5-5444-01-P1

DRAFT DESIGN PLANS AND DRAWINGS

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TxDOT Project 5-5444-01: Pilot Implementation of Pavement Repair Guidelines for Longitudinal Cracks and Joints

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Performing Organization:	**Sponsoring Organization:**
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Performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.	

Research Study 5-5444
Submission of Recommended Repair Details and Specifications
For U.S. 75 near Dennison, TX
December 1, 2009

Recommendations for repair of U.S. 75 are included for the longitudinally faulted and longitudinally separated slabs located near Dennison, Texas.

The following items are included:

1. Construction Sequence and Materials Estimates for US 75 Repairs
2. Details, construction specifications and material specifications for filling the sub-slab voids with grout
3. Details, construction specifications, tie bar specifications and grout specifications for filling retrofit tie-bar slots
4. Details for milling and preparing surface for bonded concrete overlay (BCO), details for placement of BCO with construction and materials specifications for installation of the BCO for leveling faulted slabs. (Also a copy of the ASTM C 1583 Pull-off test method for bond strength)

1. Construction Sequence

1. Wherever faulting slabs (caused by pumping of base material) is deeper than ½ in., fill the voids under the joint edges of faulted slabs, providing more uniform support along the joint and preventing further pumping. Low pressure grouting using hydraulic cements will be used such that slabs will not be lifted during grouting.

   Alternatively, clean mud and debris from longitudinal separations that are greater than ¼ in. Fill cleaned joint separations with 4,000 psi grout.

2. Lock the slabs with retro-fitted tie bars using slot stitching to prevent further separation and to provide load transfer across the joint. The integrity of the joint will be maintained during the installation of the tie bars.

3. Restore the original grade of the faulted slab (where faulting is greater than ½ in.) by overlaying the depressed pavement sections with bonded concrete overlays (BCO) that will result in restoration of ride quality. Milling will be required to (1) provide a clean, rough surface to bond the BCO and (2) to provide a minimum thickness of 1 ¼ inch for the BCO.

Materials Estimates for US 75 Longitudinal Joint Repairs near Sherman, Texas

Undersealing grout-

Assume void under one faulted slab averages 2-in wide x 15-ft long x ½-in. deep and five 2-in. diameter holes will be cored for grout injection ports in each undersealed slab. For ten faulted 10-in. thick slabs (faulting greater than ½ in.): 10 slabs x ((.17 ft. x 15 ft. x .04 ft.) + (5 holes x 0.83 ft. x 0.0069 ft^2 x 3.14)) = 1.04 cu. ft.+ 9.24 cu. ft.= 10.3 cu ft

Tie bars- (No. 6, deformed, 48 inches long) = placed on 3-ft centers (5 per 15-ft slab)

Example: estimate 5 bars/ slab x 20 slabs = 100 + 10% contingency = 110

Tie bars- (No. 6, deformed, 48 inches long) = placed on 2-ft centers (7 per 15-ft slab)

Example: estimate 7 bars / slab x 20 slabs = 140 + 10% contingency = 154

Tie bars- (No. 8, deformed, 48 inches long) = placed on 3-ft centers (5 per 15-ft slab)

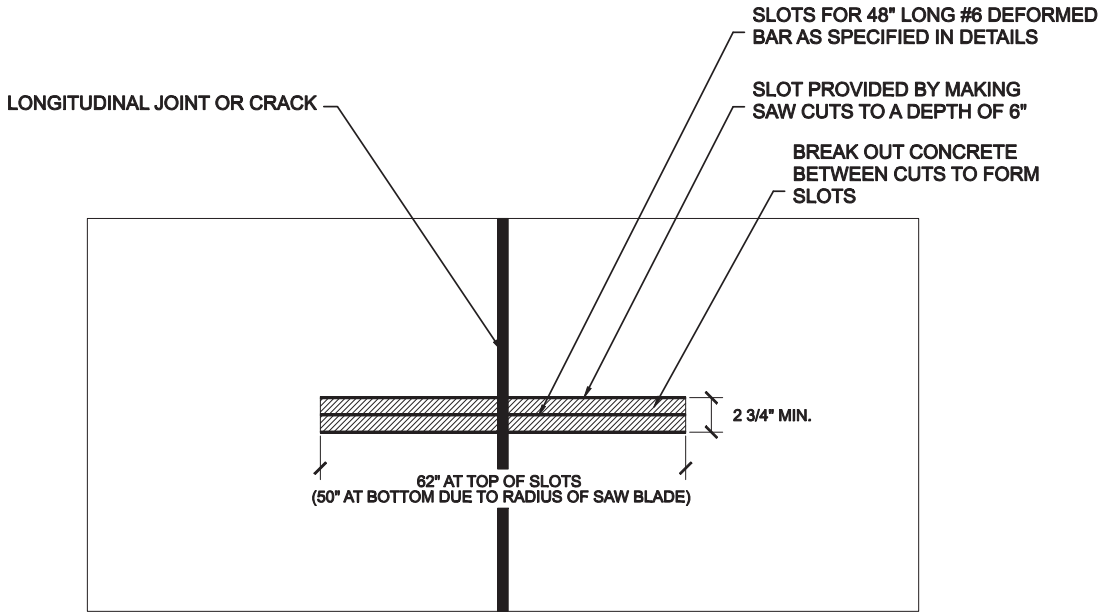
Example: estimate 5 bars/ slab x 20 slabs = 100 + 10% contingency = 110

Embedment grout for tie bars- 30 cu. ft.

Estimate slot for tie bar = 2 ¾ in. wide x 6* in. deep x 56** in. = 924 cu. in.
Vol. of No. 6 tie bar = 48 in. long x (3/8 in.)^2 x 3.14 = 21cu. in.
Volume to be filled with epoxy grout = 924 – 21 = 903 cu. in.
100 slots x 903 cu. in. / slot = 90,300 cu. in. or 52.25 cu ft. **Order 120% = 63 cu. ft.**
* for overlay sections do not fill top ½ in. of 6-in. deep slot to leave room for milling.
**54 is average width of trapezoid 50-in. bottom, 62-in. top (see detail No.3).

BCO (Portland Cement Mortar) = 16 cu. yd.

Estimate for 10 slabs (6 feet wide x 15 feet long x 1.25 inches thick)
= 94 cubic feet (3.5 cubic yards). **Order materials for 4 cu. yd**.
(includes overage for priming, QC testing, and waste)



PLAN OF SAWING DETAIL FOR SLOT STITCHING

2. Filling and Undersealing Sub-Slab Voids with Low-Pressure Grouting

2.1 Special Specification for Filling and Undersealing Base Voids with Low-Pressure Grout

2.2 Grouting Detail Before Slot Stitching

SPECIAL SPECIFICATION

LPGUBV

Filling and Undersealing Base Voids

with Low-Pressure Grout

1. Description. This Item shall govern for the filling and sealing of existing voids under the concrete pavement at locations shown on the plans or designated by the Engineer. This work shall include drilling injection holes, placement of undersealing material, monitoring to avoid lifting slabs, clean up and other related work.

2. Special Requirements. The Contractor shall use a crew experienced and competent in the work of pressure grouting and pavement undersealing. The crew and equipment furnished by the Contractor shall have satisfactory production capabilities in the judgment of the Engineer.

3. Materials. The materials shall consist of a mixture of Type I, II or III Portland cement, a fluidifier, fly ash and water. All materials shall be furnished by the Contractor.

Type I, II or III Portland cement shall conform to the requirements of DMS-4600, "Hydraulic Cement".

The fluidifier shall be a cement dispersing agent possessing such characteristics that will inhibit early stiffening of the pumpable mortar, tend to hold the solid constituents of the fluid mortar in suspension and prevent completely all setting shrinkage of the grout.

Water shall conform to Item 421, "Hydraulic Cement Concrete".

Use fly ash that meets the requirements of DMS-4610. Select the fly ash from an approved source. The Materials and Pavements Section of the Construction Division maintain a list of approved sources.

4. Equipment. The equipment used shall be that customarily used in the pressure grouting of earthen embankments or pressure grouting of concrete pavement. It shall consist of at least the following:

(1) Air compressors of sufficient capacity for operating pneumatic hammers.

(2) Pneumatic hammers equipped with drills that will cut 2- in. diameter or other approved diameter holes through the rigid pavement. The equipment shall be in satisfactory operating condition and operated in such a manner so as to prevent unnecessary damage to the slab. The pneumatic hammer shall not be heavier than 60 lb. and the downfeed pressure whether by hand or mechanical means shall not exceed 200 lb. The Contractor shall furnish a blow pipe with sufficient air pressure to dislodge loose

debris from the drill holes.

(3) Cylindrical wooden plugs or other approved plugs that satisfactorily plug holes until the grout has set.

(4) Equipment for accurately measuring and proportioning by volume or weight the various materials composing the grout.

(5) A colloidal mixer that is capable of operating in a range from 800 rpm to 2,000 rpm and thoroughly mixing the various components of the grout in an approved manner.

(6) A positive action pump that is capable of forcing grout through a drilled hole into voids and cavities beneath the pavement slab. The pump shall be capable of supplying a varying pressure up to a maximum of one hundred pounds per square inch at the end of the discharge pipe, when pumping grout of the specified consistency. The injection pump shall be capable of continuous pumping at rates as low as 1-1/2 gallons per minute.

The discharge line shall be equipped with a positive cut-off valve at the nozzle end, and a bypass return line for recirculating the grout back into a holding tank or mixer unless otherwise approved by the Engineer.

(7) A stop watch and flow cone conforming to the dimensions and other requirements of Test Method Tex-437-A, "Method of Test for Flow of Grout Mixtures (Flow-Cone Method)".

(8) The Contractor shall supply equipment to measure slab lift. This equipment shall be capable of detecting the lift of slab in the area of pumping. The equipment shall have the capability of making this measurement as the slab is being pumped and be fast enough in response to insure that the slab will not be raised above the limit set in this specification.

(9) The Contractor shall furnish a vehicle having a single rear axle with dual tires that can be loaded to 18 kips evenly distributed between the inside and outside wheel path, a vehicle driver and sufficient manpower to assist in the operation of the static load measuring gauges. Maintain the tire pressure at 70 psi.

5. **Proportioning Grout Mixture**. The mixture used in pressure grouting, herein referred to as "Grout Slurry", shall consist of proportions of Portland cement, fly ash, fluidifier and water.

The Contractor shall furnish the Engineer the proposed mix design meeting the following requirements:

. • The grout slurry shall remain fluid and not exhibit a resistance to flow for a minimum of one hour.

. • The time of efflux from the flow cone shall be between 10 and 20 seconds. Perform the flow test in accordance with Test Method Tex-437-A, "Method of Test for Flow of Grout Mixtures (Flow-Cone Method)."

. • The grout slurry shall achieve initial set in less than 4 hours. Do not allow the grout slurry to carry traffic until which time it has set to the satisfaction of the Engineer; or until which set time, as determined with Test Method Tex-302- D, "Time of Setting of Hydraulic Cement by Gillmore Needles", has been reached.

- The 7 day compressive strength of the grout slurry shall not be less than 200 psi. The compressive strength shall be determined in accordance with Test Method Tex-307-D, "Compressive Strength of Hydraulic Cement Mortars".

6. Deflection Testing. Each joint and slab on the project or within designated areas of the project is subject to be tested by the Engineer in cooperation with the Contractor using the Falling-Weight Deflectometer (FWD). Test joints in question before and after pressure grouting. If the deflection testing is done after grouting, then it will be done the next day before 11:00 a.m. All testing shall be limited to the hours between daylight and 11:00 a.m. The Engineer will use the deflection data to determine where re-grouting is necessary. A maximum of 2 properly performed groutings will be required. The Engineer will determine the specific joints that are to be tested.

7. Construction Methods. Drill 2- in. diameter (or other approved diameter) holes through the concrete pavement at the locations indicated on the plans or designated by the Engineer. Drill these holes to a depth sufficient to penetrate any stabilized base and into the subgrade. Subgrade penetration shall not exceed 3 in. For holes nearest the edges of the slab, the joints or a major crack, a maximum of 3 in. from the precise marked location is considered to be reasonable. For other holes a maximum 6 in. tolerance is considered to be reasonable. Rotate the drills to avoid cracking the pavement and to provide satisfactory holes of the proper diameter for effective operations in pressure grouting. When drilling holes, the drills shall be held as nearly perpendicular as possible to the pavement surface. Irregular or unsatisfactory holes which cannot be satisfactorily used in pressure grouting shall be filled with grout and new holes shall be drilled. The Contractor shall exercise sufficient precautions during all operations to insure that slabs are not broken or cracked. Any slab that develops a crack that extends through the drill hole will be considered to have been damaged during the process of the work and it shall be repaired or replaced at no cost to the Department. Repair or replacement will be in accordance with techniques approved by the Engineer. No more holes shall be drilled during a day's operations than can be grouted during the same day, unless specific approval is given by the Engineer.

After drilling the holes, lower a pipe connected to the discharge hose on the pressure grout pump into the holes. The discharge end of the pipe shall extend below any overlays which might exist, but not below the lower surface of the concrete pavement.

To fill all voids, pumping of grout will be required in holes designated by the Engineer. During the subsealing operation, use a positive means of monitoring lifts. The upward movement of the pavement should not be greater than 0.25 in. or as directed by the Engineer. Pump each hole until maximum pressure is built-up, grout is observed flowing from hole-to-hole, or as directed by the Engineer. Maximum allowable pressure shall not exceed 40 psi., except for the allowance of a short surge to 150 psi when starting to pump.

Monitor the pressure by an accurate pressure gauge in the grout line that is protected from the grout slurry. Water displaced from the void structure by the grout

shall be allowed to flow out freely, but shall not interfere with adjacent traffic. Excessive loss of grout through cracks, joints, or from backpressure in the hose or in the shoulder area shall not be tolerated.

Do not perform pressure grouting when pavement surface temperatures are below 35ºF or if the subgrade and/or base course material is frozen.

After the completion of grouting in any 1 hole, withdraw the discharge pipe from that hole and plug the hole immediately. Temporary plugs may be used since additional grout may be placed in particular holes to complete the required work in that area.

Remove temporary plugs when sufficient time has elapsed to permit the grout to set sufficiently so that back pressure will not force it through the hole, fill the space occupied by the plug with a reasonably stiff grout or an approved concrete mixture, and then compact.

In the event the Engineer determines that continued grout injection at any specific location is no longer economically feasible, he may direct the Contractor to cease grout injection at that location.

The Engineer may modify the construction methods outlined above, for sufficient justification, as field conditions dictate.

The Contractor shall use such approved measures as are necessary to keep all pavement surfaces adjacent to the actual grouting operation in progress reasonably clean of excess grout and other materials at all times.

Prior to the placement of traffic on the work area, clean the pavement (including adjacent shoulders) to the satisfaction of the Engineer.

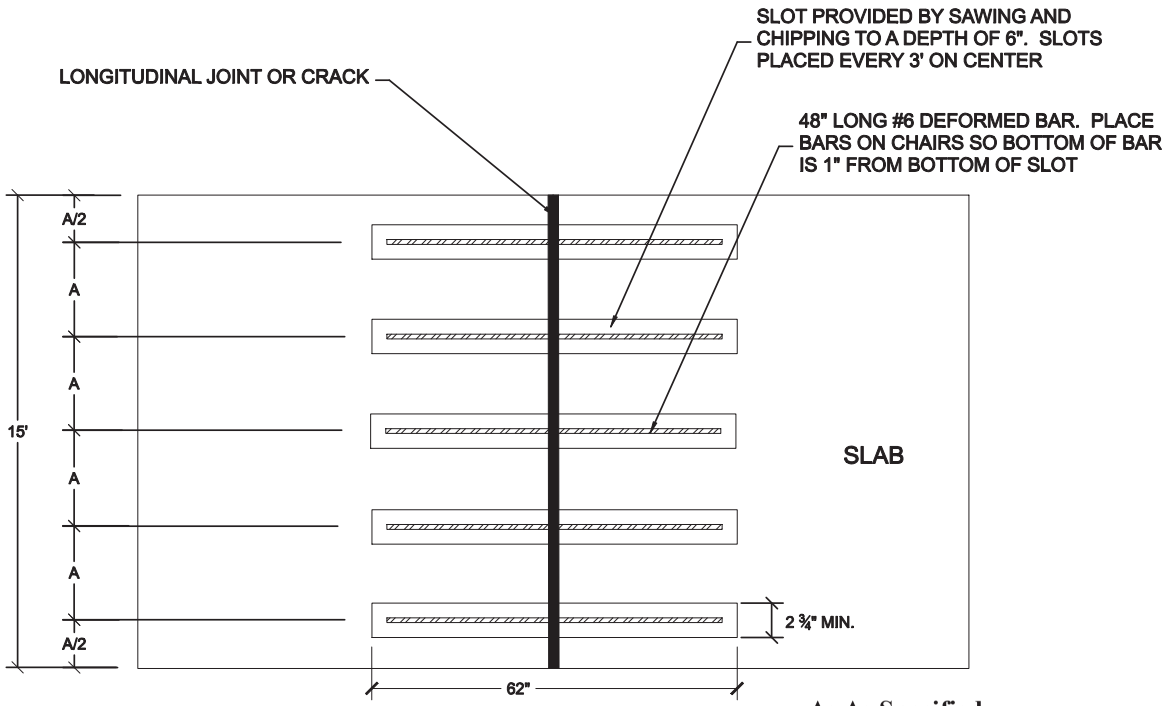
Keep all traffic off the grouted slab for at least 4 hours unless otherwise directed by the Engineer.

8. Measurement. Drilled holes will be measured by each drilled hole actually drilled and filled as necessary to accomplish the work provided herein.

The undersealing grout slurry, mixed and placed as specified herein, will be measured by the cubic foot (dry measure) of each material (cement and fly ash) incorporated into the underseal, prior to mixing.

9. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for “Drilled Holes” and “Grout Slurry.”

These prices shall be full compensation for all work covered by this Item, including but not limited to, drilling, temporary plugging and final sealing of holes in the concrete slabs; for securing and furnishing all materials including fluidifier and water; including all royalty, freight and storage involved; for mixing, proportioning and pumping the undersealing slurry grout into the voids under the concrete slabs; for cleaning up and for all manipulation, labor, tools, equipment and incidentals necessary to complete the work.



SLOT STITCHING PLAN VIEW

A: As Specified

6 Panels Use No. 8 Bars at 36”
6 Panels Use No. 6 Bars at 24”
2 Panels Use No. 6 Bars at 36”

SPECIAL SPECIFICATION

SSLJCP

Slot-Stitching Longitudinal Joints in Concrete Pavement

1. **Description.** Install tie bars across longitudinal cracks or joints in concrete pavement in accordance with the details shown on the plans and the requirements of this item.

2. **Materials.** Furnish the following materials, unless otherwise shown on the plans or directed by the Engineer:

   A. **Concrete.** Provide Class HES concrete conforming to Item 421, "Hydraulic Cement Concrete," with the following exceptions or additions:

      1) Design concrete mix with a maximum water to cement ratio of 0.38, and a minimum average flexural strength of 700 psi at the specified age to return lane to traffic. Test in accordance with Tex-448-A. Note that this flexural strength of 700 psi is the opening criteria for returning the pavement to traffic, thus this same 700 psi flexural strength must be proven at whatever target age is required.

      2) Use aggregate from siliceous sources only. Provide washed aggregate with 100% passing the 1/2 in. sieve. No more than 15% of the mix must be of any one size of aggregate.

      3) Use shrinkage reducing or compensating admixtures, or water reducing admixtures as approved to achieve a fluid non-segregating mixture. Do not use retarding admixtures. When using any admixtures, document the type, quantity, and location of mix placement on a copy of the final plans.

      4) The use of proprietary, high strength, rapid setting mixes may be approved when the materials demonstrate the satisfied performance. Obtain approval for the materials and proportions before using. Document the placement locations and material properties of proprietary materials on a copy of the final plans.

   B. **Steel Tie Bars.** Provide 48-in. long No. 6 deformed and 48-in. long No. 8 deformed steel tie bars as specified on plans and details and in accordance with Section 360.2.B, "Reinforcing Steel."

C. **Epoxy.** Provide epoxy materials for bonding new concrete to old concrete or for concrete repair materials that conforms to DMS-6100, "Epoxy and Adhesives."

D. **Membrane Curing Compound**. Provide membrane curing compounds that conform to the requirements of DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants", Type 2, Class A.

3. **Construction Methods.** Demonstrate slot-stitching work for approval of all the equipment and procedures. Provide tie bars at locations and spacing as detailed in the plans.

A. **Slot Formation**.

1) Provide slots using multiple saw cuts made with a diamond impregnated saw blade to a depth of 6 in. This depth will provide the needed clearance under the tie bars for the support devices and for encasing the tie bars in the repair material.

2) The slot width is 2 7/8 in. minimum and 3 ½ in. maximum.

3) Provide enough length of the cut to allow the tie bar to be placed at the mid-depth of the slab with a 1-in. space between the ends of the tie bar and the ends of the slot. (Typically this is 62 to 64 in. for 6 ½-in deep cut in a 10-in. thick pavement with a 20-in. diameter saw blade.)

4) Use lightweight jackhammers less than 30 lb. or hand tools to remove the "fins" formed by sawing.

5) Do not spall or fracture concrete adjacent to the slots. Repair damages to concrete pavement caused by Contractor's operation without any additional compensation. Repair in accordance with Item 361, "Full-Depth Repair of Concrete Pavement" or Item 720, "Repair of Spalling in Concrete Pavement," if spalls are 0.25 to 3 in. in depth, or as approved.

B. **Tie Bar Placement**.

1) Rinse the slot with potable water, sand blasted, and blown clean and dry with high pressure oil-free air to remove sand, water and dust.

2) Place tie bars at locations and spacing as detailed in the plans. Place the tie bars on support chairs or on spiral coil rings of 1-in. backer rod, so that the tie bars rest horizontal at the mid-depth of the slab.

C. **Repair Material Placement.**

1) Do not place concrete when the air temperature is below 65ºF. Use a vibrator head at most 1 in. in diameter to consolidate the concrete repair material. Do not dislodge or move the tie bar out of position, but the repair material must fill the space under the bar.

2) Finish the repair material level with the existing slab surfaces.

3) Cure the repair surface in accordance with Section 360.4.I. If a proprietary mix is used, use manufacturer's curing procedure.

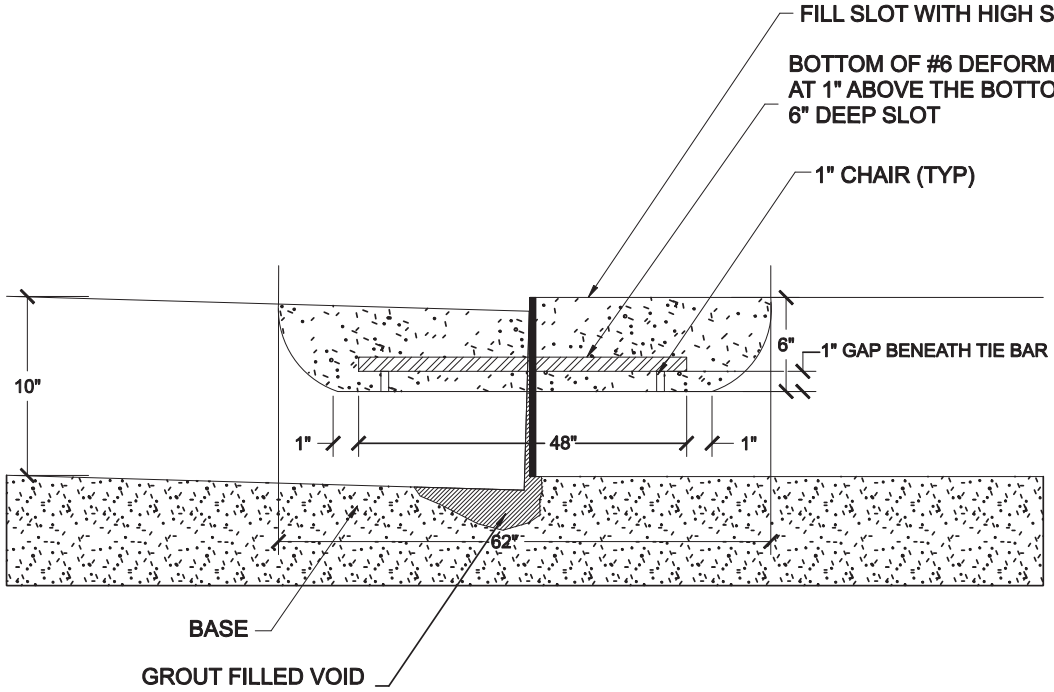
4) Use insulation blankets to facilitate curing and the strength gain of repair areas if desired. Provide insulating blankets with a minimum thermal resistance (R) rating of 0.5 hour-square foot °F/BTU and in good condition.

5) Make and cure concrete compressive strength test specimens as directed.

D. **Opening to Traffic.** The pavement may be opened to traffic after all tie bars have been installed at a joint and the concrete has obtained a minimum average flexural strength of 700 psi or as directed by the Engineer. Determine the flexural strength in accordance with Tex-448-A by using concrete specimens cured at the job site under the same conditions as the pavement. Opening the pavement does not relieve the Contractor from his responsibility for the work in accordance with Item 7, "Legal Relations and Responsibilities." Seal all joints and clean the pavement before opening the pavement to traffic.

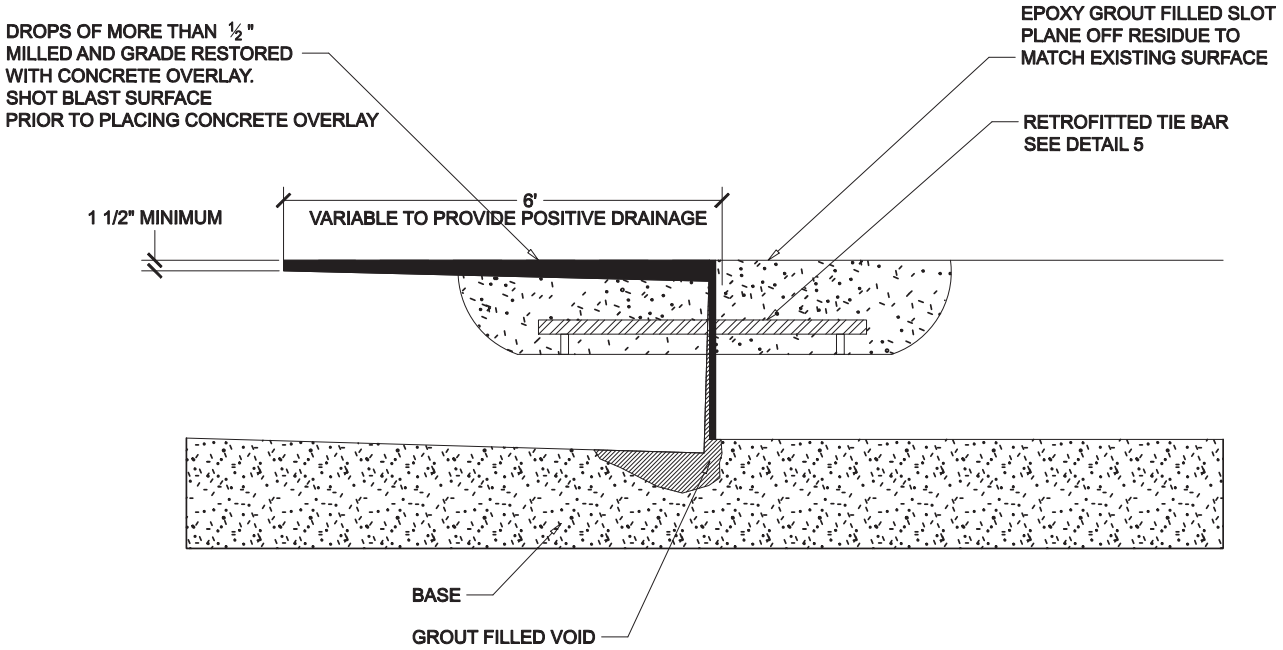
4. **Measurement.** This Item will be measured as each completed and accepted tie bar complete in place.

5. **Payment.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Slot-Stitching Longitudinal Joints in Concrete Pavement". This price is full compensation for furnishing all materials, tools, labor, equipment and incidentals necessary to complete the work. No payment will be made for extra work required to repair damage to the adjacent pavement that occurred during sawing.



SLOT STITCHING DETAIL

FOR FAULTED SLABS



SLOT STITCHING DETAIL WITH CONCRETE OVERLAY

FOR FAULTED SLABS

4. Restoring Grade for Faulted Slabs

4.1 Special Specification for Cold Milling Concrete Pavement Prior to Overlay

4.2 Milling Detail

4.3 Special Specification for Cleaning Milled Concrete Pavement

4.4 Slot Stitching Detail with BCO for Faulted Slabs

SPECIAL SPECIFICATION

CMCPBCO

Cold Milling Concrete Pavement for Bonded Concrete Overlay

1. Description. Cold milling shall consist of removing existing surfacing material including some of the concrete substrate as shown in the plans. Non-portland cement concrete overlay materials shall be milled off completely and the concrete surface shall be milled to create an area to place a rapid-setting latex-modified concrete inlay or overlay. The concrete surface shall be milled down to a uniform depth in specified areas a shown in the plans or described in the special provisions.

2. Materials. Essentially all of the milled material shall be pulverized to pass a 1-inch sieve.

3. Equipment . The milling shall be done with a commercially manufactured machine able to perform this work to the Engineer's satisfaction. The milling machine shall be self-propelled and shall have sufficient power, traction, and stability to maintain an accurate depth of cut.

A. The cold milling machine shall be equipped with automatic controls for establishing profile grades at each edge of the machine. The reference shall be the existing pavement or taut reference lines erected and maintained by the Contractor true to line and grade. A single reference may be used if the machine can maintain the designated transverse slope.

B. When referenced from existing pavement, the cold milling machine shall be controlled by a self-contained grade reference system provided by the machine's manufacturer for that purpose. The sensing point shall react to compensate for 25 percent of the actual change in elevation due to a hump or dip that is 3 feet or less in length. The self-contained grade reference system shall be used at or near the centerline of the roadway. On the adjacent pass with the milling machine, a joint matching shoe may be used.

C. Broken, missing, or worn teeth shall be replaced if the machine is unable to maintain the surface texture requirements.

D. The machine shall be equipped with a loading elevator to remove the milled material from the roadway surface.

E. The machine shall be equipped with means to effectively control dust generated by the cutting operation.

4. Construction Methods. Before beginning work on roadway demonstrate the milling machine to assure proper condition and operation of equipment to the satisfaction of the engineer.

A. The milled surface shall not be open to traffic.

B. When milling removes pavement markings, the Contractor must place temporary pavement marking before opening the road for public use.

C. The texture produced by the cold milling operation shall be uniform, and continuous longitudinal striations will not be allowed.

D. When milling is done under traffic maintained conditions, the Contractor shall uniformly mill the partial-lane width with one machine.

E. The milling must result in a vertical longitudinal face between 1-1/2 inch and 2-1/2 inch in depth between the lanes. At the end of each day, no milled surface will be present to vehicular traffic. Work shall be scheduled so that the milled surface will not be present between traffic lanes over weekends, holidays, or other extended periods when work is not being performed.

F. Transitions between milled and unmilled surfaces will not be feathered either by milling or with wedges of bituminous material (maximum slope 1 horizontal to 4 vertical).

G. Surfacing material that cannot be removed by cold milling equipment because of physical or geometric constraints may be removed by other methods approved by the Engineer.

H. If traffic has been detoured from the milled area, the surface shall be swept once per day. When milling is performed under traffic maintained conditions, the milled surface shall be inlaid with rapid-setting portland cement concrete that has achieved at least 2500 psi compression strength before any traffic is placed on it.

I. The Contractor shall mill curbs in accordance with the plans.

J. The Contractor shall prepare stockpile sites by removing all vegetation on the portion of the site on which the material will actually be placed. The stockpile area shall be graded so that water will drain away from the stockpiled material. Unsurfaced areas upon which material is stockpiled shall be smoothed and rolled so that the salvaged material may later be removed with a minimum of loss.

K. The Contractor shall stockpile salvaged material for the Department at the locations shown in the plans or special provisions.

L. The Engineer shall locate each stockpile. The maximum height of stockpiles is 10 feet. Equipment shall not be driven over the stockpiled material.

M. Concrete millings from inlays will not be salvaged but shall be disposed of in accordance with the specified removal requirements.

5. Method of Measurement. The bid proposal "Schedule of Items" shall indicate whether the milling will be measured for payment by the ton, station, or square yards of completed and accepted work.

A. Roadways that are measured by the station (100 feet) shall be measured horizontally along the project centerline between the beginning and ending points of the work.

B. Areas outside the typical cross section shown in the plans will be measured in equivalent stations based on one station's area for the immediately adjacent roadway.

C. Since the entire roadway width is not milled, the length of the milled roadway shall be added for the payment.

D. Each milled slab will be measured separately in stations of 20 feet without regard to width. Stations will be measured horizontally along the project centerline between

the beginning and ending points.

E. Roadways that are measured by the square yard shall be measured to ± 1 SY.

F. Areas outside the typical cross section shown in the plans will also be measured to ± 1 SY.

G. Deductions will be made for all areas greater than 1 SY that are not milled.

H. Measurement of temporary traffic control devices will be made in accordance with Section 422.

I. Milling concrete for inlays will be measured for payment by the each.

J. Milling concrete curb is measured in linear feet along the back face of the curb.

6. Basis of Payment

A. Pay Item Pay Unit

Concrete Surface Milling Station (Sta)

Concrete Surface Milling Square Yard (SY)

Milling Concrete for Inlays Each (ea)

Payment for temporary traffic control devices will be made in accordance with Section 422.

B. Payment is full compensation for all work prescribed in this Section.

SPECIAL SPECIFICATION

SBSB

Cleaning Milled Concrete Pavement

1. Description. This Item shall govern for the cleaning by steel shot abrasion media of existing hydraulic cement concrete pavement surfaces at the locations shown on the plans or as directed by the Engineer and in accordance with the requirements herein.

2. Equipment. The abrasion cleaning shall be done by a machine designed and built for high production pavement texturing. Each machine shall have a minimum average production rate of 1200 sq. yd. per hour for concrete surfaces. The machine shall employ the HVIM (High Velocity Impact Method) by hurling steel abrasive media at high velocity to abrasively clean and texture the surface. The machine shall be capable of varying the velocity of the steel abrasive as well as the speed of the machine to provide the desired surface texture. Utilization of radial blades in multiple centrifugal wheels shall produce a continuous, minimum six-foot wide swath. This is synchronous to the recycling of the abrasive and vacuuming of surface materials into a self-contained vacuum unit of 2 cu. yd. or more, meeting or exceeding all environmental quality standards. No objectionable dust shall be emitted during the work. The machinery shall direct the velocity of abrasion in a bi-directional fashion, giving uniform abrasion to the surface. When transverse curves are present, the abrasion will be at an angle transverse to the grooves to give equal texture to the grove edges.

On-board controls capable of providing and monitoring uniform velocity and direction will be required. Self contained lighting for night operations will be required.

A generator driven electromagnet equal in width and production to the texturing machine will be available on the project. It will be used to pick up any steel abrasive left behind the machine if deemed necessary by the Engineer.

Verifiable proof of prior major pavement texturing, in accordance with the specification, or satisfactory test sections performed at the Contractor's expense will be necessary before the equipment will be approved.

3. Construction. Steel blast abrasion cleaning shall be done on the areas indicated on the plans. It shall be performed in a continuous operation of consecutive passes up to 6 ft. in width (if necessary), parallel to the centerline, so that one 6-ft. path can be completed in a single pass. The cleaned surface shall have a uniform surface appearance and be devoid of machine product streaks, ruts or overlapping grooves which will inhibit the free flow of water. It shall have a non-directional texture. Following the abrasive cleaning operation, the electromagnet shall pass over the

entire surface if deemed necessary by the Engineer.

The abrasion cleaning shall not encroach on the existing centerline stripes, lane stripes, traffic arrows, cross bar stripes, traffic buttons or other traffic markings unless approved by the Engineer. The distance from the edge of traffic markings to the texture shall be a maximum of 3 in. The longitudinal area between dashed lane markings need not be textured.

All surfacing materials removed during the abrasion cleaning process shall be collected and stored in the vacuum unit until it can be removed from the project and disposed of by the Contractor. No on-site transfer of, or storage of, the materials will be permitted. No loose material will be left on the roadway or swept off to the side of the roadway.

4. Testing. The Engineer will require the following testing procedure.

ICRI Concrete Surface Profile (CSP) When cleaning first begins close visual inspection of cleaned surface should closely compare to the minimal texture of molded ICRI (International Concrete Repair Institute)coupons CSP1-3. This level of surface cleaning must remain similar throughout the cleaning of each milled slab, and each cleaned slab will be visually compared to the ICRI CSP coupons to the satisfaction of the inspector before an overlay is placed.

5. Measurement. This Item will be measured by the square yard of surface area. Square yard calculations will be based on the neat dimensions shown on the plans or as adjusted by the Engineer.

6. Payment. The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Texturing Portland Cement Concrete Pavement." This price shall be full compensation for texturing the pavement surface as well as vacuuming, hauling, unloading and satisfactory storing or disposing of the material, for all labor, equipment, supplies and incidentals necessary to complete the work.

3. Slot Stitching

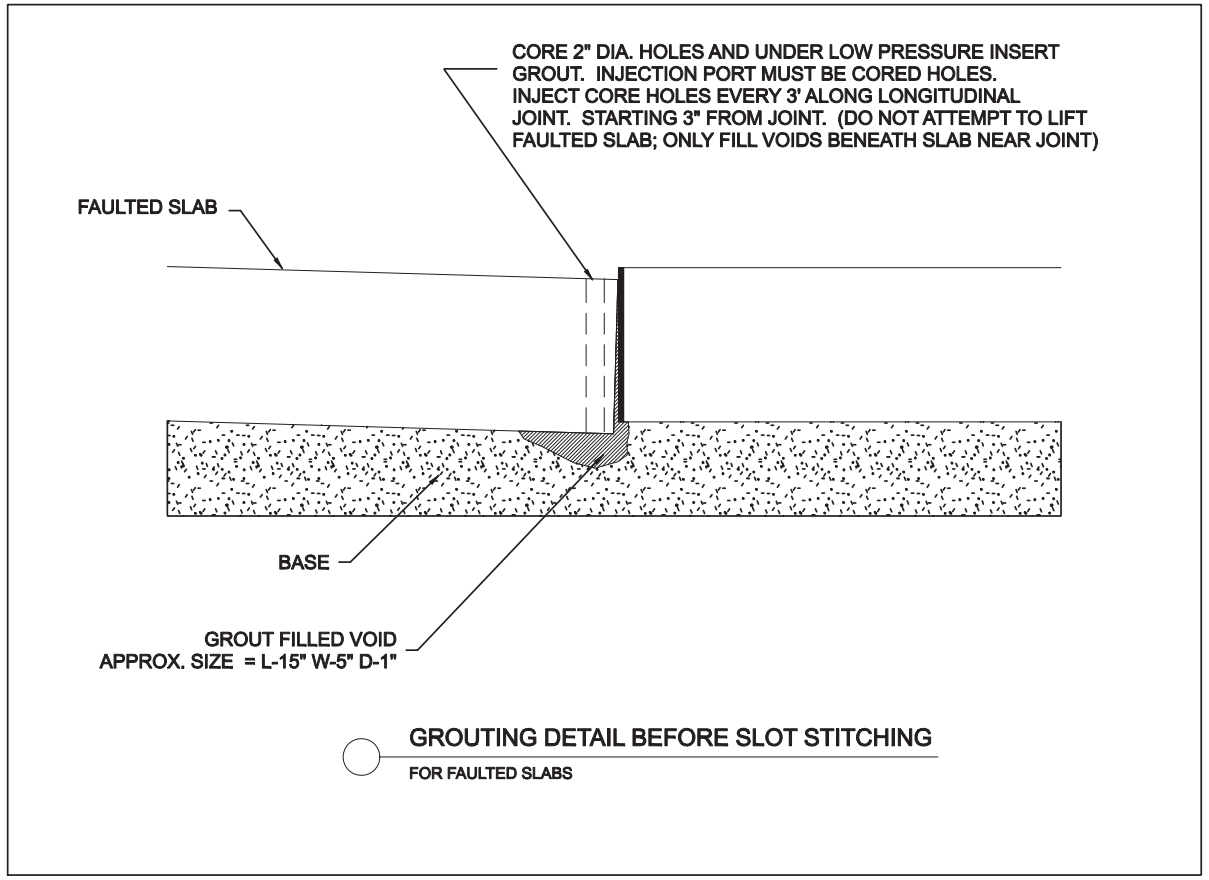
3.1 Special Specification for Slot Stitching Longitudinal Joints in Concrete Pavement

3.2 Plan View of Sawing Detail for Slot Stitching

3.3 Slot Stitching Plan View

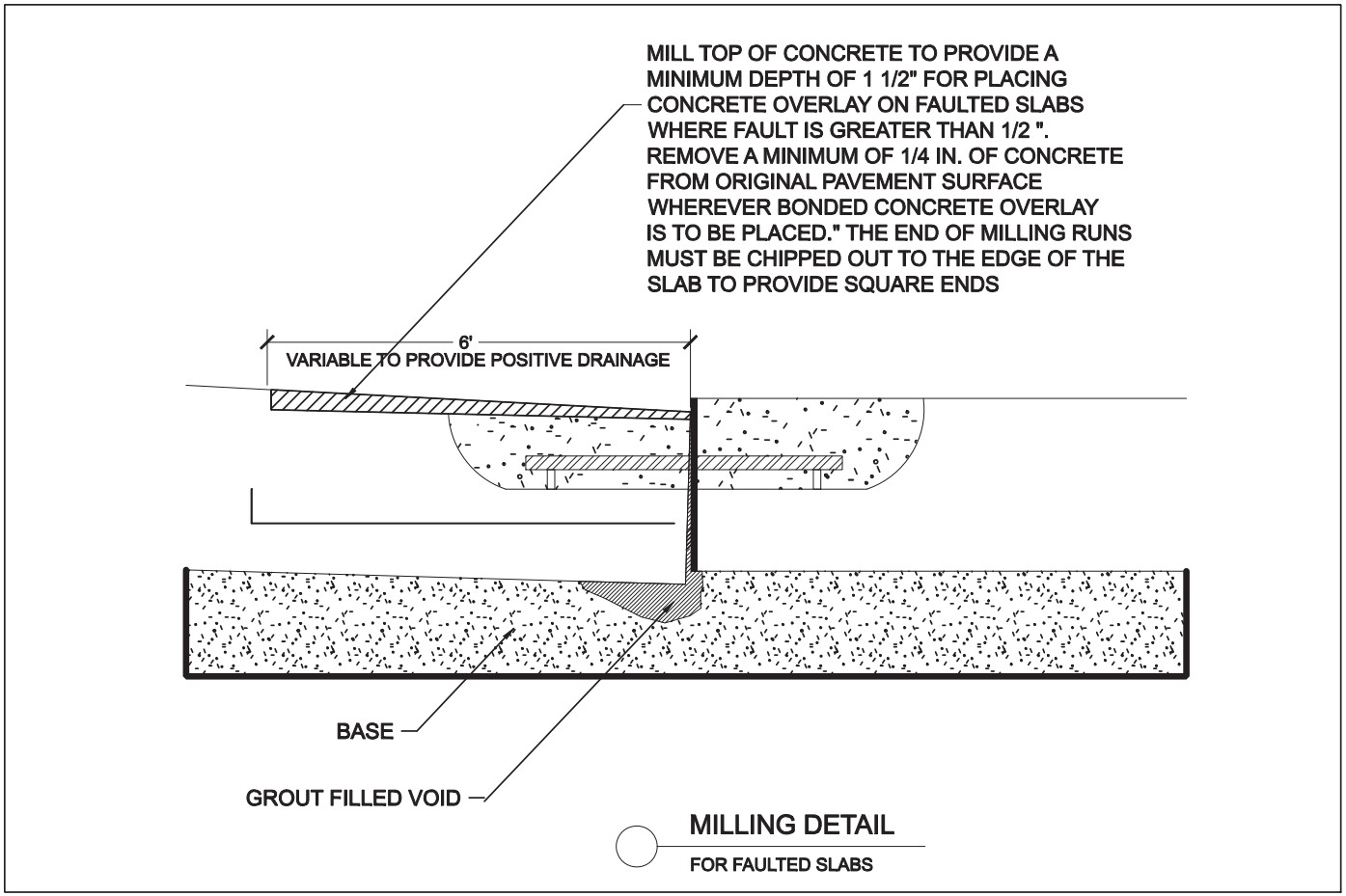
3.4 Slot Stitching Section for Unfaulted Slabs

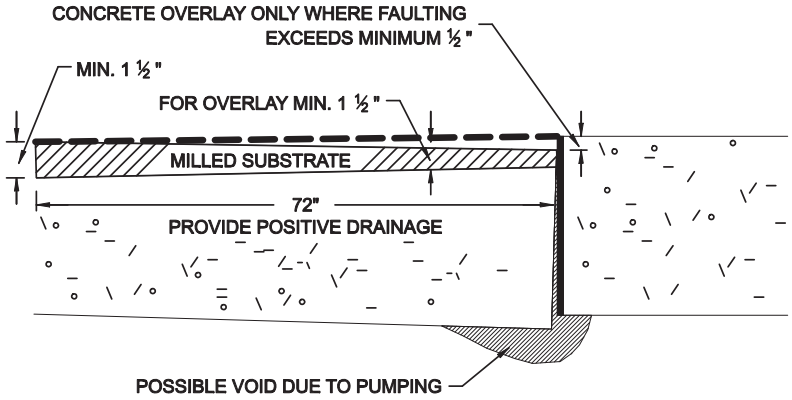
3.5 Slot Stitching Section for Faulted Slabs



GROUTING DETAIL BEFORE SLOT STITCHING

FOR FAULTED SLABS


MILL TOP OF CONCRETE TO PROVIDE A MINIMUM DEPTH OF 1 1/2" FOR PLACING CONCRETE OVERLAY ON FAULTED SLABS WHERE FAULT IS GREATER THAN 1/2 ". REMOVE A MINIMUM OF 1/4 IN. OF CONCRETE FROM ORIGINAL PAVEMENT SURFACE WHEREVER BONDED CONCRETE OVERLAY IS TO BE PLACED." THE END OF MILLING RUNS MUST BE CHIPPED OUT TO THE EDGE OF THE SLAB TO PROVIDE SQUARE ENDS
6'
VARIABLE TO PROVIDE POSITIVE DRAINAGE
BASE
GROUT FILLED VOID
MILLING DETAIL
FOR FAULTED SLABS



REGARDLESS OF FAULT DEPTH, MINIMUM OF ¼" OF SURFACE MUST BE REMOVED FROM THE SUBSTRATE FOR BONDING CONCRETE OVERLAY.

THE MILLING MUST RESULT IN A CAVITY (FOR THE CONCRETE OVERLAY) THAT IS BETWEEN 1 ½" AND 2 ½" DEEP BY 72" WIDE BY THE LONGITUDINAL LENGTH OF THE SLAB. THE END OF MILLING RUNS MUST BE CHIPPED OUT TO THE EDGE OF SLAB TO PROVIDE SQUARE ENDS.

OVERLAY WILL PRODUCE NEW SURFACE ON FAULTED SLAB THAT IS FLUSH WITH TOP SURFACE OF UNFAULTED SLAB

MILLING AND CONCRETE OVERLAY DETAIL

FOR FAULTED SLABS