

S-1 (2301) FABRICATION AND PLACEMENT OF PRECAST CONCRETE PAVEMENT PANELS

REVISED 2/2/2005

SP2000-???

S-1.1 DESCRIPTION

Furnish and install reinforced precast concrete highway pavement slabs as shown on the plans in accordance with this specification.

These special provisions apply to removal of the existing portland cement concrete pavement as shown on the plans, replacement and construction, as shown on the plans, requires construction of the Super-Slab™ precast pavement system. The Super-Slab™ system consists of reinforced precast concrete panels with cast-in features for establishing load transfer, lane-to-lane ties, and uniform support under the panels. The method of panel placement as described in these special provisions is a vital feature of the Super-Slab™ paving system, for which no proposal for alternate construction method will be accepted. "Or equal" systems are not allowed in this contract.

S-1.2 PRE-PLACEMENT MEETING

Supervisory personnel of the Contractor, technical representative of the Super-Slab™ System, precast panel fabricator, and any subcontractor who will be involved in the precast pavement construction work shall meet with the Engineer at a preconstruction conference, at a mutually agreed time and location, to discuss the methods of accomplishing the work and the contingency plan.

The Contractor shall provide a facility for the conference. The facility shall be at a location agreed to by the Engineer and Contractor. The conference shall be conducted by the Engineer. All conference attendees shall sign an attendance sheet provided by the Engineer. Fabrication and placement of the precast concrete panels or any of the preparatory work shall not proceed until the above-mentioned personnel have attended the preconstruction conference.

In addition to the preconstruction conference, the technical representative for the Super-Slab™ System shall conduct training on the installation techniques and requirements of the Super-Slab™ system. Attendance at this training is mandatory for the project superintendent, construction foreman, the project surveyor, grout suppliers, grout installers, equipment operators involved in operating the SUPERGRADER™ (or other specialized grading equipment) and setting the panels, any subcontractors involved in installation of the panels, and the Engineer or his designated representative(s). The training shall be in addition to the preconstruction conference and shall be scheduled no more than 2 weeks prior to the placement of the panels. The training shall be held during normal working hours.

The Contractor shall present a detailed schedule breakdown of each task required to place the precast pavement within the allotted time. Schedule backup including equipment type, quantity and production rates shall also be provided.

S-1.3 MATERIALS

A) Portland Cement Concrete shall conform to the requirements of Specification 3126, 3137, and 2461. The Mix Design shall be 3W36 and have a minimum compressive strength of 3900 psi at 28 days. The Precast Fabricator shall submit a mix design to the Engineer for approval.

B) Reinforcing and Tie Bars shall conform to the requirements of Specification 3301 unless otherwise shown on the Contract Drawings.

C) Cement Bedding Grout shall meet the following requirements:

- (1) Compressive Strength - When tested in accordance with ASTM C 109, a minimum of 500 pounds per square inch in 24 hours.
- (2) Shrinkage - When tested in accordance with ASTM C157, the dry shrinkage shall be less 0.04% at 28 days.
- (3) Flowability - When tested in accordance with ASTM C939 using a ½ inch flow cone, the flowability shall be 30 seconds or less.

D) Miscellaneous Materials

- (1) Chairs, Bolsters and other metal supporting devices - All chairs, bolsters, and other metal supporting devices shall be ASTM A666 Stainless Steel Type 316L, or carbon steel with 1/2 inch long plastic coated leg ends.
- (2) Foam Gaskets - Two pound polyester foam gasket material meeting the requirements of ASTM D3574 installed as shown on the plan sheets to create discrete grout chambers.

E) Joints

- (1) Preformed bituminous joint filler shall conform to the requirements of Specification 3702 and shall be punched to admit dowels. Filler for each joint shall be furnished in a single piece for the full depth and width required for the joint.
- (2) Dowels shall be 1 ½ inch diameter, 18 inches long, epoxy coated, spaced 12 inches on center and shall conform to the requirements of Specification 3302.
- (3) Precast forms shall be capable of maintaining dowels and slot formers in proper position and alignment both before and during concrete placement in plant. Embed dowels as shown on the Contract Drawings.
- (4) Longitudinal and transverse joints shall be sealed according to Specification 3725 and in accordance with standard plans and plates.

F) Grout for Dowel Slots shall meet the following requirements:

- (1) Compressive Strength - When tested in accordance with ASTM C 109, a minimum of 2500 pounds per square inch in eight hours, or prior to opening to traffic, whichever results in the shorter curing period.
- (2) Shrinkage - When tested in accordance with ASTM C157, the dry shrinkage shall be less 0.04% at 28 days.
- (3) Freeze-Thaw Resistance – Maximum of 1.0% loss
- (4) Flowability - As required to completely fill the slots under the weather conditions expected at the time of grouting.
- (5) Twenty-one days prior to installation of the precast pavement mix a trial batch of the grout for dowel slots to demonstrate to the Engineer the flowability and compressive required strength can be achieved. The Engineer will test the trial batch in accordance with ASTM C 109.

G) Cushion Sand for the Setting Bed

The cushion sand shall be crusher run limestone (stone dust) free of unsuitable materials. All processing shall be completed at the source and the gradation shall meet the following:

Sieve Size Designation	Percent Passing By Weight
½ inch	100
No. 4	80 – 100
No. 10	55 – 75
No. 40	10 – 40
No. 200	0 - 20

A) Connections - Design, detail and provide anchors, dowels, bolts, steel inserts, connecting plates and any additional reinforcement as required in connection with the fabrication and placing of precast concrete units to be held in position rigidly to prevent displacement while concrete is being placed and cured. All welding shall be in accordance with applicable sections of AWS D 1.4 and AWS D1.5.

B) The concrete slabs shall be cast to the following tolerances:

Length	+/- ¼ inch
Width	+/- ¼ inch
Thickness	+/- 1/8 inch
Difference in diagonals	not to exceed ¼ inch
Edge Squareness	1/8 inch in 10 inches (in relation to top and bottom surfaces)

C) Dowel Bars, dowel slots and assemblies shall be checked for position and alignment. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 2 percent or ¼ inch per foot of dowel bar. Dowel position shall meet the following:

- (1) Horizontally, within plus or minus ½ inch of specified spacing.
- (2) Vertically, within plus or minus ½ inch at mid-depth of slab.
- (3) Midpoint of the dowel relative to the center of the joint, within one inch.
- (4) Dowel Slot centers shall horizontally align within ¼ inch of the matching dowel bar.

D) In-Place Pavement Requirements

- (1) Pavement Alignment
 - (a) Lateral and longitudinal deviation from the alignment of the pavement edge shown on the Contract Drawings shall not exceed plus or minus 0.04 foot.
 - (b) Vertical deviation from the grade shown on the Contract Drawings shall not exceed plus or minus 0.04 foot.
- (2) The surface planes of the newly placed adjacent panels shall be within plus or minus 1/8" of each other vertically.
- (3) Edge Elevation Differential - The difference in elevation across a joint between slabs shall not exceed .02 foot.
- (4) No cracks or spalls.
- (5) Finished surface shall be smooth, even textured, uniform in color and free of surface defects and blemishes.

S-1.5 FABRICATION

All concrete shall be cast in forms at a plant before delivery to the construction site.

Fabricate precast concrete pavement slabs to conform to the shape and size shown on the contract drawings. The Contractor is advised that certain elements and/or processes contained in the plans and this specification for Precast Concrete Highway Pavement Slabs (Super-Slab™) may be patented or subject to patents pending by the Fort Miller Company, Inc. of Schuylerville, NY (518) 695-5000.

A) Cast pavement slabs to the length and width indicated on the plans. Cast slabs as single planed or warped planed as shown on the shop drawings and provide drawings for Engineers review. Label each slab clearly showing the mark number, date of manufacture, fabricator and the Mn/DOT project number.

B) Fabrication shall be governed by the provisions of 3238 unless superceded by any additional requirements contained herein.

C) Formwork

- (1) Construct forms to withstand all casting, stripping and handling operations.

- (2) Construct forms to maintain units within the tolerances specified in 1.4B.
- (3) Securely attach anchorage devices to formwork in locations not affecting position of main reinforcement or placing of concrete.
- (4) Forms shall be made of steel.
- (5) Forms shall remain in place until a lifting and stripping strength requirement of 3000 pounds per square inch compressive strength is achieved.
- (6) All forms and beds shall be thoroughly cleaned after each use.

D) Reinforcement

- (1) Fabricate and place concrete reinforcement as shown on Contract Drawings and on approved shop drawings in accordance with 2472.
- (2) Bend all concrete reinforcement cold. Heating of bars or steel wire is prohibited.
- (3) Clean concrete reinforcement of loose rust, mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- (4) Additional reinforcing, if required, shall be provided to resist all tensile stresses incurred during handling and placement.
- (5) Reinforcing Bar Accessories and Reinforcing Bar Couplers shall be of a non-corrosive type to suit the condition, or as specified on the Contract Drawings.
- (6) All reinforcement in precast concrete units shall be epoxy coated unless otherwise noted on the Contract Drawings.

E) Dowels

- (1) Place dowels of required size and type, at locations shown on the Contract Drawings.
- (2) Set all dowels accurately, parallel to the pavement surface and perpendicular to the pavement joint to within tolerance of the dimensions shown on the Contract Drawings.
- (3) Support dowels rigidly using approved assemblies capable of holding dowels in position during the entire fabrication.
- (4) After fabrication, protect dowels against damage during lifting, handling and transporting.

F) Casting

- (1) Place concrete in continuous operation.
- (2) Provide block-outs for openings as required.
- (3) Provide permanent markings on precast units to identify pickup points and location in pavement.
- (4) Curing of precast concrete shall be by either in accordance with 2405. Requirements of 2405.3F3 shall apply when any external source of heat is used.

G) Surface Texturing

- (1) Fill all air pockets and holes over 1/2 inch in diameter using a sand-cement paste. Sand-cement paste shall be taken from concrete mix being used after being screened from a 3/8" sieve. For exposed areas, form offsets or fins over 1/8 inch shall be ground smooth.
- (2) Provide smooth surfaces on the bottom and side surfaces of each slab; provide an astroturf carpet or broom type finish to the top surface of the slab by dragging the carpet transversely to the traffic direction, or as ordered by the Engineer.
- (3) Provide two identical samples (minimum 0.6-m by 0.6-m size) of the specified finish and submit them to the Engineer for approval. The Engineer shall return one sample to the precast plant where it will be kept throughout the production process for quality assurance purposes. Match the texture of the production precast slabs to the finish of the approved texture samples.

H) Top Edges - Round the top edges of all panels with a hand stone to prevent chipping during handling and installation. No Chamfering on the top edge will be allowed.

I) Unless approved by the Engineer, do not drill or cut holes or install sleeves in precast concrete units larger than size permitted by precast concrete manufacturer for pipe, conduits duct or other penetrations after fabrication.

J) Do not cut reinforcing without written approval of the manufacturer and as acceptable to the Engineer.

K) Quality Control/Quality Assurance

Contractor's Quality Control

(1) Precast Plant

(a) The Precast manufacturer's production facility shall be certified through either NPCA or PCI.

(b) The plant quality control and engineering shall be under the direction of an engineer with at least five years experience in this field.

(2) Precast Concrete Installer Qualifications

The entity performing installation of precast concrete pavement can demonstrate the abilities required under this Contract. The qualifications include:

(a) Ability to lift, handle and transport precast concrete units of similar size and weight.

(b) Ability to install precast concrete units to within the same or stricter tolerances required in 1.4C.

Engineer's Quality Assurance Inspections

(1) At the Precast Plant

(a) Prior to shipment the Engineer will approve each precast concrete unit, subject to the following:

(b) Each unit shall be free of cracks and spalls.

(c) Dimensions shall meet the tolerance requirements of 1.5A.

(d) Concrete will be tested in accordance with and meet the requirements of 2461.

(e) Dowel bars and slots will meet the requirements of 1.4C

(f) Surface finish will meet the requirements of 1.5G.

(2) At the Storage Area

(a) Upon delivery to the storage area and as precast units are stacked, they will be inspected by the Engineer for any damage due to handling and transport. All repairs to the precast units shall be performed according to a written repair plan submitted and approved by the Engineer.

(b) Any units which are cracked, have more than one dowel bar bent out of tolerance or are spalled greater than six inches in any dimension shall be removed and replaced with a new precast unit at no cost to the Agency.

(c) Spalls less than six inches shall be repaired as approved by the Engineer.

(d) When a single dowel is bent out of tolerance, it shall be cut off flush with the face of the edge of the precast unit.

(3) Acceptability of precast concrete units is at the sole discretion of the Engineer. Any remedial work ordered by the Engineer shall be at no additional cost to the Agency.

(L) Delivery, Storage and Handling

(1) The manufacturer's instructions for handling and transportation of precast concrete units shall be followed.

(2) Lift units at designated points only, using approved lifting inserts.

(3) Do not place units in positions that will cause overstress, warp, or twist.

(4) Protect units from dirt, damage and staining at all times.

(5) Place stored units so that identification marks are discernible.

(6) Stacked members shall be separated and supported by dunnage placed as shown on the approved shop drawings. Dunnage shall be arranged in vertical planes at a distance not greater than the depth of the member from designated pickup points. Dunnage shall not be continuous over more than one stack of precast units. Stacking of members shall be

such that lifting devices will be accessible and undamaged. The upper members of a stacked tier shall not be used as storage areas for shorter units or equipment.

- (7) Prior to installation, the Contractor shall inspect all panels for missing or damaged gasket material. The Contractor in the field shall replace any gasket material that has been displaced or will otherwise compromise the grouting operation.

S-1.6 CONSTRUCTION

(A) Application of Pavement Joints

- (1) The type, size, shape and location of joints, shall be as shown on the Contract Drawings.
- (2) Break bond at all joints by coating the entire length of the exposed portion of the dowel with a thin even film of lubricating oil.

(B) Removals and Surface Preparation

- (1) Sawcut and Remove existing concrete pavement.
- (2) Install fine graded stone dust setting bed in accordance with Contract Drawings, and the precast manufacturer's instructions and technical specifications. Specialized grading equipment provided by the Precast Manufacturer shall be used. Verify elevation of the stone dust base is within a tolerance of plus or minus 1/10 inch prior to proceeding with placement of precast units.

(C) Placement of Precast Concrete Units

- (1) A representative of the precast manufacturer shall be present at the construction site to advise the Engineer and the Contractor on the proper handling and placement of the precast units at no additional cost to the Agency.
- (2) Mark out leading ends and leading edges of all slabs to ensure proper placement and fit. Allow for the joint width shown on the Contract Drawings. Do not disturb the graded stone dust setting bed during mark out.
- (3) Uniformly dampen stone dust surface with a fine spray of water, care should be taken not to disturb the surface grade, or placement markings.
- (4) Place precast units in accordance with the precast manufacturers placing instructions and the placement mark out lines.
- (5) Set the precast units in a manner such that the slab contacts the setting bed uniformly to avoid disturbing the finished fine graded stone dust setting bed and to avoid damaging the edges of the slab. Insure the inverted slots on the bottom of the slab properly align with the embedded dowels protruding from previously placed slabs.
- (6) Use tie off ropes to avoid chipping or spalling edges of the precast units. Use wood wedges or similar devices to guide the slab in to the correct position. The use of steel pry bars that chip edges should be avoided. Repair chipped or spalled areas as required by the Engineer.
- (7) Verify that slab grades and edge elevation differentials are within the tolerances specified in 1.4B, reset slabs if required.
- (8) Fill lifting insert holes with grout for dowel slots.

(D) Dowel Slot Grouting

- (1) Provide sufficient mixing and pumping equipment to meet the production requirements of the project.
- (2) Install spray foam grout dams at the free ends of joints to prevent grout from escaping.
- (3) Mix dowel bar grout in strict accordance with the manufactures directions and to meet the requirements of 1.3F.
- (4) Pump dowel grout into one grout port in each dowel slot until it exudes from the second grout port in the same slot. Avoid or minimize spilling of grout on the surface of the precast slabs.
- (5) While the grout is plastic, monitor the grout ports and add material if settlement occurs.

(E) Cement Grout Bed

- (1) Begin installation of cement grout bed once the joint slots units have been properly grouted.
- (2) Mix cement grout in accordance with the manufacturer's recommendation.
- (3) The pump shall be capable of moving the grout from the injection port to the vent hole at the other end of the slab without lifting the slab.
- (4) Commence grout pumping at the downhill chamber at the lowest port. Pump the grout until it exudes from the corresponding port at the other end of the slab insuring full bedding of the slab in that chamber. Complete the grouting operation, chamber by chamber until all remaining chambers are filled.
- (5) Grout pressure shall be continually monitored for pressure build up.
- (6) Monitor vent port to ensure that the cement grout is being properly distributed. If the grout does not exude from the port at the other end of the slab, check the flowability of the mix using the flow cone. Modify the mix design or operations accordingly.

(F) Field Tests

- (1) When the precast slab is being set, the Engineer and Contractor shall jointly test the pavement surface for conformance to the smoothness requirements of 1.4 D. If the slabs are not in conformance with 1.4D, the slab shall be removed and corrected until requirements are met. Any other deficiencies shall be corrected as specified in 1.6G.

(G) Correction of Deficiencies as specified herein shall be made at no cost to the Agency.

- (1) Remove and Replace Precast Concrete Units

Precast concrete units shall be removed and replaced in a manner approved by the Engineer and at no additional cost to the Agency if any of the following deficiencies exist in the finished pavement:

- (a) Units exhibiting any cracks, due to installation.
- (2) Spall Repairs - Any slabs that spall during installation will be repaired as approved by the Engineer.

S-1.7 MEASUREMENT AND PAYMENT

The work for the installation of precast concrete highway pavement slabs will be measured as the number of precast panels satisfactorily furnished and installed.

Payment will be made per each panel and shall be payment in full for all costs incidental thereto.

<u>Item</u>	<u>Description</u>	<u>Unit</u>
2301.602	Precast Concrete Pavement Panels.....	Each