRACTOR’s expense, if it becomes mixed with subgrade material.
9. Proof roll subbase prior to installation of base course.

B. Base and Surface Course:
1. Do not place aggregate base on frozen, soft, unstable or rutted subgrade, subbase, or aggregate base.
2. Additives may be used to ease compaction, shaping, and maintenance of the aggregate surface.
3. Do not rut or distort the subbase material or aggregate base during spreading.

4. Place in uniform layers to such a depth that when compacted, the course will have the thickness indicated on the Drawings.
5. The compacted depth of each layer shall not be more than 6 inches nor less than 3 inches.
6. Compact each layer of aggregate.
7. Place aggregate shoulder material in conjunction with the top layer of aggregate base material.
8. Shape to the crown and grade within a tolerance of ± 0.05 feet unless otherwise specified. The surface of each spreading operation shall be continuously maintained in a smooth condition.
9. Roll the shaped surface, when required, to provide thorough compaction.
10. Where the existing surface is very irregular, the use of a scarifier may be required. Wetting may be required to facilitate shaping the surface and to assist in providing compaction.
11. Remove, dispose of and replace aggregate base material, at the CONTRACTOR's expense, if it becomes mixed with the subbase or subgrade material.
12. Final shaping and compacting shall be accomplished by use of a subgrade machine operating on crawler tracks, or by the use of a maintainer or surface planer, with a rigid frame.
13. If the subgrade, subbase, or aggregate base is damaged due to the CONTRACTOR's operations or by traffic, restore to the specified condition at
14. CONTRACTOR's expense.

END OF SECTION 32 11 23

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing and installation of form work, reinforcement, concrete pavement, and pavement markings for exterior work:
   1. Roadways.
   2. Parking lots.
   3. Miscellaneous exterior concrete pavement (not including concrete walks, driveways, and curb and gutter).

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Concrete Pavement (of the thickness specified):
   1. Basis of Measurement: Square yard (SY) for the actual number of square yards of concrete pavement constructed.
   2. Basis of Payment: Furnishing all labor, equipment, and materials necessary to construct the concrete pavement as specified. This work shall include preparation of the subgrade; furnishing, placing, and compacting subbase and base materials; furnishing, placing, curing, and protecting the concrete pavement and integral curbs, including tie bars, joint hook bolts, end headers, pavement reinforcement (when specified), all joint materials, load transfer devices, dowel bar assemblies, end of pour load transfer devices, sawing, cleaning, patching spalls, tests, backfill, fine grading, cleanup, pavement admixtures and accelerators, cold weather protection; and includes all labor, material, equipment, and machinery required to construct the pavement complete in place. This Bid Item includes the cost of curb drops, adjustment of structures within the ROW, protecting and replacing government plat and street corners, designated survey bolts and benchmarks, pavement striping, and marking if specified. Also included is the cost of replacing existing aggregate, bituminous, or concrete drive approaches, if necessary, due to change in grade of the ROW grading cross-sections or due to damage by the CONTRACTOR’s construction methods and operations. No extra payment will be made for extra thickness of concrete at joints and in intersections.

B. Concrete Pavement Patching (of the thickness specified):
   1. Basis of Measurement: Square yards (SY) for the actual number of square yards of concrete pavement replaced.
   2. Basis of Payment: Furnishing, placing, and compacting aggregate base material; furnishing, placing, finishing, and curing all concrete pavement required, including saw cutting, subgrade or base preparation, backfill, grading, furnishing and placing shoulder material, reinforcement, dowel bars, lane ties, joint materials, and other Work required to complete this item.

C. Pavement Marking (of the size and color specified):
   1. Basis of Measurement: Linear Feet (LF).
   2. Basis of Payment: Furnishing all labor, equipment, and material necessary to perform the work of this item.

D. Cold Plastic Pavement Marking (of the size and color specified):
   1. Basis of Measurement: Linear Feet (LF).
   2. Basis of Payment: Furnishing all labor, equipment, and material necessary to perform the work of this item including removing curing compound from new concrete surfaces before applying cold plastic tape.

E. Cold Plastic Pavement Marking (of the symbol specified):
   1. Basis of Measurement: Each.
   2. Basis of Payment: Furnishing all labor, equipment, and material necessary to perform the work of this item including removing curing compound from new concrete surfaces before applying cold plastic tape.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Publications:
      a. A185 - Steel Welded Wire, Fabric, Plain for Concrete Reinforcement.
      b. A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
      c. A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
      d. A820 - Steel Fibers for Fiber Reinforced Concrete.
      e. C33 - Specification for Concrete Aggregates.
      f. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      g. C94 - Specification for Ready-Mixed Concrete.
      h. C136 - Sieve Analysis of Fine and Coarse Aggregates.
      i. C150 - Specification for Portland Cement.
      j. C260 - Specification for Air-Entraining Admixtures for Concrete.
      k. C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      l. C330 - Specification for Lightweight Aggregates for Structural Concrete.
      m. C494 - Specification for Chemical Admixtures for Concrete.
      n. C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
      o. C989 - Ground Granulated Blast Furnace Slag (GGBFS) For Use in Concrete and Mortars.
      p. C1116 Standard Specification for Fiber Reinforced Concrete and Shotcrete.

q. C1260 - Potential Alkali Reactivity of Aggregates (Mortar-bar method).
r. C1293 - Determination of Length Change of Concrete Due to Alkali-silica Reaction (Concrete prism test).
s. C1567 - Potential alkali-silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-bar method).
t. D3963/D and 3963M - Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars.

2. ACI - American Concrete Institute:
   a. 117 - Standard Tolerances for Concrete Construction and Materials.
   b. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
   c. 224.3R – Joints in Concrete Construction.
   d. 302.1R - Guide for Concrete Floor and Slab Construction.
   e. 303R - Guide to Cast-In-Place Architectural Concrete Practice.
   f. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
   g. 304.2R Placing Concrete by Pumping Methods.
   h. 305R - Hot Weather Concreting.
   i. 306R - Cold Weather Concreting.
   j. 309R - Guide for Consolidation of Concrete.
   k. 330 - Guide for Design and Construction of Concrete Parking Lots.
   l. 360 - Design of Slabs on Grade.
3. Concrete Reinforcing Steel Institute (CRSI):
   a. Manual of Standard Practice – current edition.
   b. Placing Reinforcing Bars – current edition.
4. Americans with Disabilities Act (ADA).
5. MDOT Current Standards:
   a. Specifications for Construction.
   b. Standard Plans.
6. St. Clair County Road Commission (SCCRC) Requirements.
7. The City of Port Huron Requirements.

1.04 SUBMITTALS

A. Action Submittals:
   1. Provide mix design(s) for concrete to be supplied.
      a. Include quantities and sources of all aggregates, cement, cementitious materials, and admixtures to be used.
      b. Submitted from a MDOT certified testing laboratory regularly engaged in designing and testing concrete for exterior paving.
      c. Use test results for mix design from within the past 12 months.
   2. Product Data: Submit Manufacturer’s product data with application and installation instructions for admixtures, curing compounds, expansion joint fillers and sealants.

3. Alkali-Silica Reactivity (ASR):
    a. Submit to ENGINEER ASTM C1260 Accelerated mortar bar test, and ASTM C1293 Concrete prism expansion for ASR from aggregate supplier.
    b. Documentation may include previous testing (within previous 1 year) of materials and sources intended for use.
    c. Documentation may include previous testing (within previous 1 year) from other projects or records provided by the material suppliers.

1.05 QUALITY ASSURANCE

A. Pre-Paving Meeting:
1. Meeting held at a time mutually agreed upon with ENGINEER, OWNER, CONTRACTOR and subcontractors involved in the paving work.
2. Discussion of proposed schedule and methods of accomplishing all phases of the paving work.
3. Minutes distributed to all in attendance.

B. Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design.

C. Testing of Materials:
1. In accordance with Section 01 40 00 "Quality Requirements."
2. In accordance with approved CONTRACTOR's Quality Control Plan.
3. In accordance with all applicable standards.

D. Batch tickets: Furnish batch tickets to ENGINEER, or ENGINEER'S representative for material incorporated in the Project to verify that the required concrete mix has been supplied.

E. Batch Plant Certification: Ensure portland cement concrete batch plant is certified to meet the requirements specified in the National Ready Mixed Concrete Association *Certification of Ready Mixed Concrete Production Facilities Quality Control Manual* or other MDOT approved requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete Reinforcement:
   1. Welded wire fabric in accordance with ASTM A185, yield stress 65,000 psi.
   2. Reinforcing bars in accordance with ASTM A615, yield stress 60,000 psi.

B. Cement:
   1. Portland cement: ASTM C150, Type IA.
   2. For high early strength concrete the cement shall be air-entraining portland cement Type IIIA.
   3. Do not use different Manufacturers of cement, or different degrees of fineness.

C. Cementitious Materials or Cement Substitutes:
   1. Fly Ash: ASTM C618, Class C or F.
   2. Ground Granulated Blast Furnace Slag (GGBFS):
      a. ASTM C989 Grade 100 minimum.
      b. Use only as a blending material with Type I or Type IA portland cement.
   3. Silica Fume, Dry-Densified:
      a. ASTM C1240.
      b. Use only as a blending material with Type I or Type IA portland cement.
   4. Reduce the cement quantity up to a maximum of 25% for fly ash substitution or up to 30% for GGBFS substitution.
   5. Fly ash or GGBFS weight additions must equal the weight of the cement reduction.
   6. For concrete containing portland cement, fly ash and GGBFS in the same mix design, reduce the cement quantity up to 40%, with the maximum fly ash quantity not exceeding 15%.

D. Aggregates:
   1. Grade aggregates according to procedures of ASTM C136, Class M, Exposure 4.
   2. Coarse Aggregates: ASTM C33, Number 57 (1-inch), crushed limestone.
   3. Fine Aggregate: ASTM C33.
   4. Test all aggregates for alkali-silica reactivity and provide mitigation method, if required.

E. Water: Clean, fresh and potable.

F. Steel Reinforcement:
   1. Reinforcement shall meet MDOT Standard Specifications.

2. Deformed bars that conform to ASTM A706 or Grade 60 steel bars ASTM A615.
3. Bars for Dowels or Lane Ties: Conform to Grade 40 ASTM A615 or A617.
4. Welded Wire Fabric: Conform to ASTM A185.
5. Epoxy Coating:
    a. Where required, conform to ASTM D3963/D3963M.
    b. Select coating material from MDOT qualified products list.
    c. Provide certification, if required by ENGINEER, that material conforms to standards.
    d. Use bar chairs and wire ties that are plastic coated, epoxy coated or plastic.

G. Epoxy Coating Material:
1. Corrosion Protection Coatings:
    a. One part, heat curable, thermosetting powdered epoxy.
    b. Conforming with ASTM A775.
2. Epoxy Coating Patching Material:
    a. Compatible with factory applied epoxy coating.
    b. Conforming with ASTM A775.

H. Synthetic Fibers:
1. Synthetic fibers are fibers manufactured from polymer-based materials such as polypropylene, nylon and polyethylene telephthalate.
2. Monofilament or fibrillated polypropylene designed for use in concrete pavement.

I. Admixtures:
1. General:
    a. No admixture shall contain more than 0.1% water soluble chloride ions by mass of cementitious material.
    b. No admixture shall contain calcium chloride.
2. Air-Entraining:
    a. Required in all mixtures.
    b. Comply with ASTM C260.
    c. Daravair series or Darex series, by W.R. Grace & Company; Micro Air, by BASF Admixtures, Inc.; or equal.
3. Water-Reducing Admixtures:
    a. Provide concrete mixtures with the same strength, air content as the respective concrete without the admixture.
    b. Select water reducing admixtures from MDOT's qualified products list.
    c. Admixture dosage rates are based on the total cementitious material (cement plus fly ash or GGBFS).

J. Curing Agents:
1. Comply with ASTM C309, Type 2, Class B.

2.02 CONCRETE MIX DESIGN

A. Concrete shall conform to Grade 3500 as shown in Table 1004-1 of the MDOT Specifications. Design mix to project normal-weight concrete consisting of a mixture of portland cement, blended portland cement, cement substitutes, fine aggregate, coarse aggregate, water and admixtures, when required or permitted, producing the following properties:
   1. Cement Content: 5.6 sack (526 lbs).
   2. Compressive Strength: 3,500 psi (min) at 28 days.
   3. Air Content: 6.5% ±1.5%.
   4. Slump: 0 to 3 inches or the slump in the approved mix design.
   5. Water Cement Ratio: 0.45 maximum.

B. Alkali-Silica Reactivity (ASR):
   1. The Concrete supplier is required to evaluate the fine aggregates (only) used in the production of the concrete for ASR.
   2. Submit to the ENGINEER ASTM C1260 Accelerated mortar bar test for ASR from the aggregate supplier.
   3. Submit to the ENGINEER ASTM C1293 Concrete prism expansion for ASR from the aggregate supplier if available, or if necessary.
   4. Documentation may include previous testing of materials so long as material source has not changed, and test is not more than 1 year old.
   5. No ASR mitigation is required if aggregates are non-reactive where ASTM C1260 Accelerated mortar bar test expansion is less than 0.10% at 14 days, or if ASTM C1293 Concrete prism expansion is less than 0.04% at 1 year.
   6. If ASTM C1260 mortar bar test results is more than 0.10% expansion at 14 days, ASTM C1293 concrete prism test is required to be performed before aggregates can be used.
   7. ASR mitigation is required if aggregates are found to be moderately reactive where ASTM C1293 Concrete prism expansion is equal to or greater than 0.04%, but less than 0.12% at 1 year.
   8. Aggregates will not be accepted if ASTM C1293 Concrete prism expansion is equal to or greater than 0.12% at 1 year.

C. Mitigation Methods for Moderately Reactive Aggregates:
   1. In accordance with MDOT approved Specifications.
   2. Use low Alkali Cements:
      a. Submit mill test report data and calculations for Cement and Fly Ash.
      b. Maximum Alkali content of cementitious materials (cement and fly ash) (Na2Oe) (Na2O equivalent) $\leq$ 3.5 lbs/cyd.
      c. Maximum Alkali content in cement (Na2Oe) (Na2O equivalent) $\leq$ 0.7%.
      d. Maximum lime CaO in Fly ash $\leq$ 20%.
      e. Minimum Silica in Fly ash $SiO_2 \geq 35\%$.
      f. Total oxides in Fly ash ($SiO_2 + Al_2O_3 + Fe_2O_3$) $\geq$ 60%.

3. Demonstrate the effectiveness of the proposed mix combination to resist the potential for excessive expansion caused by ASR using current and historic data:
    a. ASTM C1567 (14 day test) using both coarse and fine aggregate and all cementitious materials.
    b. Mortar bars constructed of cementitious materials and coarse and fine aggregates must produce an expansion of less than 0.10%.

2.03 FORM WORK

A. Provide necessary form work to provide concrete dimensions indicated on the Drawings ±1/2 inch.
    1. Forms to be straight and true, minimum 1 5/8-inch thick wood, full depth of concrete or steel forms.
    2. All curved radius pours to be smooth deflectable steel or wood forms.

2.04 CONTRACTION JOINTS

A. Provide necessary contraction joints to control random cracking with sawcut or hand-troweled joint.
    1. Depth: 1/4 slab thickness minimum, or as indicated on the Drawings.
    2. Spacing according to St. Clair County Road Commission Requirements.
    3. Cut in location as indicated on the Drawings.
    4. Keep panels as square as possible with length not more than 25% greater than width.

2.05 ISOLATION (EXPANSION) JOINTS

A. Joint fiber shall be preformed, composed of either blended, bonded flexible and waterproof fiber meeting the requirements of AASHTO M213 or polyvinyl chloride with fabric strand.

B. Full depth of concrete.

2.06 SEALANTS

A. Joint sealant to be hot-poured rubber in accordance with MDOT requirements.

2.07 PAVEMENT MARKINGS

A. Marking paint shall meet Federal Specification GSA-FSSTT-P-115E Type 1.

B. Size and Color: 4-inch or 6-inch width, white, yellow, blue or other color depending on intended use.
    1. As indicated on the Drawings.
    2. In accordance with guidelines, MMUTCD and FHWA – MUTCD.

C. Traffic paint shall be waterborne spray type for stripe marking. If seasonal limitations prevent the placement of waterborne paint, the ENGINEER may approve regular dry paint. Select pavement marking materials from the MDOT Qualified Product List.

D. Glass beads shall meet MDOT requirements with the exception of bead coating for waterborne pavement marking paint. The bead used in waterborne pavement marking shall have a moisture resistant coating and an adhesion promoting silane coating.

PART 3 - EXECUTION

3.01 PREPARATION

A. Test subgrade, subbase or aggregate base for density.
   1. Rework surfaces that have become too wet or dry to provide the required density.
   2. Required Density: Minimum 95% of Maximum Density.

B. Proof of Test Rolling:
   1. Field test the uniformity and stability of the subgrade, subbase, or base.
   2. Loaded dump truck or other approved equipment over entire area in each of 2 perpendicular directions.
   3. Areas indicated or as designated by ENGINEER or field representative.
   4. In presence of ENGINEER or field representative.
   5. Repair/undercut unstable or yielding areas as directed.

C. Fine Grading:
   1. Immediately prior to placing paving materials, test the subgrade or aggregate base course for conformity to the elevations and cross-section as indicated on the Drawings.
   2. Fine grade as necessary to bring base course into conformance with the proper elevation and cross-section.
   3. Compact areas which have been re-graded to minimum 95% Maximum Density.

D. Do not place concrete until the surface to be paved upon has been inspected and approved by ENGINEER.

3.02 INSTALLATION

A. Weather, Temperature, and other Limitations:
   1. Do not place concrete until the ambient air temperature away from artificial heat is at least 25 degrees F and rising, unless otherwise approved by ENGINEER.
   2. Do not place concrete if portions of the base, subbase, or subgrade layer are frozen, or if the grade exhibits poor stability from excessive moisture levels.

3. Temperature of concrete at time of placement shall be between 45 degrees F and 90 degrees F.
4. Paving will not be allowed between November 15 and May 1 without written approval from the St. Clair County Road Commission and City Engineer.

B. Cold Weather Concrete Operations:
1. Comply with the recommendations of ACI 306R.
2. Recommended Protective Measures:
   a. Heating materials.
   b. Providing insulating blankets and windbreaks.
   c. Heated enclosures.
   d. Advise ENGINEER of planned protective measures.
   e. Straw or similar materials are not allowed.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete on frozen subgrade.

C. Hot Weather Concrete Operations:
1. Comply with the recommendations of ACI 305R.
2. Recommended Protective Measures:
   a. Cooling materials.
   b. Concrete placement during cooler hours of the day.
   c. Providing shading and windbreaks.
3. Advise ENGINEER of planned protective measures.

D. Preparation of Base:
1. Excavate to the required depth and to a width that will permit forming.
2. Remove unsuitable material below the required depth and replace with suitable material approved by the ENGINEER.
3. Shape and compact the base to conform to the section indicated on the Drawings.

E. Forms:
1. Use fixed forms.
2. Apply form releasing agent to prevent concrete from bonding to forms.
3. Provide straight, full depth forms free of warp and strong enough to resist springing during concrete placement.
4. Firmly stake fixed forms to prohibit movement.

F. Placing and Finishing Concrete:
1. Place all concrete in accordance with ACI 304R and ACI 304.2R.
2. Do not exceed the time limits specified in Table 1001-1 of the MDOT Specifications for the time of charging the mixer to complete concrete discharge.
3. Moisten base before placing concrete.
4. Place concrete and consolidate, including along the faces of the forms, before finishing.

5. Place and finish in a continuous operation.
6. When replacing gutters along with concrete walk ramps, construct the gutter to the same dimensions and profile and use the same reinforcement pattern as the existing gutter.
7. Float the surface just enough to produce a smooth surface free from irregularities.
8. Round edges and joints with an approved finishing tool.
9. Broom finish concrete walks and ramps by drawing a fine-hair broom across the concrete surface, perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the ENGINEER.

G. Joints:
1. General: Comply with ACI 318-6.3, 6.4, and ACI 301, Section 6.
   a. Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete.
   b. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
   c. Seal joints with hot-poured rubber asphalt in accordance with St. Clair County Road Commission joint standard details.
2. Weakened-Plane (Contraction) Joints:
   a. Provide weakened-plane (contraction) joints, sectioning concrete into areas:
      1) As indicated on the Drawings.
      2) 24 to 36 times the thickness of the slab if not indicated on the Drawings.
   b. Contraction joints for curbs shall be provided at maximum 10 foot intervals and maximum 15 foot spacing for slabs, unless indicated otherwise.
   c. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:
      1) Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
      2) Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
3. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.
4. Expansion Joints:
   a. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.

b. Locate expansion joints at 100 feet on center along linear lengths of curb and walks, and at points of radii of curbs unless otherwise indicated.

5. Extend joint fillers full width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface for joint sealant.
6. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

H. Reinforcing:
1. Install reinforcing as indicated on the Drawings.
2. Install in accordance with CRSI for placing reinforcing bars and Manual of Standard Practice.

I. Epoxy Coating:
1. Minimum 6 mils thick and uniform.
2. Coat reinforcement after fabrication.
3. Repair damage to epoxy coating in accordance with:
a. ASTM A775.
b. Epoxy-coating Manufacturer's recommendations.

J. Backfilling:
1. After the concrete has gained sufficient strength, remove fixed forms and backfill with suitable material approved by the ENGINEER.
2. Compact and level the backfill 1-inch below the surface of the concrete.

3.03 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
   1. Exterior slabs and concrete pavement types shall have a non-slip finish by scoring the surface with a heavy broom, perpendicular to the line of traffic.
   2. Repeat operation if required to provide a line texture acceptable to the ENGINEER.

3.04 CURING

A. General:
   1. As soon as possible, after texturing operations have been completed and after the free water has left the surface, coat the concrete walk surface and sides of slip-formed concrete walks with a uniform layer of membrane curing compound.
   2. Apply 1 coat of curing compound on non-grooved surfaces and 2 coats on grooved surfaces.
   3. Apply not less than 1 gallon per 25 square yards of concrete for each application.
   4. Apply the second coat after the first has dried sufficiently but do not exceed 2 hours between coats.
   5. Keep the compound thoroughly mixed according to the Manufacturer's recommendations.
   6. Do not thin curing compound.
   7. Reapply curing compound immediately to surfaces damaged by rain, joint sawing, foot traffic or other activities.
   8. If fixed forms are removed during the curing period, coat the entire area of the sides of the concrete walk with curing compound immediately after removal of forms.

B. These requirements are minimum requirements only.

C. Repair or replacement of concrete showing damage due to inadequate curing is required.

D. All costs associated with this corrective work will be borne by the CONTRACTOR.

3.05 PROTECTION

A. Protect the concrete from damage until acceptance of the Work.

B. Protect the concrete from freezing until the concrete has attained a compressive strength of at least 1800 psi.

C. Maintain surface as clean by removing surface stains and spillage of materials as they occur.

D. Sweep concrete and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

3.06 DEFECTIVE WORK

A. The following list of deficiencies are considered defective work and removal or replacement by the CONTRACTOR at no cost to the OWNER is required:
   1. Difference in elevation between panels of 1/2-inch or greater.
   2. Cracks of any lengths that are 1/8-inch wide or wider.
   3. Surface spalling covering in excess of 20% of the area of any 1 panel.
   4. A hole that is 1/2-inch or greater in depth and 2 inches or greater in diameter.
   5. Residual splatter that is 1/2-inch or higher and attached to a panel.
   6. Elevation difference of 3/4-inch in 10 feet caused by settling, that has not caused an elevation difference between panels.
   7. Multiple hairline cracking.
   8. Footprints, bike tire tracks, animal tracks, or the like, created while concrete was not cured.
   9. ASR cracking or potholing.
   10. Other work identified as defective by OWNER.

3.07 PAVEMENT MARKING

A. Apply pavement marking in accordance with SCCRC, MDOT, and FHWA requirements.

B. Clean pavement surface of sand, dirt, oil, and free of foreign material. Remove curing compound from new concrete surfaces before applying cold plastic tape.

C. Pavement surface shall be dry:
   1. Apply waterborne paint when the surface temperatures of the pavement is 50 degrees F or higher.
   2. Apply regular dry paint when the surface temperature of the pavement is 25 degrees F or higher.
   3. Wait at least 14 days after the surface is placed to apply regular dry pavement markings unless otherwise approved by the ENGINEER.

D. Follow Drawings for layout of pavement markings, symbols, and the like.

E. Apply pavement marking uniformly to the surface, with sharp and well-defined edges.

F. Protect pavement marking from traffic crossing over uncured paint.

G. Apply second coat of paint to areas designated by ENGINEER just prior to Project completion.

3.08 CLEAN-UP

A. For duration of work, CONTRACTOR is to maintain work area free of waste material, debris, and the like.

B. CONTRACTOR shall provide on-site containers as necessary for work of this Section. Locate as directed by ENGINEER.

C. Upon completion and when directed by ENGINEER, CONTRACTOR shall remove all excess material, debris, and equipment.

D. Prior to acceptance of the work, clean the pavement and related areas to remove dirt and stones.

END OF SECTION 32 13 13

SECTION 32 13 14 – CONCRETE WALKS AND DRIVEWAYS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing and installation of concrete walks and concrete driveways.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Sidewalk, Conc, (of the thickness specified), Modified:
   1. Basis of Measurement: Square feet (SF) for the actual number of square feet of sidewalk constructed.
   2. Basis of Payment: Furnishing all labor, equipment, and materials necessary to construct the sidewalk, including the cost of any permits required; excavating and preparing the subbase; furnishing, placing, and compacting MDOT Class II sand cushion; placing, finishing, and curing the sidewalk; and all related cleanup and grading of the Work area.

B. Concrete Sidewalk Ramp (of the thickness specified):
   1. Basis of Measurement: Square feet (SF) for the actual number of square feet of sidewalk ramp and level landing constructed.
   2. Basis of Payment: Furnishing all labor, equipment, and materials necessary to construct the sidewalk ramp and level landing, including the cost of any permits required; excavating and preparing the subbase; furnishing, placing, and compacting MDOT Class II sand cushion; placing, finishing, and curing the sidewalk ramp; level landing; monolithic rolled curbs or side flares along the longitudinal edges of the ramp or landing; curb and gutter openings; and all related cleanup and grading of the Work area.

C. ADA Sidewalk Ramp Tactile Warning Plate:
   1. Basis of Measurement: Square feet (SF) for actual number of square feet of tactile warning plate placed.
   2. Basis of Payment: Furnish and place warning plate at locations indicated on drawings.

D. Concrete Driveway (of the thickness specified):
   1. Basis of Measurement: Square yards (SY) for the actual number of square yards of concrete driveway constructed.
   2. Basis of Payment: Furnishing all labor, equipment, and materials necessary to construct the concrete driveway, including the cost of any permits required; excavating and preparing the subbase; furnishing, placing, and compacting base material; placing, finishing, and curing the driveway; and all related cleanup and grading of the Work area.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Publications:
      a. A185 - Steel Welded Wire, Fabric, Plain for Concrete Reinforcement.
      b. A820 - Steel Fibers for Fiber Reinforced Concrete.
      c. C33 - Specification for Concrete Aggregates.
      d. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      e. C94 - Specification for Ready-Mixed Concrete.
      f. C136 - Sieve Analysis of Fine and Coarse Aggregates.
      g. C150 - Specification for Portland Cement.
      h. C260 - Specification for Air-Entraining Admixtures for Concrete.
      i. C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      j. C330 - Specification for Lightweight Aggregates for Structural Concrete.
      k. C494 - Specification for Chemical Admixtures for Concrete.
      l. C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
   2. ACI – American Concrete Institute:
      a. 117 - Standard Tolerances for Concrete Construction and Materials.
      b. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      c. 224.3R – Joints in Concrete Construction.
      d. 302.1R - Guide for Concrete Floor and Slab Construction.
      e. 303R - Guide to Cast-In-Place Architectural Concrete Practice.
      f. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
      g. 305R - Hot Weather Concreting.
      h. 306R - Cold Weather Concreting.
      i. 309R - Guide for Consolidation of Concrete.
   3. Americans with Disabilities Act (ADA).
   4. MDOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.
   5. St. Clair County Road Commission (SCCRC) Requirements.
   6. The City of Port Huron Requirements.

1.04 SUBMITTALS

A. Action Submittals:
   1. Provide mix design for concrete to be supplied.

a. Include quantities and sources of all aggregates, cement, cementitious materials, and admixtures to be used.
b. Submitted from a MDOT certified testing laboratory regularly engaged in designing and testing concrete for exterior paving.
c. Use test results for mix design from within the past 12 months.

2. Product Data: Submit Manufacturer's product data with application and installation instructions for admixtures, curing compounds, expansion joint fillers and sealants.
3. Alkali-Silica Reactivity (ASR):
   a. Submit to ENGINEER ASTM C1260 Accelerated mortar bar test, and ASTM C1293 Concrete prism expansion for ASR from aggregate supplier.
   b. Documentation may include previous testing (within previous 1 year) of materials and sources intended for use.
   c. Documentation may include previous testing (within previous 1 year) from other projects or records provided by the material suppliers.
4. Stamped Colored Concrete
   a. Concrete Colorant:
      1) Submit to OWNER standard pigment color options to choose from.
      2) Documentation to include source/manufacturer of the product, release agent, curing compound, surface sealer.

1.05 QUALITY ASSURANCE

A. Pre-Paving Meeting:
1. Meeting held at a time mutually agreed upon with ENGINEER, OWNER, CONTRACTOR and subcontractors involved in the paving work.
2. Discussion of proposed schedule and methods of accomplishing all phases of the paving work.
3. Minutes distributed to all in attendance.

B. Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design.
3. Contractor has a Michigan Concrete Association (MCA) Decorative Concrete Certification, or proven equivalent manufacturer training and certification for placing decorative concrete.

C. Testing of Materials:
1. In accordance with Section 01 40 00 "Quality Requirements."
2. In accordance with approved CONTRACTOR's Quality Control Plan.
3. In accordance with all applicable standards.

D. Batch tickets: Furnish batch tickets to ENGINEER, or ENGINEER'S representative for material incorporated in the Project to verify that the required concrete mix has been supplied.

E. Batch Plant Certification: Ensure portland cement concrete batch plant is certified to meet the requirements specified in the National Ready Mixed Concrete Association *Certification of Ready Mixed Concrete Production Facilities Quality Control Manual* or other MDOT approved requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement:
1. Portland cement, ASTM C150, Type IA or I/II.
2. For high early strength concrete the cement shall be air-entraining portland cement Type IIIA.
3. Do not use different types of cement, different manufacturers of cement, or different degrees of fineness.

B. Cementitious Materials or Cement Substitutes:
1. Fly Ash: ASTM C618, Class C or F.
2. Ground Granulated Blast Furnace Slag (GGBFS):
   a. ASTM C989 Grade 100 minimum.
   b. Use only as a blending material with Type I or Type IA portland cement.
3. Silica Fume, Dry-Densified:
   a. ASTM C1240.
   b. Use only as a blending material with Type I or Type IA portland cement.
4. Reduce the cement quantity up to a maximum of 25% for fly ash substitution or up to 30% for GGBFS substitution.
5. Fly ash or GGBFS weight additions must equal the weight of the cement reduction.
6. For concrete containing portland cement, fly ash and GGBFS in the same mix design, reduce the cement quantity up to 40%, with the maximum fly ash quantity not exceeding 15%.

C. Aggregates:
   1. Granular Material Class II in accordance with Section 902 of the 2020 MDOT Standard Specifications for Construction
   2. Grade aggregates according to procedures of ASTM C136, Class M, Exposure 4.
   3. Coarse Aggregates: ASTM C33-5S, Number 57 (1-inch), crushed limestone.
   4. Fine Aggregate: ASTM C33.
   5. Test all aggregates for alkali-silica reactivity and provide mitigation method, if required.

D. Water: Clean, fresh and potable.

E. Admixtures:
   1. General:
      a. No admixture shall contain more than 0.1% water soluble chloride ions by mass of cementitious material.
      b. No admixture shall contain calcium chloride.
   2. Air-Entraining:
      a. Comply with ASTM C260.
      b. Daravair series or Darex series, by W.R. Grace & Company; Micro Air, by BASF Admixtures, Inc.; or equal.
   3. Water-Reducing Admixtures:
      a. Provide concrete mixtures with the same strength, air content as the respective concrete without the admixture.
      b. Select water reducing admixtures from MDOT's qualified products list.
      c. Admixture dosage rates are based on the total cementitious material (cement plus fly ash or GGBFS).

F. Release Agent:
   1. Dry-shake powder to facilitate release of imprinting tools as manufactured by Brickform Rafco or Prism Pigments.

G. Curing Agents:
   1. Curing agents shall comply with ASTM C309, Type 2, Class B.
   2. Colored Concrete: Use transparent curing compound meeting subsection 903.05B of the MDOT Standard Specifications for Construction. [ASTM C 309, Type 1 or 1D]. Standard curing compounds cannot be used on colored concrete.

H. Surface Sealer:
   1. Use a "crystal clear" Class A solvent acrylic decorative sealer in low-sheen, anti-slip form from approved list below, or other as approved by the system manufacturer and the ENGINEER.
      a. Brickform – Safety-Seal MS-5
      b. Vexcon Chemicals
         1) Certivex AC 1315 solvent vase sealer (with curing compounds)

2) Certivex Gloss Sealer FT solvent base sealer (without curing compounds)
3) Shur Grip – anti-slip sealer additive.

I. Concrete Reinforcement:
1. In accordance with MDOT requirements and drawings when required.
2. Welded wire fabric in accordance with ASTM A185.

2.02 CONCRETE MIX DESIGN

A. Concrete shall conform to Grade 3500 as shown in Table 1004-1 of the MDOT Specifications. Design mix to project normal-weight concrete consisting of portland cement, aggregate, add mixtures, and water producing the following properties:
1. Cement content: 5.6 sack (526 lbs).
2. Compressive Strength: 3,500 psi (min) at 28 days.
3. Air Content: 6.5% ±1.5%.
4. Slump: 0 to 3 inches or the slump in the approved mix design.
5. Water Cement Ratio: 0.45 maximum.

B. Alkali-Silica Reactivity (ASR):
1. The Concrete supplier is required to evaluate the fine aggregates (only) used in the production of the concrete for ASR.
2. Submit to the ENGINEER ASTM C1260 Accelerated mortar bar test for ASR from the aggregate supplier.
3. Submit to the ENGINEER ASTM C1293 concrete prism expansion for ASR from the aggregate supplier if available, or if necessary.
4. Documentation may include previous testing of materials so long as material source has not changed, and test is not more than 1 year old.
5. No ASR mitigation is required if aggregates are non-reactive where ASTM C1260 accelerated mortar bar test expansion is less than 0.10% at 14 days, or if ASTM C1293 Concrete prism expansion is less than 0.04% at 1 year.
6. If ASTM C1260 mortar bar test results is more than 0.10% expansion at 14 days, ASTM C1293 concrete prism test is required to be performed before aggregates can be used.
7. ASR mitigation is required if aggregates are found to be moderately reactive where ASTM C1293 Concrete prism expansion is equal to or greater than 0.04%, but less than 0.12% at 1 year.
8. Aggregates will not be accepted if ASTM C1293 Concrete prism expansion is equal to or greater than 0.12% at 1 year.

C. Mitigation Methods for Moderately Reactive Aggregates:
1. In accordance with DOT approved Specifications.
2. Use low Alkali Cements:
a. Submit mill test report data and calculations for Cement and Fly ash.
b. Maximum Alkali content of cementitious materials (cement and fly ash) (Na2Oe) (Na2O equivalent) ≤ 3.5 lbs/cyd.

c. Maximum Alkali content in cement (Na2Oe) (Na2O equivalent) ≤ 0.7%.
d. Maximum lime CaO in Fly ash ≤ 20%.
e. Minimum Silica in Fly ash SiO_2 ≥ 35%.
f. Total oxides in Fly ash (SiO_2 + Al_2O_3 + Fe_2O_3) ≥ 60%.

3. Demonstrate the effectiveness of the proposed mix combination to resist the potential for excessive expansion caused by ASR using current and historic data:
   a. ASTM C1567 (14 day test) using both coarse and fine aggregate and all cementitious materials.
   b. Mortar bars constructed of cementitious materials and coarse and fine aggregates must produce an expansion of less than 0.10%.

2.03 SAND CUSHIONS AND SAND FILL

A. Provide sand backfill material for sidewalk base consisting of natural sand composed of granular material resulting from the natural disintegration of rock. This material shall consist of clean, hard, durable, uncoated particles of sand, free from clay lumps and soft or flaky material. Sand used for backfill shall be 4 inches thick and conform to the gradation for Class II material specified in Section 902 of the MDOT Standard Specifications for Construction.

2.04 DETECTABLE/TACTILE WARNING SURFACES

A. Furnish and install tactile surface plate into uncured concrete cement.
   1. In accordance with most current Americans With Disabilities Act (ADA).
   2. Materials: As specified on The City of Port Huron Standard Detail Sheets.

2.05 FORM WORK

A. Provide necessary form work to provide concrete dimensions indicated on the Drawings ±1/2 inch.
   1. Forms to be straight and true, minimum 1 5/8-inch thick wood, full depth of concrete or steel forms.
   2. All curved radius pours to be smooth deflectable steel or wood forms.

2.06 CONTRACTION JOINTS

A. Provide necessary contraction joints to control random cracking with sawcut or hand-troweled joint.
   1. Depth: 1/4 slab thickness minimum, or as indicated on the Drawings.
   2. Cut and space joints as indicated on the drawings.

2.07 EXPANSION JOINTS

A. Joint fiber shall be preformed, composed of either blended, bonded flexible and waterproof fiber meeting the requirements of AASHTO M213 or polyvinyl chloride with fabric strand or ASTM D1751 fiber joint filler.

B. Full depth of concrete.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide smooth 4-inch sand base compacted to at least 98 percent maximum density in accordance with ASTM D1557.

B. Do not place concrete until the surface to be paved upon has been inspected and approved by ENGINEER.

3.02 INSTALLATION

A. Weather, Temperature, and other Limitations:
1. Do not place concrete until the ambient air temperature away from artificial heat is at least 25 degrees F and rising, unless otherwise approved by ENGINEER.
2. Do not place concrete if portions of the base, subbase, or subgrade layer are frozen, or if the grade exhibits poor stability from excessive moisture levels.
3. Temperature of concrete at time of placement shall be between 45 degrees F and 90 degrees F.
4. Paving will not be allowed between November 15 and May 1 without written approval from the St. Clair County Road Commission and City Engineer.

B. Cold Weather Concrete Operations:
1. Comply with the recommendations of ACI 306R.
2. Recommended Protective Measures:
   a. Heating materials.
   b. Providing insulating blankets and windbreaks.
   c. Heated enclosures.
3. Advise ENGINEER of planned protective measures.
4. Straw or similar materials shall not be allowed.
5. Do not use frozen materials or materials containing ice or snow.
6. Do not place concrete on frozen subgrade.

C. Hot Weather Concrete Operations:
1. Comply with the recommendations of ACI 305R.
2. Recommended Protective Measures:
   a. Cooling materials.
   b. Concrete placement during cooler hours of the day.

c. Providing shading and windbreaks.

3. Advise ENGINEER of planned protective measures.

D. Slope:

1. All walks should have a cross slope of a minimum 1% and maximum 2% sloped toward a curb or lower elevation.

E. Preparation of Base:

1. Excavate to the required depth and to a width that will permit forming.
2. Remove unsuitable material below the required depth and replace with suitable material approved by the ENGINEER.
3. Shape and compact the base to conform to the section indicated on the Drawings.

F. Forms:

1. Use fixed forms.
2. Apply form releasing agent to prevent concrete from bonding to forms.
3. Provide straight, full depth forms free of warp and strong enough to resist springing during concrete placement.
4. Firmly stake fixed forms to prohibit movement.

G. Placing and Finishing Concrete:

1. Placing of concrete shall not commence until an approved inspection has been made of the forms and subgrade.
2. Place all concrete in accordance with ACI 304R and ACI 304.2R.
3. Do not exceed the time limits specified in Table 1001-1 of the MDOT Specifications for the time of charging the mixer to complete concrete discharge.
4. Moisten base before placing concrete.
5. Place concrete and consolidate, including along the faces of the forms, before finishing.
6. Place and finish in a continuous operation.
7. When replacing gutters along with concrete walk ramps, construct the gutter to the same dimensions and profile and use the same reinforcement pattern as the existing gutter.
8. Float the surface just enough to produce a smooth surface free from irregularities.
9. Round edges and joints with an approved finishing tool.
10. Broom finish concrete walks, ramps, and driveways by drawing a fine-hair broom across the concrete surface, perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the ENGINEER.
11. Stamped Colored Concrete:
    a. To impact desired texture/stamp, use high-quality resilient mats reproduced from casting of natural materials and proving uniform control of joint depth. Use tools capable of producing the selected pattern. Use imprinting tool(s) from approved manufacturer.

b. Joints should take into account the pattern as approved in the mock-up.

c. Color Release: Apply powder release per manufacturer guidelines at the minimum rate required to cover the previously colored surface. “Liquid Antique” agent can be used as a substitute for dry release. If clear liquid release is to be used, apply per manufacturer guidelines. Colored powder release can be mixed with clear liquid and sprayed on the surface only after imprinting has been completed, to create and accent coloring.

d. Imprint Pattern: Comply with the tool manufacturer’s standard and MCA practices. Lay out to proper alignment and imprint constant depth while concrete is plastic. Do not allow the surface to crust over or harden before stamping. Hand-tool in the areas where imprinting tools are not practical.

e. Removal of Excess Release – Wash off excess release agent with normal water pressure prior to joints being cut. Remove a minimum of 80 percent of the release. Temperature conditions will dictate the timing of the release removal. Dispose of any excess release agent in compliance with local regulations.

f. Acid washing of decorative surface may be required to achieve the desired finish, as directed by the Engineer. A minimum of 36 hours after placement, apply a solution of 1 part muriatic acid to 30 parts potable water to the surface of the paveme3nt and lightly scrub with a straw broom. Wash the surface until proper color has been achieved and then flush thoroughly

g. Sealing Decorative Surface – Seal the surface with approved sealer according to manufacturer’s recommendation.

H. Joints:

1. General: Comply with ACI 318-6.3, 6.4, and ACI 301, Section 6.
   a. Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete.
   b. Construct transverse joints at right angles to the centerline, unless otherwise indicated.
2. Weakened-Plane (Contraction) Joints:
   a. Provide weakened-plane (contraction) joints, sectioning concrete into areas
      1) As indicated on the Drawings.
   b. Contraction joints for curbs shall be provided at 10 foot intervals and 20 foot spacing for slabs, unless shown otherwise.
   c. Construct weakened plane joints for a depth equal to at least 1/4 concrete thickness, as follows:
      1) Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2) Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

3. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.
4. Expansion Joints:
   a. Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
   b. Locate expansion joints at 50 feet on center along linear lengths of walks, and at points of radii of curbs unless otherwise indicated.
5. Extend joint fillers full width and depth of joint, and not less than 1/2 inch or more than 1 inch below finished surface for joint sealant.
6. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than 1 length is required, lace or clip joint filler sections together.

I. Thickness: Except as otherwise specified or indicated on the Drawings, provide a minimum thickness of 4 inches for sidewalks, 6 inches for sidewalk ramps, and 6 inches for driveways.

J. Where walkways cross driveways, provide a minimum thickness of 6 inches.

K. Ramps:
1. As indicated on the Drawings.
2. No ramp shall exceed 1:12 slope.
3. Place detectable warning domed plates in fresh concrete in accordance with Manufacturer's instructions on ramp surface.
4. ADA domes to be 24 inches wide, full width of ramp.

L. Reinforcing:
1. Install reinforcing as indicated on the Drawings.

M. Backfilling:
1. After the concrete has gained sufficient strength, remove fixed forms and backfill with suitable material approved by the ENGINEER.
2. Compact and level the backfill 1-inch below the surface of the concrete.

3.03 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, and formed joints with an edging tool, and round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
   1. Exterior slabs, sidewalks, flow channels, flumes, curbs, and other similar concrete pavement types shall have a non-slip finish by scoring the surface with a fine-hair broom, perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the ENGINEER.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by ENGINEER.

3.04 CURING

A. General:
   1. After texturing operations have been completed and after the free water has left the surface, coat the concrete walk surface and sides of slip-formed concrete walks with a uniform layer of membrane curing compound.
   2. Apply 1 coat of curing compound on non-grooved surfaces and 2 coats on grooved surfaces.
   3. Apply not less than 1 gallon per 25 square yards of concrete for each application.
   4. Apply the second coat after the first has dried sufficiently but do not exceed 2 hours between coats.
   5. Keep the compound thoroughly mixed according to the Manufacturer’s recommendations.
   6. Do not thin curing compound.
   7. Reapply curing compound immediately to surfaces damaged by rain, joint sawing, foot traffic or other activities.
   8. If fixed forms are removed during the curing period, coat the entire area of the sides of the concrete walk with curing compound immediately after removal of forms.

B. These requirements are minimum requirements only.

C. Repair or replacement of concrete showing damage due to inadequate curing is required.

D. All costs associated with this corrective work will be borne by the CONTRACTOR.

3.05 ADA TRUNCATED DOMES

A. Prior to installation, review mix design with concrete supplier and installer to ensure concrete has proper slump and will not set too rapidly to allow for proper installation.

B. Install system in accordance with Manufacturer's specifications and recommendations. Dome panels to be perpendicular and parallel with curb with no gaps between panels. Panels must be level and flush with adjacent concrete walk. Installation must be acceptable to ENGINEER or removed and replaced at CONTRACTOR's expense.

C. Install top of domes flush with top of adjacent concrete along top and sides of plates. Install bottom of domes flush with concrete at lower end of plates.

3.06 PROTECTION

A. Protect the walks and driveways from damage until acceptance of the Work.

B. Protect the concrete from freezing until the concrete has attained a compressive strength of at least 1800 psi.

C. Maintain walks and driveways as clean as practical by removing surface stains and spillage of materials as they occur.

D. Sweep concrete walks and driveways and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

3.07 DEFECTIVE WORK

A. The following list of deficiencies shall be considered defective work and shall be replaced by the CONTRACTOR at no cost to the OWNER:
   1. Difference in elevation between panels of 1/2-inch or greater.
   2. Cracks of any length that are 1/8-inch wide or wider.
   3. Surface spalling covering in excess of 20% of the area of any 1 panel.
   4. A hole that is 1/2-inch or greater in depth and 2 inches or greater in diameter.
   5. Residual splatter that is 1/2-inch or higher and attached to a panel.
   6. Elevation difference of 3/4-inch in 10 feet caused by settling, that has not caused an elevation difference between panels.
   7. Multiple hairline cracking.
   8. Footprints, bike tire tracks, animal tracks, or the like, created while concrete was not cured.
   9. Improperly install tactile warning surface.
   10. ASR cracking or potholing.
   11. Other work identified as defective by OWNER.

3.08 CLEAN-UP

A. For duration of work, CONTRACTOR is to maintain work area free of waste material, debris, and the like.

B. CONTRACTOR shall provide on-site containers as necessary for work of this Section. Locate as directed by ENGINEER.

C. Upon completion and when directed by ENGINEER, CONTRACTOR shall remove all excess material, debris, and equipment.

D. Prior to acceptance of the work, clean the pavement and related areas to remove dirt and stones.

END OF SECTION 32 13 14

SECTION 32 16 13 – CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing and installation of concrete curbs and gutters and concrete driveway openings.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Proposal as a Bid Item:
   1. Concrete Curbs:
      a. Basis of Measurement: Linear feet (LF) along the back of curb as installed.
      b. Basis of Payment: Furnish all labor, equipment, and materials necessary to construct the curb as specified including excavation, compaction, bedding and backfill, disposal of excess excavated material, and seeding of backfill or sodding of backfill as required.
   2. Concrete Driveway Opening (of the type specified):
      a. Basis of Measurement: Linear feet (LF) measured from springline to springline.
      b. Basis of Payment: Furnish all labor, equipment, and materials necessary to construct the driveway opening as specified including reinforcement, excavation, compaction, bedding and backfill, disposal of excess excavated material, and seeding of backfill or sodding of backfill as required.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Publications:
      a. A820 - Steel Fibers for Fiber Reinforced Concrete.
      b. C33 - Specification for Concrete Aggregates.
      c. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      d. C94 - Specification for Ready-Mixed Concrete.
      e. C136 - Sieve Analysis of Fine and Coarse Aggregates.
      f. C150 - Specification for Portland Cement.
      g. C260 - Specification for Air-Entraining Admixtures for Concrete.
      h. C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

i. C330 - Specification for Lightweight Aggregates for Structural Concrete.
j. C494 - Specification for Chemical Admixtures for Concrete.
k. C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

2. ACI – American Concrete Institute:
   a. 117 - Standard Tolerances for Concrete Construction and Materials.
   b. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
   c. 302.1R - Guide for Concrete Floor and Slab Construction.
   d. 303R - Guide to Cast-In-Place Architectural Concrete Practice.
   e. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
   f. 305R - Hot Weather Concreting.
   g. 306R - Cold Weather Concreting.
   h. 309R - Guide for Consolidation of Concrete.
3. Concrete Reinforcing Steel Institute (CRSI):
   a. Manual of Standard Practice – current edition.
   b. Placing Reinforcing Bars – current edition.
4. Americans with Disabilities Act (ADA).
5. MDOT Current Standards:
   a. Specifications for Construction.
   b. Standard Plans.
6. St. Clair County Road Commission (SCCRC) Requirements.
7. The City of Port Huron Requirements.

1.04 SUBMITTALS

A. Action Submittals:
   1. Provide mix design for concrete to be supplied.
      a. Include quantities and sources of all aggregates, cement, cementitious materials, and admixtures to be used.
      b. Submitted from a MDOT certified testing laboratory regularly engaged in designing and testing concrete for exterior paving.
      c. Use test results for mix design from within the past 12 months.
   2. Product Data: Submit Manufacturer’s product data with application and installation instructions for admixtures, curing compounds, expansion joint fillers and sealants.
   3. Alkali-Silica Reactivity (ASR):
      a. Submit to ENGINEER ASTM C1260 Accelerated mortar bar test, and ASTM C1293 Concrete prism expansion for ASR from aggregate supplier.
      b. Documentation may include previous testing (within previous 2 years) of materials and sources intended for use.
      c. Documentation may include previous testing (within previous 2 years) from other projects or records provided by the material suppliers.

1.05 QUALITY ASSURANCE

A. Pre-Paving Meeting:
   1. Meeting held at a time mutually agreed upon with ENGINEER, OWNER, CONTRACTOR and subcontractors involved in the paving work.
   2. Discussion of proposed schedule and methods of accomplishing all phases of the paving work.
   3. Minutes distributed to all in attendance.

B. Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

C. Testing of Materials:
   1. In accordance with Section 01 40 00 "Quality Requirements."
   2. In accordance with approved CONTRACTOR's Quality Control Plan.
   3. In accordance with all applicable standards.

D. Batch tickets: Furnish batch tickets to ENGINEER, or ENGINEER'S representative for material incorporated in the Project to verify that the required concrete mix has been supplied.

E. Batch Plant Certification: Ensure portland cement concrete batch plant is certified to meet the requirements specified in the National Ready Mixed Concrete Association *Certification of Ready Mixed Concrete Production Facilities Quality Control Manual* or other MDOT approved requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement:
   1. Portland cement, ASTM C150, Type IA.
   2. For high early strength concrete the cement shall be air-entraining portland cement Type IIIA.
   3. Do not use different types of cement, different manufacturers of cement, or different degrees of fineness.

B. Fly Ash: ASTM C618, Class F.

C. Aggregates:
1. Grade aggregates according to procedures of ASTM C136, Class M, Exposure 4.
2. Coarse Aggregates: ASTM C33-5S, Number 57 (1-inch), crushed limestone.
3. Fine Aggregate: ASTM C33.

D. Water: Clean, fresh and potable.

E. Admixtures:
1. General:
a. No admixture shall contain more than 0.1% water soluble chloride ions by mass of cementitious material.
b. No admixture shall contain calcium chloride.
2. Air-Entraining:
a. Comply with ASTM C260.
b. Daravair series or Darex series, by W.R. Grace & Company; Micro Air, by BASF Admixtures, Inc.; or equal.

F. Curing Agents:
1. Curing agents shall comply with ASTM C309, Type 2, Class B.

G. Concrete Reinforcement:
1. Reinforcement shall meet MDOT Standard Specifications.
2. Deformed reinforcing bars.
3. ASTM A615, Fy = 60,000 psi.
4. Required only when indicated on the Drawings.

2.02 CONCRETE MIX DESIGN

A. Concrete shall conform to Grade 3500 as shown in Table 1004-1 of the MDOT Specifications. Design mix to project normal-weight concrete consisting of portland cement, aggregate, air-entrained add mixture, and water producing the following properties:
1. Cement Content: 5.6 sack (526 lbs).
2. Compressive Strength: 3,500 psi (min) at 28 days.
3. Air Content: 6.5% ±1.5%.
4. Air content may be reduced to 4.5% if curb and gutter is being installed with slip-form machine.
5. Slump: 0 to 3 inches unless mid-range water reducer is used then slump may be 6 inches.
6. Water Cement Ratio: 0.45 maximum.

B. Sand Cushions and Sand Fill: 4-inches of compacted granular material.

2.03 FORMWORK

A. Provide necessary formwork to provide concrete dimensions indicated on the Drawings ±1/2 inch.
   1. Forms to be straight and true, minimum 1 5/8-inch thick wood, full depth of concrete or steel forms.
   2. All curved radius pours to be smooth deflectable steel or wood forms.

2.04 CONTRACTION JOINTS

A. Construct joints, as approved by the ENGINEER, to ensure a plane-of-weakness at least 1/4 the depth of the section.

2.05 EXPANSION JOINTS

A. Joint fiber shall be preformed, composed of either blended, bonded flexible and waterproof fiber meeting the requirements of AASHTO M213 or polyvinyl chloride with fabric strand or ASTM D1751 fiber joint filler.

2.06 SEALANTS

A. Joint sealant to be hot-poured rubber in accordance with MDOT requirements.

PART 3 - EXECUTION

3.01 GRADING

A. Provide smooth base of granular material compacted to 95% of its maximum density in accordance with ASTM D1557.

3.02 INSTALLATION

A. Weather, Temperature, and other Limitations:
   1. Do not place concrete until the ambient air temperature away from artificial heat is at least 25 degrees F and rising, unless otherwise approved by ENGINEER.
   2. Do not place concrete if portions of the base, subbase, or subgrade layer are frozen, or if the grade exhibits poor stability from excessive moisture levels.
   3. Temperature of concrete at time of placement shall be between 45 degrees F and 90 degrees F.
   4. Paving will not be allowed between November 15 and May 1 without written approval from the St. Clair County Road Commission.

B. Cold Weather Concrete Operations:
   1. Comply with the recommendations of ACI 306R.
   2. Recommended Protective Measures:
      a. Heating materials.
      b. Providing insulating blankets and windbreaks.
      c. Heated enclosures.
   3. Advise ENGINEER of planned protective measures.

4. Straw or similar materials shall not be allowed.
5. Do not use frozen materials or materials containing ice or snow.
6. Do not place concrete on frozen subgrade.

C. Hot Weather Concrete Operations:
1. Comply with the recommendations of ACI 305R.
2. Recommended Protective Measures:
   a. Cooling materials.
   b. Concrete placement during cooler hours of the day.
   c. Providing shading and windbreaks.
3. Advise ENGINEER of planned protective measures.

D. Preparation of Base:
1. Excavate to the required depth and to a width that will permit forming.
2. Remove unsuitable material below the required depth and replace with suitable material approved by the ENGINEER.
3. Shape and compact the base to conform to the section indicated on the Drawings.

E. Forms:
1. Use fixed forms.
2. Apply form releasing agent to prevent concrete from bonding to forms.
3. Provide straight, full depth forms free of warp and strong enough to resist springing during concrete placement.
4. Firmly stake fixed forms to prohibit movement.

F. Reinforcing:
1. Place reinforcement in accordance with CRSI placing reinforcement bars and Manual of Standard Practice.
2. Tolerances indicated in ACI 117.
3. 3-inch minimum cover.

G. Placing and Finishing Concrete:
1. Place all concrete in accordance with ACI 304R and ACI 304.2R.
2. Do not exceed the time limits specified in Table 1001-1 of the MDOT Specifications for the time of charging the mixer to complete concrete discharge.
3. Moisten base before placing concrete.
4. Place concrete and consolidate, including along the faces of the forms, before finishing.
5. Place and finish in a continuous operation.
6. When replacing gutters along with concrete walk ramps, construct the gutter to the same dimensions and profile and use the same reinforcement pattern as the existing gutter.
7. Float the surface just enough to produce a smooth surface free from irregularities.
8. Round edges and joints with an approved finishing tool.

H. Joints:
   1. General: Comply with ACI 318-6.3, 6.4, and ACI 301, Section 6.
      a. Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to the centerline, unless otherwise indicated on the Drawings.
   2. Weakened-Plane (Contraction) Joints:
      a. Provide weakened-plane (contraction) joints, sectioning concrete into areas as indicated on the Drawings.
      b. Contraction joints for curbs shall be 1-1/2 inch deep provided at 10 foot intervals unless indicated otherwise on the Drawings.
   3. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.
   4. Install expansion joints at the end point of curves of all radius curbs.
   5. Seal joints with hot-poured rubber asphalt in accordance with St. Clair County Road Commission standard details.

I. Backfilling:
   1. After the concrete has gained sufficient strength, remove fixed forms and backfill with suitable material approved by the ENGINEER.
   2. Compact and level the backfill 1-inch below the surface of the concrete.

3.03 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screening and floating. Use hand method only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing to create a non-slip finish by scoring the surface with a fine-hair broom, perpendicular to the line of traffic. Repeat operation if required to provide a fine line texture acceptable to the ENGINEER. Finish edges with 1/2-inch radius.

D. Do not remove forms for 24-hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the ENGINEER.

3.04 CURING

A. General:
   1. After texturing operations have been completed and after the free water has left the surface, coat the concrete with a uniform layer of membrane curing compound.
   2. Apply 1 coat of curing compound on non-grooved surfaces and 2 coats on grooved surfaces.
   3. Apply not less than 1 gallon per 25 square yards of concrete for each application.
   4. Apply the second coat after the first has dried sufficiently but do not exceed 2 hours between coats.
   5. Keep the compound thoroughly mixed according to the Manufacturer's recommendations.
   6. Do not thin curing compound.
   7. Reapply curing compound immediately to surfaces damaged by rain, joint sawing, foot traffic or other activities.
   8. If fixed forms are removed during the curing period, coat the entire area of the sides of the concrete walk with curing compound immediately after removal of forms.

B. These requirements are minimum requirements only.

C. Repair or replacement of concrete showing damage due to inadequate curing is required.

D. All costs associated with this corrective work will be borne by the CONTRACTOR.

3.05 PROTECTION

A. Protect the concrete from damage until acceptance of the Work.

B. Protect the concrete from freezing until the concrete has attained a compressive strength of at least 1800 psi.

C. Maintain as clean as practical by removing surface stains and spillage of materials as they occur.

D. Sweep concrete and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

3.06 DEFECTIVE WORK

A. The following list of deficiencies shall be considered defective work and shall be replaced by the CONTRACTOR at no cost to the OWNER:
   1. Cracks of any length that are 1/8-inch wide or wider.
   2. A hole that is 1/2-inch or greater in depth and 2 inches or greater in diameter.
   3. Residual splatter that is 1/2-inch or higher than adjacent concrete.
   4. Elevation difference of 1/4-inch in 10 feet caused by settling or improper forming.
   5. Footprints, bike tire tracks, animal tracks, or the like, created while concrete was not cured.
   6. Other work identified as defective by OWNER.

3.07 CLEANING

A. For duration of work, CONTRACTOR is to maintain work area free of waste material, debris, and the like.

B. CONTRACTOR shall provide on-site containers as necessary for work of this Section. Locate as directed by ENGINEER

C. Upon completion and when directed by ENGINEER, CONTRACTOR shall remove all excess material, debris, and equipment.

D. Prior to acceptance of the work, clean the pavement and related areas to remove dirt and stones.

END OF SECTION 32 16 13

SECTION 33 40 00 – STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the furnishing and installation of a storm sewer system.

1.02 UNIT PRICE – MEASUREMENT AND PAYMENT

A. The cost of all work under this item shall be included in the cost of the Project and no separate payment shall be made therefore unless listed in the Bid Form as a Bid Item.

B. When listed in the Bid Form as a Bid Item:
   1. Sewer (of the type, class, size, and trench detail specified):
      a. Basis of Measurement: Foot (Ft). Measured at ground level from center to center of the appurtenances connected by the sewer pipe or end of pipe.
      b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to furnish, install, and place into service the sewer pipe or culvert, including: Pipe, pipe fittings, and all other appurtenances; connections to existing or proposed manholes and/or pipe; existing sewer line connections into proposed system; patching and plastering of manholes that have been "cut into"; excavation; disposal of surplus excavation; bulkheads; dewatering; stabilization of trench subgrade; sheeting and bracing trenches; bedding material; special bedding in unstable soil; compacted backfill (trench Detail A or B, as required by the city of Port Huron Standard Detail Drawings); plugging or capping existing utilities where required; repairing or replacing all existing utilities damaged as a result of construction operations; replacement of pavement and sidewalks (unless listed as a separate item in the Bid Form); maintenance aggregate; temporary pavement and patching; fence removal and replacement; mail box removal and replacement; landscape (ornamental trees, bushes, and shrubs) removal and replacement; sprinkler system removal and replacement; and road, curb and gutter, sidewalk, parking lot, paved spillways and driveway restoration; regrading disturbed road ditches; swale restoration; resetting culverts; restoring shoulders; final grading, seeding and cleanup; and other necessary work incidental to the construction of sewer not specifically listed.
      Seventy percent of the Unit Price for sewers will be considered earned when the pipe is satisfactorily installed. An additional 20 percent of the Unit Price for sewer will be considered earned when the roadways, driveways, and drainage are restored and maintained

in a satisfactory, useable condition. The balance of the Unit Price for sewers will be considered earned after the sewer has been finally inspected and the sewer placed in service; finish grading (including final ditching of the project area) has been completed; the seeding and mulching (or sodding if specified on the drawings) has been completed; and the aggregate roadways and streets have been fully restored.

2. Manholes, Catch Basins, Inlets, Tee Manholes, Junction Chambers, or Other Storm Drainage Structures:
   a. Basis of Measurement: Each (EA).
   b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to install the structure and appurtenance completely as detailed on the drawings, including: excavation; disposal of surplus excavation; bulkheads; dewatering; stabilization of trench subgrade; sheeting and bracing trenches; bedding material; special bedding in unstable soil; compacted backfill (to match trench Detail A or B used for the utility pipe, as required by the city of Port Huron Standard Detail Drawings); precast concrete structure; reinforcing steel; brick and/ or blocks; mortar; plastering; forms and forming reinforced concrete structures; forming and shaping of bottom fillets; sleeves; pipes; pipe fittings, connections, grates; steps; frame and cover; fittings; thrust blocks; connections; plugging or capping existing utilities where required; repairing or replacing all existing utilities damaged as a result of construction operations; replacing surface conditions; and all other incidental work not specifically listed.
3. Underdrain(of the type, class, size, and trench detail specified):
   a. Basis of Measurement: Foot (Ft).
   b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to furnish, install, and place into service the underdrain as specified on the plans and per MDOT.
4. End Section (of the type and size specified):
   a. Basis of Measurement: Each (EA).
   b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to furnish, install, and place into service the end section.
5. Dr Structure Cover (of the type and size specified):
   a. Basis of Measurement: Each (EA).
   b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to furnish, install, and place into service the frame and cover.
6. Outlet Control Structure:
   a. Basis of Measurement: Each (EA).
   b. Basis of Payment: Furnishing all labor, equipment, and materials necessary to install and place into service the outlet control structure.

1.03 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standards:
      a. A48 - Gray Iron Castings.
      b. A536 - Ductile Iron Castings.
      c. C14 - Concrete Sewer, Storm Drain and Culvert Pipe.
      d. C55 - Concrete Building Brick.
      e. C62 - Building Brick (Solid Masonry Units Made from Clay or Shale).
      f. C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
      g. C139 - Concrete Masonry Units for Construction of Catch Basins and Manholes.
      h. C270 - Mortar for Unit Masonry.
      i. C443 - Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets.
      j. C478 - Precast Concrete Manhole Sections.
      k. C497 - Method of Testing Concrete Pipe, Sections or Tile.
      l. C822 - Definitions of Terms Relating to Concrete Pipe and Related Products.
      m. C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
      n. C924 – Standard Practice for Testing Concrete Sewer Lines by Low-Pressure Air Test Method.
      o. C1103 – Standard Practice for Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Line.
      p. D449 - Asphalt Used in Dampproofing and Waterproofing.
      q. D520 - Zinc Dust Pigment for Paints.
      r. D3350 - Standard Specifications for Polyethylene Plastic Pipes and Fitting Materials.
      s. F449 - Subsurface Installation of Corrugated Thermoplastic Tubing for Agricultural Drainage or Water Table Control.
      t. F1417 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
   2. AASHTO Standard Specifications:
      a. M36 - Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
      b. M167 - Standard Plate for Pipe, Pipe Arches, and Arches.
      c. M190 - Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
      d. M218 - Steel Sheet, Zinc-Coated (Galvanized) for Corrugated Steel Pipe.
      e. M274 - Steel Sheet, Aluminum-Coated (Type 2) for Corrugated Steel Pipe.
      f. M288 - Geotextiles Used for Subsurface Drainage Purposes.
   3. MDOT Current Standards:
      a. Specifications for Construction.

b. Standard Plans.

4. St. Clair County Road Commission (SCCRC) Requirements.
5. The City of Port Huron Requirements.
6. Office of St. Clair County Public Services Commissioner.

1.04 DEFINITIONS

A. Abbreviations:
1. RCP - Reinforced concrete pipe.
2. CSP - Corrugated steel pipe.
3. PVC - Polyvinyl chloride.

1.05 SUBMITTALS

A. Action Submittals: For Product Data:
1. Pipe.
2. Manholes.
3. Catch Basins & Inlets.
4. End Sections.
5. Water Quality Structures.

B. Informational Submittals: Submit Manufacturers' sworn statements that the pipe materials furnished comply with this Specification

1.06 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Testing of Material Installation:
1. Light or reflected light test for alignment.
2. Visual inspection for leakage and workmanship.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to OWNER.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. RCP: Northern Concrete Pipe; or equal.

B. CSP: Contech; St. Regis Culvert, Inc.; or equal.

C. PVC: Contech; JM Eagle; or equal.

2.02 PIPE MATERIALS

A. RCP:
1. General: Type and class as indicated on the Drawings.
2. Types:
a. Reinforced Concrete (RCP): ASTM C76.
3. Joints:
a. Premium O-ring or Profile Gasket and shall conform to ASTM C-443. Lubricants by pipe Supplier.
b. With OWNER approval, bituminous compound joint filler material may be allowed for rear yard storm sewer (ASTM D994) provided joints are covered in geotextile fabric and the pipe is bedded in sand.
1) Geotextile Fabric: Nonwoven. Width: 3 feet.
2) Physical Requirements:

	Geotextile Blanket	Geotextile Blanket with MDOT Class II Backfill
Grab Tensile Strength (Minimum), Lbs.	90	
Trapezoid Tear Strength (Minimum), Lbs.	45	
Puncture Strength (Minimum), Lbs.	45	
Mullen Burst Strength (Minimum), PSI	140	100
Permittivity Per Second, Sec^{-1}	0.5	
Apparent Opening Size (Maximum), MM	0.21	0.30 (Pavement and Foundation Underdrains) 0.60 (Other Areas)

3) For pipe wrap where backfill around the pipe meets MDOT granular material Class II requirements; geotextiles, including knitted polyester sock, which meet the following minimum requirements in the applied condition are permitted:
a) Mass/Unit Area: 3.0 oz/sq. yd.

b) Mullen Burst Strength: 100 psi.
c) Maximum Apparent Opening Size: 0.30 mm for pavement and foundation underdrains; and 0.60 mm in all other areas.

4. End Sections:
   a. As indicated on the Drawings.
   b. Type:
      1) Flared concrete end section with concrete footing.
5. Bar Screen: As indicated on the Drawings.

B. CSP:
1. General: Type, gage, and corrugations as indicated on the Drawings.
2. Types:
   a. Galvanized: AASHTO M36.
      1) Zinc-coated Sheets: AASHTO M218.
   b. Bituminous-coated: AASHTO M190.
3. Corrugations:
   a. Pitch and Depth:
      1) 12-inch to 72-inch Diameter: 2-2/3-inch x 1/2-inch.
4. Wall Thickness:
   a. Minimum: 0.064 inches (16 gage), unless indicated otherwise on the Drawings.
5. Coupling Bands:
   a. Pipe Diameters 12 Inches to 36 Inches with Annular Corrugations or Reformed Ends:
      1) Corrugated band with sleeve gasket; or
   b. Coating: Match pipes being connected.
   c. Wall Thickness: Match pipes being connected.
   d. Width:

Coupling Width	Pipe Diameter
7 inches	18 inches and less
12 inches	24 inches through 60 inches
24 inches	Over 60 inches

6. End Sections:
   a. As indicated on the Drawings.
7. Bar Screen: As indicated on the Drawings.

C. PVC Pipe:
1. General: PVC pipe may be allowed for roof drain connections to manholes or catch basins. Type and schedule as indicated on the Drawings.
2. Types:
   a. Smooth Walled:
      1) 4-inch to 15-inch ASTM D3034.
      2) 18-inch to 48-inch ASTM F679.
   b. Ribbed ASTM F794.
3. Section Properties:

a. SDR 23.5.
b. Schedule 40.
c. Truss Pipe

4. Joints:
   a. Push-on Type Joint.
   b. ASTM D3212.
5. Fittings: Manufactured and furnished by the pipe Supplier.

2.03 MANHOLES, CATCH BASINS AND INLETS

A. Type of Units:
1. As indicated on the Drawings:
2. Precast Reinforced Concrete:
   a. Base Section: ASTM C478, precast or poured concrete base.
   b. Riser and Cone Sections: ASTM C478.
   c. Joints: Premium O-ring or Profile Gasket conforming to ASTM C443.
3. Radial Concrete Block:
   a. Base Slab: ASTM C478, separate base slab.
   b. Blocks:
      1) ASTM C139.
   c. Joints: Mortar: ASTM C270, Type M.

B. Hardware:
1. Steps:
   a. General:
      1) Steps shall be placed in all catch basins more than 7 feet deep or catch basins with oil/grease separators.
      2) Steps shall be factory installed by M.A. Industries, PS-1 (precast manhole), PS1-B (block manhole) polypropylene, or approved equal.
      3) If steps are to be installed, than eccentric cones shall be installed (per ASTM C-478 for pre-cast structures)
2. Castings: in accordance with the city of Port Huron Standard Detail Drawings.
3. Mortar: ASTM C270, Type M.
4. Brick:
   a. Concrete: ASTM C55, Type I, Grade N.
5. Grade Rings: ASTM C478.
6. Concrete: MDOT S3.
7. Waterproofing:
   a. Bituminous: ASTM D449.

PART 3 - EXECUTION

3.01 PREPARATION

A. Alignment and Grade:
   1. If there is a grade discrepancy or an obstruction which is not indicated on the Drawings, notify OWNER and obtain instructions prior to proceeding.
   2. Where Storm Sewer Crosses Water Main:
      a. Expose water main prior to laying storm sewer to verify existing depth.
      b. Maintain minimum clearance of 18 inches unless otherwise indicated on the Drawings or approved by OWNER.
      c. Space joints equidistant from crossing.
   3. Control:
      a. Level and Grade Rod: Check line and grade at each structure or cleanout, and 25 foot intervals thereafter.
      b. Laser Beam:
         1) Check Line and Grade At: Set-up point, 25 feet, 50 feet, 100 feet and 100-foot intervals thereafter.
         2) Reset laser at each manhole with a 600 feet maximum.
      c. Allowable Deflection:
         1) Horizontal: 0.20 feet.
         2) Vertical: 0.10 feet.

3.02 INSTALLATION

A. General:
   1. Install pipe, fittings and appurtenances in accordance with Manufacturer's recommendations except as herein specified or indicated on the Drawings.
   2. Prevent entrance of foreign material.

B. Pipe Laying for Concrete and PVC Pipe:
   1. Bearing: Support entire length of pipe barrel evenly with extra excavation at joints.
   2. Direction: Commence at outlet and proceed up grade with spigot ends pointing in direction of flow.
   3. Method:
      a. Wipe clean the socket of pipe last laid.
      b. Center spigot end of pipe to be laid and push home against base of socket.
      c. Center pipe to form a sewer with a uniform invert.

C. Pipe Laying for CSP Culvert:
   1. Bearing: Support entire length of pipe barrel evenly with extra excavation at joints.
   2. Direction: Commence at outlet and precede upgrade with inside laps of circumferential joints pointing in direction of flow, and with no longitudinal joints in the lower quadrant.
   3. Method:
      a. Put coupling band into position at the end of pipe last laid with band open to receive next section.

b. Bring next section into position within about 1-inch of section last laid.
c. Clean the interior of band and exterior of pipe of all dirt, stones and debris.
d. Center pipe to match connecting parts of both the band pipe sections.
e. Insert bolts and tighten.

D. Tolerances:
1. The maximum allowable deviation from grade for gravity flow pipe shall be 2 percent of the pipe diameter, but not more than 0.1 foot.
2. Maximum allowable deviation from line between manholes:
a. 3 inches for pipe 8 to 12 inches in diameter.
b. 6 inches for pipe 15 to 24 inches in diameter.
c. 9 inches for pipe greater than 24 inches in diameter.
d. Maximum deflection per pipe shall be 1 inch.

E. Jointing:
1. Bituminous Compound:
a. Surfaces of Joint: Clean and dry before compound is applied.
b. Apply bituminous compound to the spigot or tongue of the pipe in sufficient quantity to completely fill the space between the pipe tongue and the mating pipe bell when the joint is pushed home.
c. Pipe 36 inches and larger shall have the inside of the joint pointed with mortar by removing the bituminous compound to a minimum depth of 3/4 inch and filling this space with mortar. Pipe smaller than 36 inches in diameter shall not require pointing.
2. Lubricants: As required for coated CSP pipe. As required for gaskets.
3. Gaskets:
a. Surfaces of Joint: Clean and dry before lubricant is applied.
b. Take care in laying that the pipe does not shift and that it remains in a home position after assembly.
4. Band Connector for CSP:
a. Bar, Bolt, and Strap: Tighten bolts to a torque of 100 to 300 foot pounds.
5. Geotextile Wrap: Wrap around joint surfaces.
6. Allowable Joint Tolerance:
a. Maximum: 1/2-inch at newest surfaces of the joint.
b. Allowable joint tolerance shall not affect the lines and grades and their permissible to tolerances.

F. Manholes:
1. Base Section Placement: Full and even bearing.
2. Precast Units: Mortar joints, lift holes, and around pipes.
3. Block Units:
a. Block: Set in full bed of mortar with key slots filled.
b. Joints: Maximum 1/2-inch wide at inside face and wiped.
c. Exterior coating: 1/2-inch mortar coat outside surface.

4. Top of Casting Elevation:
   a. Bituminous Base Course: At base course grade.
   b. Final Wearing Surface:
      1) At finished grade.
      2) Adjustment of castings from base course grade to finished grade is included in the cost of the manhole.
      3) Other Areas: As directed by the OWNER or indicated on the Drawings.
5. Waterproofing: Prevent visible leakage.
6. Refer to standard detail on the Drawings.

G. Catch Basins and Inlets:
1. Base Section Placement: Full and even bearing.
2. Precast Units: Mortar joints, lift holes and around pipes.
3. Block Units:
   a. Block: Set in full bed of mortar with key slots filled.
   b. Joints: Maximum 1/2-inch below gutter grade.
   c. Exterior coating: 1/2-inch mortar coat outside surface.
4. Casting Elevation:
   a. Gutter Area: 1/2-inch below gutter grade.
   b. Other Areas: As indicated on the Drawings or directed by OWNER.
5. Waterproofing: Prevent visible leakage.
6. Refer to standard detail on the Drawings.

H. Connections:
1. To Existing Structures: Relay and repoint loose blocks and bricks as required.
2. For Future Use:
   a. Bulkhead: With 8-inch thick brick and mortar and 1/2-inch plaster outside.

3.03 REPAIR

A. Treatment of Field Welds and Damaged Galvanized Steel Surfaces:
1. Clean with wire brush.
2. Two coats of zinc rich paint conforming to ASTM D520.

3.04 CLEANING

A. Debris: Remove all dirt and debris, including cemented or wedged material from the inside of all sewers, manholes, and catch basins.

B. Final Acceptance: Clean all sewers, manholes, and catch basins before requesting final acceptance.

3.05 TESTING AND INSPECTION

A. Observation: By OWNER.

B. Alignment and Grade Tests:
   1. Visual:
      a. Each manhole to manhole section.
      b. Mirrors or Lights: Adequate to illuminate the section.

END OF SECTION 33 40 00

Michigan Department of Transportation

MAINTAINING TRAFFIC TYPICALS

MDOT Michigan Department of Transportation		COVER SHEET	COVER SHEET	DATE: JUNE 2021
		NO:		SHEET: 1 OF 1
FILE: Cover.dgn				

DISTANCE BETWEEN TRAFFIC SIGNS, "D"

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
	25	30	35	40	45	50	55	60	65	70	75
D (FEET)	250	300	350	400	450	500	550	600	650	700	750

GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE, "B"

"B" LENGTHS	SPEED,* MPH (PRIOR TO WORK AREA)											
	20	25	30	35	40	45	50	55	60	65	70	75
B (FEET)	33	50	83	132	181	230	279	329	411	476	542	625

* POSTED SPEED, OFF-PEAK 85TH PERCENTILE SPEED PRIOR TO WORK STARTING, OR THE ANTICIPATED OPERATING SPEED.

MINIMUM MERGING TAPER LENGTH, "L" (FEET)

OFFSET (FEET)	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
	25	30	35	40	45	50	55	60	65	70	75
1	11	15	21	27	45	50	55	60	65	70	75
2	21	30	41	54	90	100	110	120	130	140	150
3	32	45	62	80	135	150	165	180	195	210	225
4	42	60	82	107	180	200	220	240	260	280	300
5	53	75	103	134	225	250	275	300	325	350	375
6	63	90	123	160	270	300	330	360	390	420	450
7	73	105	143	187	315	350	385	420	455	490	525
8	84	120	164	214	360	400	440	480	520	560	600
9	94	135	184	240	405	450	495	540	585	630	675
10	105	150	205	267	450	500	550	600	650	700	750
11	115	165	225	294	495	550	605	660	715	770	825
12	125	180	245	320	540	600	660	720	780	840	900
13	136	195	266	347	585	650	715	780	845	910	975
14	146	210	286	374	630	700	770	840	910	980	1050
15	157	225	307	400	675	750	825	900	975	1050	1125

NOT TO SCALE

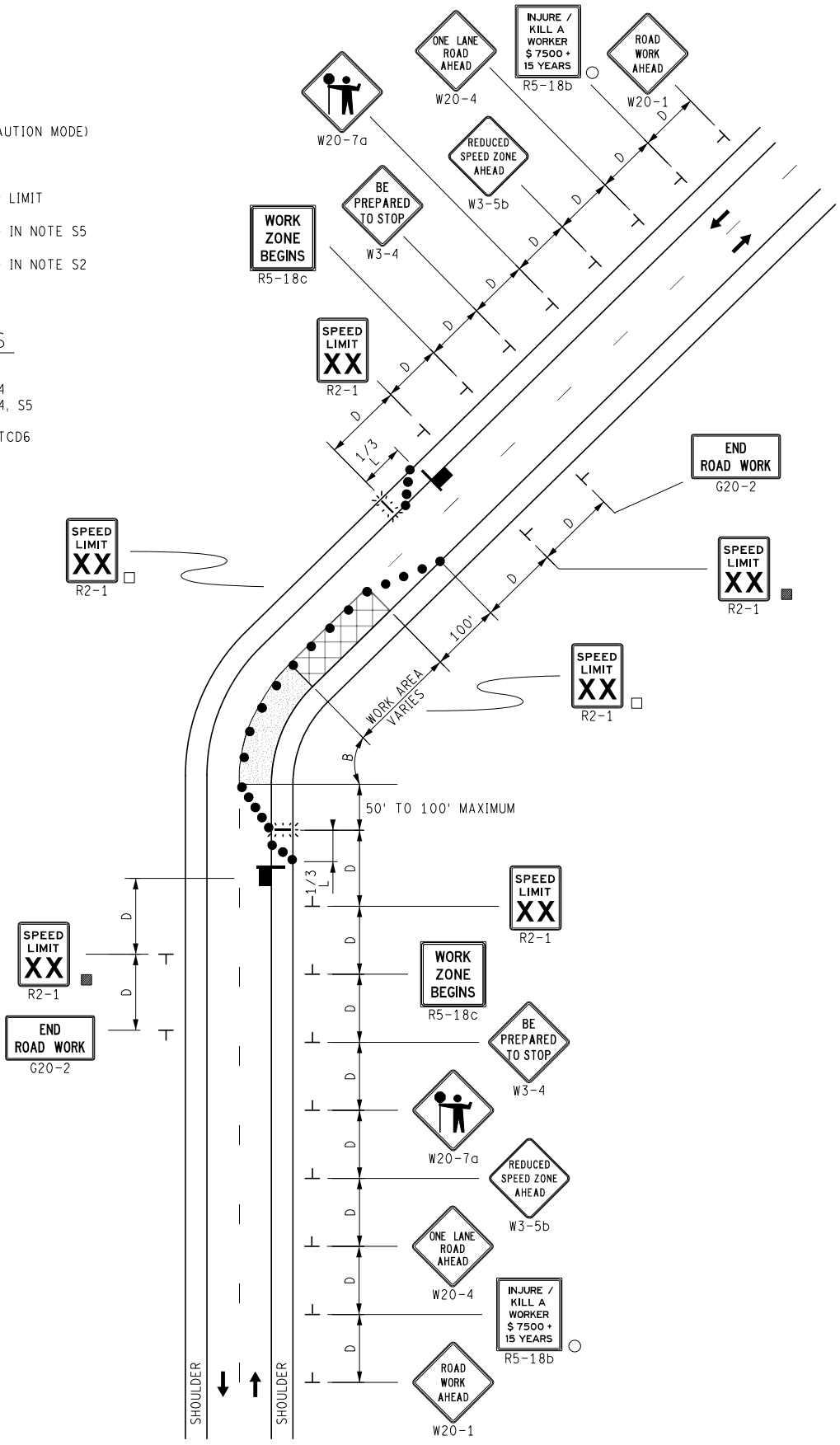
KEY

- TRAFFIC REGULATOR
- CHANNELIZING DEVICES
- LIGHTED ARROW PANEL (CAUTION MODE)
- TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- PLACE SIGN AS INDICATED IN NOTE S5
- PLACE SIGN AS INDICATED IN NOTE S2

STANDARD NOTES

(SEE GEN-NOTES)

GENERAL: G1, G2, G3, G4
SIGNING: S1, S2, S3, S4, S5
TRAF REG: TR1, TR2
DEVICES: TCD1, TCD2, TCD6



MDOT Michigan Department of Transportation	NOT TO SCALE	MAINTAINING TRAFFIC TYPICAL	LANE CLOSURE UTILIZING TRAFFIC REGULATORS ON A 2-LANE UNDIVIDED ROADWAY	DATE: MAY 2021
FILE: 110-TR-NFW-2L.dgn		NO: 110-TR-NFW-2L		SHEET: 1 OF 1