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Augusta, Maine 04333

Maine Department of Transportation

# Transportation Research Division

## Technical Report 97-20

*Subsurface Drainage for Rehabilitation of PCC Pavement*

*Interim Report - Fourth Year, August 2002*

# Transportation Research Division

## *Subsurface Drainage for Rehabilitation of PCC Pavement*

### Introduction

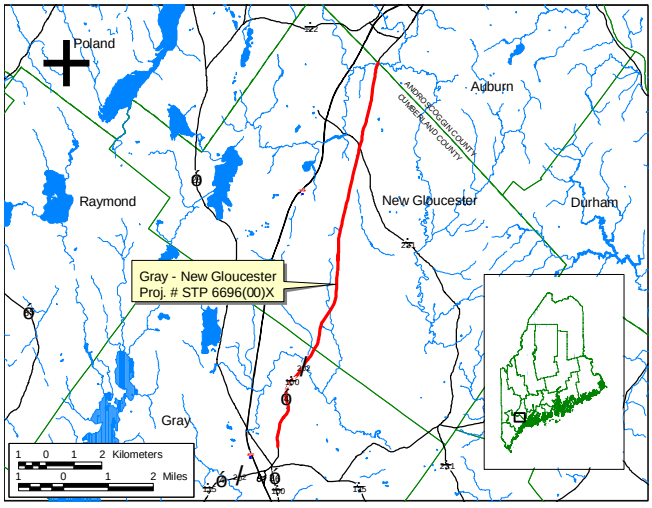
Many existing roadways are being enhanced due to the pressures of increased vehicular traffic. Some of these improvements involve widening the present travel way to accommodate a turning lane and/or additional travel lanes. This often necessitates removing unsatisfactory material in the existing shoulder and replacing with more freely draining materials containing fewer fines in an attempt to reduce differential movement between existing and new traveled ways, and to more nearly equate their load carrying abilities. Many existing roadways consist of bituminous pavements and are underlain by 5.5 or 6 m (18 or 20 ft) wide Portland Cement Concrete (PCC) pavements, further complicating the transition from existing to new pavement.

### Objectives

The existing pavement may not have a well-drained granular base or subbase especially after years of infiltration by finer adjacent soils and winter sands. Therefore, it is proposed to install subsurface drainage systems longitudinally at one or both sides of the existing roadway subbase and the proposed granular subbase shoulder replacement.

### Project Location/Description

Project number STP 6696(00)X, PIN 6696.00, Gray - New Gloucester, has been selected as a primary candidate for this experiment. The beginning point is 0.5 km (0.29 mi) north of Route 26, and extends northerly 14.29 km (8.88 mi) on Routes 4/100/202. This project has 6 m (20 ft) wide PCC under the roadway and is scheduled to have both Level I and Level II resurfacing areas, with the experimental features proposed to be installed on both. These areas are located as follows:




| Station | Scope |
|---|---|
| Sta. 0+203 - 2+100 | Level II |
| Sta. 2+100 - 7+480 | Level I |
| Sta. 7+480 - 14+493 | Level II |

Level I treatment is resurfacing of a highway that is considered to be built to established standards ("A" highway) for the first time or the next resurfacing after a more intensive resurfacing project. The treatment is concentrated on extending the life of the pavement, usually by resurfacing with a goal of at least 75 percent of the project cost in pavement items. Work is concentrated on the surface of the roadway

between shoulder berms with only an occasional item beyond that is necessary to maintain the core of the roadway. Nonfunctional guardrail systems will be repaired or replaced. Other components such as ditching, culverts and roadside safety are in satisfactory condition.

Level II is treatment to an "A" highway for the second time after it is constructed, often alternating with Level I treatments. This level emphasizes pavement expenditures but also maintains drainage structures, ditches, replaces culverts, updates or replaces guardrail as necessary, addresses roadside safety issues, and upgrading of bridge guardrail connections. Pavement treatments include overlays, grinding and overlay, cold in-place recycling, among others.

## Experimental Features

The following Special Provision and Standard Specifications describe the experimental features of each test area:

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SPECIAL PROVISION
SECTION 605.40
SUBSURFACE DRAINAGE FOR REHAB OF PCC PAVEMENT

COMMON ITEMS

Description. This work shall consist of furnishing and installing a series of experimental subsurface drainage membrane systems in accordance with these specifications and as shown on the plans. Although there are five (5) different systems utilized in this experiment, many features are common to more than one. These common features will be described first.

Drainage Geotextile. The drainage geotextile used shall satisfy the requirements of Section 722.02, Drainage Geotextile, and shall be TC MIRAFI FW 40/10, as manufactured by the NICOLON MIRAFI GROUP, 3500 Parkway Lane, Suite 500, Norcross, GA, 30092, or approved equal. The local distributor is R.P. Martino & Co., 2 Ledge Drive, Georgetown, MA, 01822 Tel. (508) 352-2106.

EQUIPMENT

General. The equipment for installation shall be capable of meeting the provisions of the Construction Requirements of this Specification. Where required, cutting of the membrane shall be done with utility knives or other approved methods.

CONSTRUCTION REQUIREMENTS

General. The trench for each of the five (5) different experimental drainage cross sections shall be excavated to the width, depth, and location as shown on the plans. The trench shall be excavated in such a manner that the soil outside the eight (8) inch maximum width is not disturbed. The bottom of the trench shall be smooth with all impediments to gravity water flow removed, and conform to line and grade to assure flow toward the outlet at all points along the bottom.

Drainage Geotextiles. The drainage geotextile shall line the trench for its entire length in all five (5) experimental drainage sections, as shown on the plans. After the various drainage systems described under UNIQUE ITEMS are installed as required, the trench shall be filled with underdrain sand or crushed stone, as shown on the plans. The portion of geotextile protruding above the surface at the sides of the trench shall be folded over the top of the aggregate to form a double thickness the full width of the

trench. This shall be secured to prevent damage to or dislodgment of the textile during subsequent construction operations. The ends will be folded in a similar fashion to prevent infiltration of fine soils into the drainage materials.
The geotextile shall be placed smoothly against the trench sides and bottom, and be maintained in that manner during backfilling and other operations. Removal and replacement of unsatisfactory geotextile and all geotextile that is damaged by traffic or construction operations, as determined by the Engineer, shall be the responsibility of the contractor. Storage of the drainage geotextile shall be as recommended by the manufacturer.

Connection To Water Outlet. The five different experimental side drainage trenches shall be connected to cross pipes, catch basins as shown on the plan or outlet in other manners as directed by the Engineer. The backfill at the outlet ends of all five experimental areas shall be crushed rock, within the drainage geotextile to the top of the trench and for a distance of at least 2 meters (6 ft.) longitudinally. A length of perforated underdrain pipe 1800 mm long and 150 mm in diameter will penetrate this water collection pocket at least 1800 mm and be connected to a solid 150 mm pipe which will convey the collected ground water to the outlet.

## UNIQUE ITEMS

Description. The following items are unique to the different experimental systems:

Underdrain Backfill Granular Material. This material shall conform to the Granular Material for Type B underdrain, as specified in Section 703.22. Placement shall be according to Section 605.04 (a), except that a) after the initial placement of backfill of not more than 300 mm (12 inches), compaction may be achieved by ponding the granular material with water, and b) the remainder of the trench may be backfilled in one lift, and compacted by ponding with water or by vibratory roller, utilizing low amplitude vibrations, at the surface.

Underdrain Backfill Crushed Material. This material shall conform to the specification 703.22, crushed material for Type C underdrain. Placement shall be according to Section 605.04 (b).

Perforated Underdrain Pipe. Materials for, and manufacturer of, this pipe shall conform to specification 605, except that the diameter shall be 100 mm (4 inches).

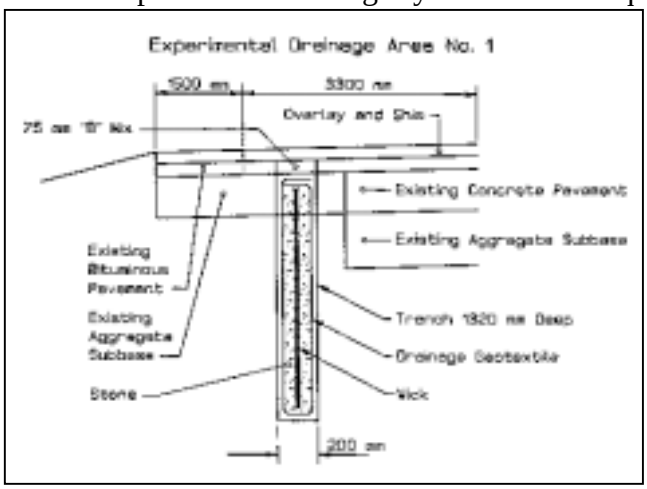
Prefabricated Drainage Composite. The prefabricated drainage composite shall be TC MIRAFI 5000, as manufactured by the NICOLON MIRAFI GROUP, 3500 Parkway Lane, Suite 500, Norcross, GA, 30092, or approved equal. The local distributor is R.P. Martino & Co., 2 Ledge Drive, Georgetown, MA, 01833, Tel. (508) 352-2106. Where joining of the sections is necessary, the recommendations of the manufacturer shall be followed.

## EQUIPMENT

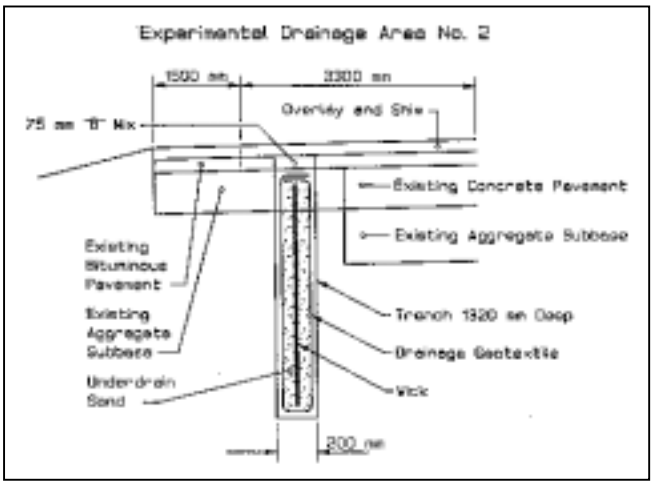
General. The equipment for installation shall be capable of meeting the provisions of the Construction Requirement of this Specification. Excavation shall be performed using a "Ditch Witch" or similar device capable of excavating a narrow trench in an expeditious manner. Backhoes or other equipment utilizing a wide bucket shall not be used without the consent of the Engineer.

CONSTRUCTION REQUIREMENTS

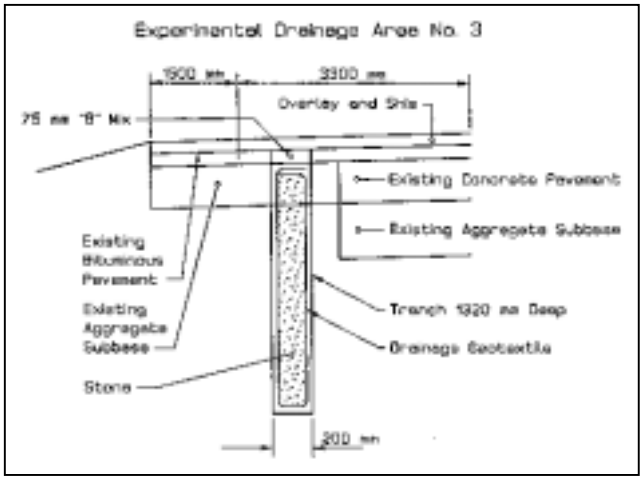
In addition to the Construction Requirements described under Common Items, each of the five (5) different experimental drainage systems have unique construction features which include the following:




Area 1. Before backfilling the trench, that has been lined with a drainage geotextile as described under Common Items, the drainage composite as described under Unique Items, Prefabricated Drainage Components, will be placed as shown on the plans, Experimental Drainage Area No. 1. Backfill material shall be as specified in Section 703.22, Underdrain Backfill crushed materials, for Type C Underdrain, and placed according to Section 605.0 4 (b). The outlet shall be constructed as shown on the plans, outlet ends for experimental Areas 1, 2, and 3.




Area 2. Before backfilling the trench, which has been lined with a drainage geotextile as described under Common Items, the drainage composite as described under Unique Items, Prefabricated Drainage Composite, will be placed as shown on the plans, Experimental Drainage Area No. 2. Backfill shall be as specified in Section 703.22, Underdrain Backfill, Granular Material, for Type B underdrain, and placed according to Section 605.04 (a) except as noted under UNIQUE ITEMS, Underdrain Backfill Granular Material. The outlet shall be as shown on the plans, Outlet Ends for Experimental Areas 1, 2, and 3. As the trench backfill in this case is underdrain sand, the final portion of the trench within the drainage membrane around and above the 150 mm underdrain pipe, shall be filled with crushed stone meeting the requirements of Section 703.22 and installed according to Section 605.04 (b).

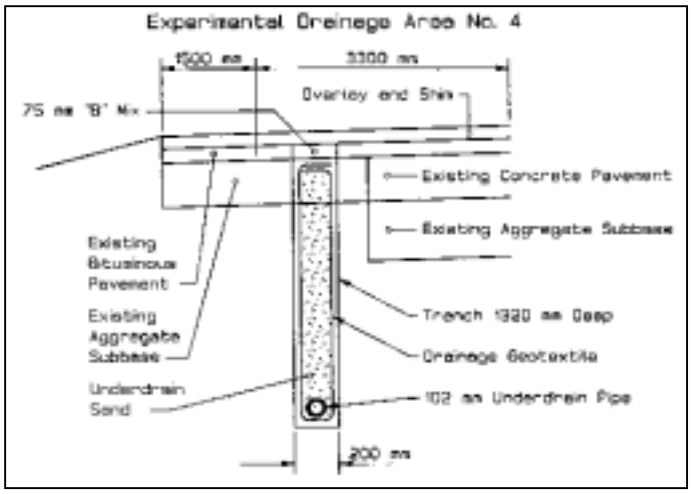


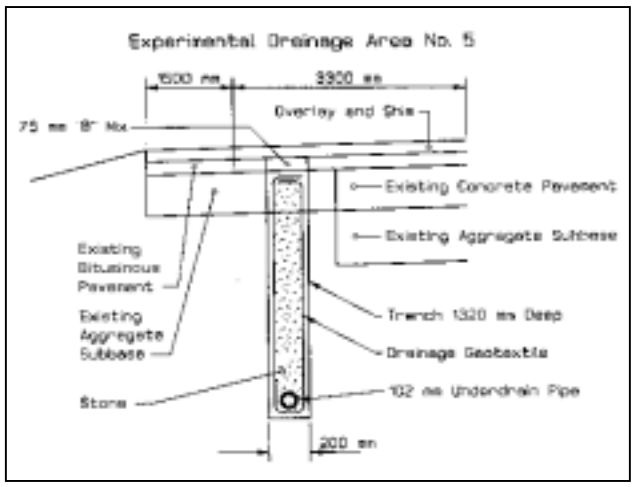

Area 3. This area utilizes crushed stone meeting the requirements of Section 703.22, and installed within the drainage geotextile in accordance with Section 605.04 (b). The outlet shall be as shown on the plans, Outlet Ends for Experimental Areas 1, 2, and 3.

Area 4. This experimental section shall contain a 100 mm (4 inch) diameter underdrain placed at the bottom of the area enclosed by the drainage geotextile, as described earlier in this Special Provision, before backfilling. Backfill shall conform to the requirements of Section 703.22, Underdrain Backfill, Granular Material, and shall be constructed as

required by Section 605.04 (a), except as noted under UNIQUE ITEMS, Underdrain Backfill Granular Material. The outlet of this 100 mm (4 inch) diameter underdrain is to be into the cross pipe at station 1+274±, left.

Area 5. Area 5 shall be similar to Area 4, except that the backfill material shall conform to the requirements of Section 703.22, Underdrain Backfill, Crushed Material, and shall be constructed as specified by Section 605.04 (b). The outlet of this 100 mm (4 inch) diameter underdrain is to be into the cross pipe at 1+274, right.

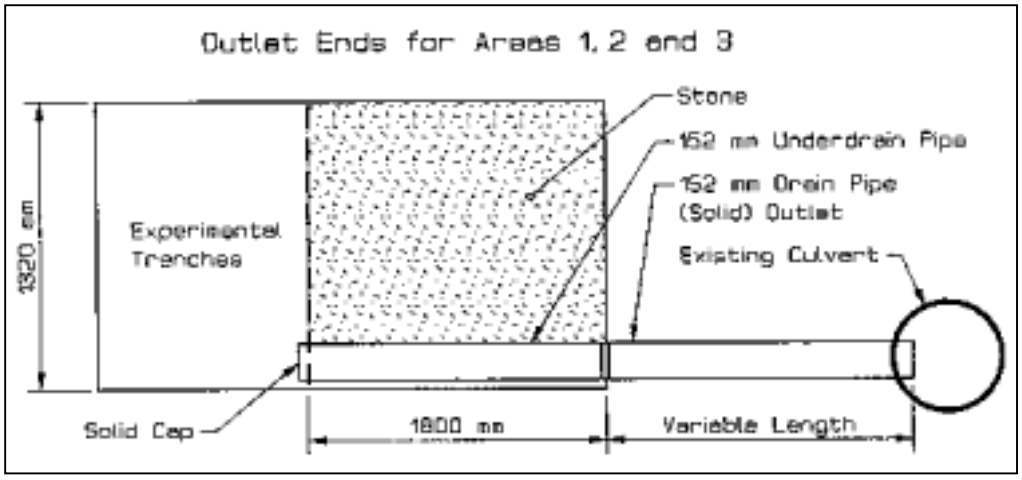



Removal and replacement of unsatisfactory drainage composite, and all other materials that are damaged by traffic or construction operations, as determined by the Engineer, are the responsibility of the contractor.

Method of Measurement. Each of the five (5) experimental drainage areas shall be measured by the meter (foot), in place.

Basis of Pavement. The accepted quantity of experimental drainage areas, Types 1, 2, 3, 4, and 5, will be paid for at the contract unit price per meter (foot). Payment will be full compensation for furnishing and placing the drainage geotextile, the drainage composite, the underdrain pipe and all other materials, labor and other incidentals necessary to complete the work.



Payment will be made under:

| Pay Items | | Pay Unit |
|---|---|---|
| 605.400 | Experimental Drainage Area No. 1 | Meter |
| 605.401 | Experimental Drainage Area No. 2 | Meter |
| 605.402 | Experimental Drainage Area No. 3 | Meter |
| 605.403 | Experimental Drainage Area No. 4 | Meter |
| 605.404 | Experimental Drainage Area No. 5 | Meter |

MAINE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS
SECTION 605.04

605.04 Underdrain Construction.

(a) Underdrain, Type B. The trench shall be excavated to the required width and depth and a bed of the specified granular material, 75 mm [3 inches] in depth, prepared in thetrench. One Hundred Fifty millimeter [Six inch] perforated pipe shall be laid on this bed with the perforations as shown on the Standard Detail plans.

After the pipe has been firmly bedded and joints securely connected, it will be inspected before any backfill is placed. The remaining backfill shall be granular material meeting the same requirements as that used for bedding the pipe.

For underdrain placed under areas of proposed pavement, the material shall be placed in 200 mm [8 inch] layers, loose measure and thoroughly compacted except that the initial layer of backfill around the pipe may be placed in a layer not exceeding 300 mm [12 inches]. For underdrains placed under areas not proposed to be paved, the initial layer of backfill shall not exceed 300 mm [12 inches] and the remaining material may be placed in one lift to the elevation of the subgrade and compacted with heavy rubber tired or vibratory compaction equipment to the satisfaction of the Engineer.

The upstream end of all completed underdrain pipe shall be sealed with cement mortar or other acceptable material. Care shall be taken that soil does not enter the pipe. Pipe so contaminated before backfilling shall be removed, cleaned and re-laid.

(b) Underdrain, Type C. The trench shall be excavated to the width and depth as determined by the size and depth of the pipe to be installed.

The perforated pipe shall be laid to line and grade centered on the bottom of the trench with the perforations as shown on the Standard Detail plans.

After the pipe has been firmly bedded and all joints securely connected it will be inspected before any backfill is placed. The backfill shall be placed in accordance with Subsection 603.08 and as shown on the Standard Detail plans using the materials specified.

When Underdrain Type B or Underdrain Type C is constructed, backfill material beyond the underdrain trench lateral limits designated on the plans shall be material conforming to the requirements of Granular Borrow, Underwater Backfill. Material within the underdrain trench limits shall conform to the requirements of the type underdrain being constructed. The Contractor shall take precautions to prevent the underdrain backfill material from becoming contaminated with clay, silts, organic matter or other

foreign matter. Methods of placing backfill material shall be limited to the use of equipment which will place material directly into the trench. Pushing material into the trench will not be allowed.

When underdrain is to be constructed in embankment fill, the excavation for the trench shall be done after the embankment has been completed to subgrade elevation.

MAINE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS
SECTION 703.22

703.22 Underdrain Backfill Material. Granular material for Underdrain Type B shall be free from organic matter and shall conform to the following table:

| Sieve Designation | | Percentage by Weight Passing Square Mesh Sieves |
|---|---|---|
| Metric | English | |
| 25.0 mm | 1 inch | 95-100 |
| 12.5 mm | 1/2 inch | 75-100 |
| 4.75 mm | No. 4 | 50-100 |
| 850 µm | No. 20 | 15-80 |
| 300 µm | No. 50 | 0-15 |
| 75 4 µm | No. 200 | 0-5.0 |

Crushed or uncrushed material for Underdrain Type C shall conform to the following table:

| Sieve Designation | | Percentage by Weight Passing Square Mesh Sieves |
|---|---|---|
| Metric | English | |
| 25.0 mm | 1 inch | 100 |
| 19.0 mm | 4 inch | 90-100 |
| 9.5 mm | 8 inch | 0-75 |
| 4.75 mm | No. 4 | 0-25 |
| 2.00 mm | No. 10 | 0-5.0 |

MAINE DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS
SECTION 722.02

722.02 Drainage Geotextile. The geotextile shall have property values expressed in "minimum" or "minimum average roll" values that meet or exceed the values stated below, as determined by the most recent test methods specified below. All mechanical property values expressed as "average" or "typical" shall be reduced by 20 percent and then compared to the values stated below.

Both woven and nonwoven geotextiles are acceptable, however, no "slit-tape" woven fabrics will be permitted. The geotextile must meet the following requirements:

| Geotextile Mechanical Property | Test Method | Minimum Permissible Value Class A* | Class B* |
|---|---|---|---|
| Grab Tensile Strength (Both directions) | ASTM D4632 or ASTM D5034 and ASTM D5035 | 800 N [180 pounds] | 356 N [80 pounds] |
| Grab Elongation | ASTM D4632 or ASTM D5034 and ASTM D5035 | 15 percent | 15 percent |
| Mullen Burst Strength | ASTM D3786 or ASTM D751 | 2000 kPa [2900 psi] | 896 kPa [130 psi] |
| Puncture Strength | Modified ASTM D3787 or modified ASTM D751 | 56 N [80 pounds] | 110 N [25 pounds] |
| Trapezoid Tear Strength | ASTM D4533 or ASTM D1117 | 220 N [50 pounds] | 110 N [25 pounds] |

| Geotextile Hydraulic Property | Test Method | Permissible Value |
|---|---|---|
| Apparent Opening Size (AOS) | CW-02215 | Sieves Sizes between 850 um and 150 um [U.S. Std. Sieve numbers) between No.20 and No.100] |
| Permeability | ASTM D4491 | 0.01 mm/sec |

* Class A Drainage applications are those where installation stresses are more severe than Class B applications, such as where very sharp angular aggregate is in contact with the fabric, or a heavy degree of compaction is required.

* Class B Drainage applications are those where installation stresses are less severe such as where fabric is used with smooth graded surfaces having no sharp angular projections, no sharp angular aggregate is used, or where compaction requirements are light.

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## Construction

It was apparent from the start of the first edge drain trench that the trenching machine, capable of excavating a ditch 0.2 m (0.66 ft) wide, could not operate properly due to 152 mm+ (6 in+) stones in the shoulder material. A decision was made to excavate the remaining experimental edge drain trenches with a 0.6 m (2 ft) wide bucket. To compensate for the additional underdrain material to fill the edge drains; the depth of each trench was decreased from 1.22 m (4.0 ft) to 1.07 m (3.5 ft).

All five areas chosen for edge drains had a problem with underlying PCC either skewing away from the roadway or no PCC pavement at all due to reconstruction of the project in 1936. A location of the PCC and edge drain is as follows:

The first edge drain was installed on September 4, 5 and 8, 1997, in Area 3 between the outlet at Station 3+263 l. and ending at Station 2+974 l. The underlying PCC slab started to skew away from the existing bituminous pavement edge at Station 3+200 to a maximum offset of 7.6 m (25 ft) L at Station 3+097 then returning to the bituminous pavement edge at Station 2+989. The contractor continued to install the edge drain along the PCC edge with no installation setbacks.

Area 5 was installed on September 8 and 9, 1997, between the outlet at Station 1+274 right and ending at Station 1+567 right. PCC pavement was not evident along the pavement edge while constructing this experimental area but, according to the 1936 plans, the edge of PCC is located 1.8 m (6 ft) r. of CL up to Station 1+369 where the PCC was removed from Station 1+369 to 1+522. The drain trench was excavated to at a depth of 1.3 m (4 ft) from the top of the existing bituminous pavement. Ledge was encountered at Station 1+299 that changed the trench depth to approximately 600 mm (24 in) from the top of the existing bituminous pavement. The contractor continued to install the edge drain along the ledge for another 75 m (246 ft) where, due to the increased elevation of the pavement and the stable elevation of the ledge, the trench depth gradually increased to 1.1 m (3.6 ft) and continued at that depth to the end of Area 5 (station 1+567). The 100 mm (4 in) drainage pipe was supported at the bottom of the edge drain pocket to maintain a gradual pitch for proper drainage.

Area 4 was placed between the outlet at Station 1+274 l. and ending at Station 1+522 l. on September 9, 10 and 11, 1997. PCC pavement was evident at an offset of 3.7 m (12 ft) from CL up to Station 1+369 where, according to the 1936 construction plans, the existing reinforcing concrete was removed between Station 1+369 and 1+522. Edge drain installation continued beyond Station 1+369 along the existing Bituminous pavement edge up to Station 1+522 where PCC pavement reappeared, inhibiting installation of the remaining edge drain.

Another small section of Area 4 edge drain, labeled Area 4C, was installed between the outlet at Station 2+035 r. and ending at Station 2+127 r. on September 17. This location had no underlying PCC pavement along the pavement edge due to relocation of the roadway.

On September 15 and 16, 1997, Area 2 was installed. Construction began at Station 2+035 r. and ends at the inlet at Station 1+720 r. Experimental edge drain was installed according to basic design. Due to the decreased trench depth the wick was curled up at the bottom, then filled on both sides with Type B Underdrain. Due to relocation of this particular area of Route 4 in 1936, there is no PCC pavement under the roadway.

Area 1 was constructed on September 16 and 17, 1997. Installation began at the outlet at Station 2+035 l. as per basic design. The wick for this section was also curled up at the bottom due to the modified trench depth. The contractor had difficulty placing equal amounts of Underdrain Type C on both sides of the wick resulting in a design modification at Station 1+944 l. The wick was placed against the roadway side of the trench then backfilled with Type C Underdrain. This modification continued to the inlet at Station 1+730 l. This area also has no PCC pavement due to relocation of the roadway in 1936.

A Control Area was set up between Stations 2+974 l. and 2+693 l. The underlying PCC pavement for this section is at an offset of 2.7 m (9 ft) l.

A second Control Area (Control 2) that has no PCC pavement was created on October 17, 2000 between Stations 3+500 r. and 3+800 r. This area will be used to evaluate experimental drainage areas that were not installed adjacent to PCC pavement.

## Visual Inspection

A visual inspection was performed on September 11, 2001.

The length of PCC edge cracking has increased in Areas 4 and 4C. The length of this type of cracking in Area 3 and the Control section has decreased from last year because the PCC edge related cracking has

deteriorated to the point that it is now considered load cracking. These areas are now labeled load cracking since load cracks are regarded as more severe than reflective PCC edge cracks.

Centerline cracking has increased in Areas 1, 2, 4, 5 and Control 2.

Between wheel path cracking has increased in Areas 2, 3 and 4C. Area 1 has a decreased amount of this type of cracking due to load cracking as mentioned earlier.

Edge of pavement cracking has increased in Areas 4c and 5. Areas 1, 2, 3, Control and Control 2 has a decreased length of this type of cracking due to the increased amount of load cracking.

Transverse cracking has increased in Areas 1, 2, 4, 4C and Control 2. Load cracking has decreased the number of transverse cracks in Areas 3, 5, and the Control section.

Load cracking has increased in all sections. Areas 1, 2, 3, 5, Control and Control 2 had edge of pavement, transverse and PCC related cracking that has deteriorated to the point that it is considered load cracking. Areas where this has occurred are showing decreased amounts of longitudinal and transverse cracking.

Rutting has increased in sections 3, 4C and Control 2. Rutting in Control 2 section has increased from less than 6 mm to between 12 and 18 mm in depth.

Table I contains a Pavement Condition Summary (PCS) for 2001. This table portrays length of PCC edge cracking, cracking between wheel paths, edge of pavement, load and transverse cracking as well as rut depths. A column showing the percent of increased cracking compared to 2000's inspection is also included.

Table II breaks down the PCS data further to show pavement distress as a percent of the length of each section. Percentage of cracking along the PCC edge in Table II is based on the length of PCC under the roadway. Percentage of load cracking is based on the total area of each section [length of section by width of lane (3.3528 m)]. Centerline, between wheel path and pavement edge percentiles is based on the length of each section.

## Summary

Area 3 and 4 has experimental edge drain installed adjacent to PCC pavement. The performance of these experimental Areas will be judged by comparing roadway pavement performance to the Control section. A review of Table II data illustrates both Experimental Areas are outperforming the Control section pertaining to PCC reflective edge cracking and load cracking. Area 3 Experimental Drainage is reducing the amount of reflective PCC edge related cracking and pavement edge cracking better than Area 4. Area 4 has 4.3 percent less load cracking than Area 3 and 8.1 percent less than the Control section. Other than a high amount of pavement edge cracking, Area 4 Experimental Drainage is reducing the amount of load associated roadway damage much better than Area 3.

Experimental Drainage in Areas 1, 2, 4C, and 5 were not installed adjacent to PCC pavement but will be evaluated for pavement performance. The Control 2 section will be used to compare performance of these Areas. All experimental Areas have lower amounts of load cracking than the Control 2 section. Only 2.7 percent of Area 5 has load cracking, this is 1.8 to 4.4 percent less than the remaining Experimental Drainage Areas and 16.2 percent less than the Control 2 section. Data reveals that the subsurface drainage

systems are effective in improving pavement serviceability based on comparing sections 1, 2, 4c, 5 to Control 2.

Based on the data, the use of Experimental Drainage can reduce the amount of PCC edge related reflective cracking and load cracking on composite roadways.

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Other Available Documents:

Construction and First Interim Report, September 1998
Second Interim Report, March 2000
Third Interim Report, November 2000

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## TABLE I. 2001 PAVEMENT CONDITION SURVEY

| Section | Total Length of Underlying PCC | Longitudinal Cracking | | | | | | | | | | | | Transverse Cracking | | | Load Cracking | | | | Rut Depth |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Along PCC Edge [1] | | | | Centerline [2] | | | | Between Wheel Path | | | Edge of Pavement | | | | | | | | |
| | m (ft) | m (ft) | "00" PCS m | Percent Increase | | m (ft) | "00" PCS m | Percent Increase | | m (ft) | "00" PCS m | Percent Increase | m (ft) | "00" PCS m | Percent Increase | Full Lane | "00" PCS m | Percent Increase | $m^2$ ($ft^2$) | "00" PCS m | Percent Increase | mm (in) |
| Area 1 | | | | | | 17.6 (58) | 2.2 | 700% | | 10.8 (35) | 19.2 | -44% | 26.1 (86) | 51.3 | -49% | 2.75 | 1.5 | 83% | 46 (495) | 27.4 | 68% | 6-12 (0.25-0.5) |
| Area 2 | | | | | | 27.6 (91) | 11 | 151% | | 40 (131) | 27.6 | 45% | 33.9 (111) | 38.1 | -11% | 7.75 | 2 | 288% | 53.4 (575) | 22.9 | 133% | 6-12 (0.25-0.5) |
| Area 3 | 78 (256) | 5.3 (17) | 11.5 | -54% | | 109.9 (361) | 109.9 | 0% | | 18 (59) | 16.2 | 11% | 10.1 (33) | 32.8 | -69% | 13.5 | 16 | -16% | 60.9 (656) | 5.95 | 924% | 6-12 (0.25-0.5) |
| Area 4 | 95 (312) | 12.2 (40) | 10 | 22% | | 78.1 (256) | 64.9 | 20% | | | | | 55.5 (182) | 55.5 | 0% | 7 | 6 | 17% | 14.5 (156) | 0.8 | 1713% | 6-12 (0.25-0.5) |
| Area 4C | | 19.7 (65) | 14 | 41% | | 29.5 (97) | 29.5 | 0% | | 14.3 (47) | 2 | 615% | 37.8 (124) | 4.1 | 822% | 3 | 1 | 200% | 21.9 (236) | 12.5 | 75% | 6-12 (0.25-0.5) |
| Area 5 | | | | | | 103.1 (338) | 89.2 | 16% | | 6 (20) | 6 | 0% | 70.4 (231) | 56.9 | 24% | 2 | 3.5 | -43% | 26.9 (290) | 18.2 | 48% | 6-12 (0.25-0.5) |
| Control | 281 (922) | 133.1 (437) | 191.2 | -30% | | 30.3 (99) | 30.3 | 0% | | | | | 19.2 (63) | 56.8 | -66% | 17.5 | 23 | -24% | 92.1 (991) | 7 | 1216% | 6-12 (0.25-0.5) |
| Control 2 | | | | | | 40.5 (133) | 16.8 | 141% | | | | | 31.8 (104) | 33.6 | -5% | 11.75 | 5 | 135% | 189.9 (2044) | 98.6 | 93% | 12-18 (0.5-0.75) |

[1] Area 4C PCC edge cracking is skewed across the lane reflecting old PCC roadway edge.
[2] Areas 1 & 2 have 305 m and Areas 4 & 5 have 248 m of common centerline.
Shaded areas have drainage installed adjacent to PCC roadway.



## TABLE II. PAVEMENT DISTRESS BY SECTION

| Section | Length of Section (m) | Length of Underlying PCC (m) | Longitudinal Cracking | | | | % Load Cracking[1] |
|---|---|---|---|---|---|---|---|
| | | | % along PCC edge | % of Centerline | % Between Wheelpath | % edge of Pavement | |
| Area 1 | 305 | | | 5.8 | 3.5 | 8.6 | 4.5 |
| Area 2 | 315 | | | 8.8 | 12.7 | 10.8 | 5.1 |
| Area 3 | 289 | 78 | 6.8 | 38.0 | 6.2 | 3.5 | 6.3 |
| Area 4 | 248 | 95 | 12.8 | 31.5 | | 22.4 | 1.7 |
| Area 4C | 92 | | | 32.1 | 15.5 | 41.1 | 7.1 |
| Area 5 | 293 | | | 35.2 | 2.0 | 24.0 | 2.7 |
| Control | 281 | 281 | 47.4 | 10.8 | | 6.8 | 9.8 |
| Control 2 | 300 | | | 13.5 | | 10.6 | 18.9 |

[1] Based on total area of Section (length of section x width of lane).
Shaded areas have drainage installed adjacent to PCC roadway.