



THURBER ENGINEERING LTD.

ALBERTA TRANSPORTATION LANDSLIDE RISK ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW

NORTH CENTRAL REGION - ATHABASCA

SITE NC73: HWY 2:46 MITSUE FROST HEAVE (km 39.5)

Highway Control Section:	HWY 2:46
Nearest Landmark	44 km NORTHWEST OF THE JUNCTION OF HWY 2:46 AND HWY 44:04
Legal Location:	NW-14-72-4-W5M
Date of Initial Observation:	2008
Date of Last Inspection:	June 2012
Last Inspected By:	Thurber Engineering Ltd. (Thurber)
Instruments Installed:	None
Instruments Operational:	None
Risk Assessment:	PF(9) x CF(2) = 18
Last Updated:	N/A
Previous Update:	N/A



1. LOCATION

The site is located on Highway 2:46 at km 39.5, and is approximately 44 km to the northwest of the junction of HWY 2:46 and HWY 44:04.

2. GENERAL DESCRIPTION OF SITE ISSUES

The primary issue of the site is the presence of a sharp transverse bump crack across the highway surface, which continued to adversely affect the highway rideability. The bump crack is typically 35 mm to 100 mm wide with 15 mm to 20 mm differential heights across the crack surface. Details of the main features of the site are shown in a sketch on Figures NC73-1 and NC73-2. Figure NC73-2 shows a simplified cross-section across the highway.

According to existing information (refer to Section G), this section of the highway was insulated in 2008 to the east of the existing crack. Site inspection visits and review of report records indicated that the crack had developed between the insulated and uninsulated sections of the highway. It appears that the crack developed due to insufficient transition length of insulation at the crack location, resulting in differential frost heave between treated and untreated roadway sections at this location.

Presence of high ground water level (due to poor surface drainage in the ditch) and frost susceptible soils below the pavement structure in the untreated section are probably the main triggers for the ongoing seasonal frost heave issue.

Secondary issues at this site include presence of icy conditions on the insulated section of the highway near the crack location, and appearance of fine stress cracks on the highway surface.

3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

Physiographic Region: Located in the Lesser Slave Lowland (Atkinson, N. and Lyster, S., 2010).

Bedrock Geology: The bedrock at the site is of the Wapiti Formation consisting of grey, feldspathic, clayey sandstone, grey bentonitic mudstone and bentonite with scattered coal beds. (Geological Map of Alberta, AGS, AEUB, 1999).

Surficial Geology: Surficial deposits in the area consist of complex glaciofluvial deposits consisting of sand and gravel with local areas of diamicton (poorly sorted sediment). The deposits are undifferentiated ice contact stratified drift and outwash. The deposits can also be glacial till and rock. Surficial deposits are expected to be between 15 m and 45 m thick. (Surficial Materials of Canada, GSC, 1995).

Hydrogeology: Local groundwater and surface water flow is expected to be northwest towards Mitsue Lake and Lesser Slave River. Regional groundwater flow is towards Lesser Slave Lake, located approximately 20 km to the northwest. (Hydrogeological Map Lesser Slave Lake Alberta, ARC, 1977).

Stratigraphy: Stratigraphic information was not available for this site.



4. CHRONOLOGY

2008

Frost heave repairs at the site were completed in October 2008. The repair consisted of excavating the pavement to a depth of 0.82 m below the top of the asphalt surface and installing 150 mm (3 layers, each 50 mm thick) of extruded polystyrene insulation (STYROFOAM Brand High Load 100) on top of the prepared sub-grade. The insulation was covered by about 500 mm of granular base and 220 mm of ACP. A 100 m to 130 m long section of the highway was insulated to the east of the bump crack.

2011

A Call-Out inspection visit was performed by Thurber in March 2011. An additional site visit was also carried out in May 2011 to capture the variation in the crack configuration between the spring and winter seasons. A temporary remedial measure, consisting of milling the highway surface, at the bump crack location, was completed in March 2011 to provide a smooth ride to travellers.

2012

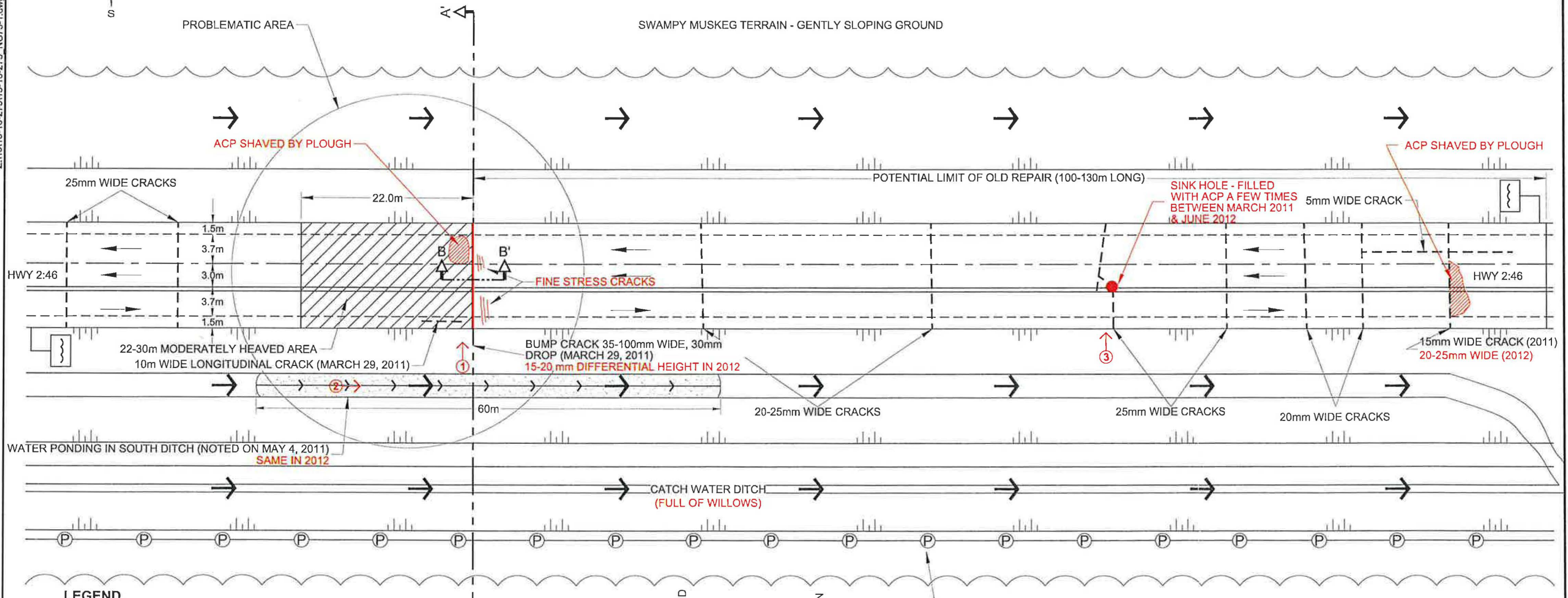
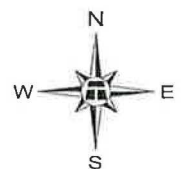
A site inspection visit was carried out in June 2012. A sink hole was noted in the highway westbound lane. The local MCI indicated that this sink hole was filled a few times in the past with ACP between March 2011 and June 2012.



REFERENCES

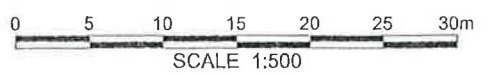
1. Atkinson, N. and Lyster, S., 2010. "Bedrock Topography of Alberta, Canada," ERCB/AGS Map 50, scale 1:1,500,000.
2. Alberta Geological Survey, Alberta Energy and Utilities Board, 1999. "Geological Map of Alberta." Map No. 236, scale 1:1,000,000, compiled by Hamilton, W.N., Price, M.C. and Langenberg, C.W..
3. Geological Survey of Canada, 1995. "Surficial Materials of Canada," Map 1880A, scale 1:500,000, compiled by Fulton, R.J..
4. Alberta Research Council, 1977. "Hydrogeological Map Lesser Slave Lake Alberta."

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- LEGEND**
- CRACKS
 - BUMP CRACK
 - MODERATELY HEAVED AREA
 - SLOPING GROUND
 - POWER POLE
 - BUMP WARNING SIGN
 - WATER FLOW DIRECTION IN DITCH
 - TREE LINE
 - PROPOSED SUBDRAIN
 - PHOTOGRAPH NUMBER AND APPROXIMATE LOCATION AND DIRECTION (JUNE 11, 2012)

NOTE:
JUNE 11, 2012 SITE OBSERVATIONS ARE SHOWN IN RED.



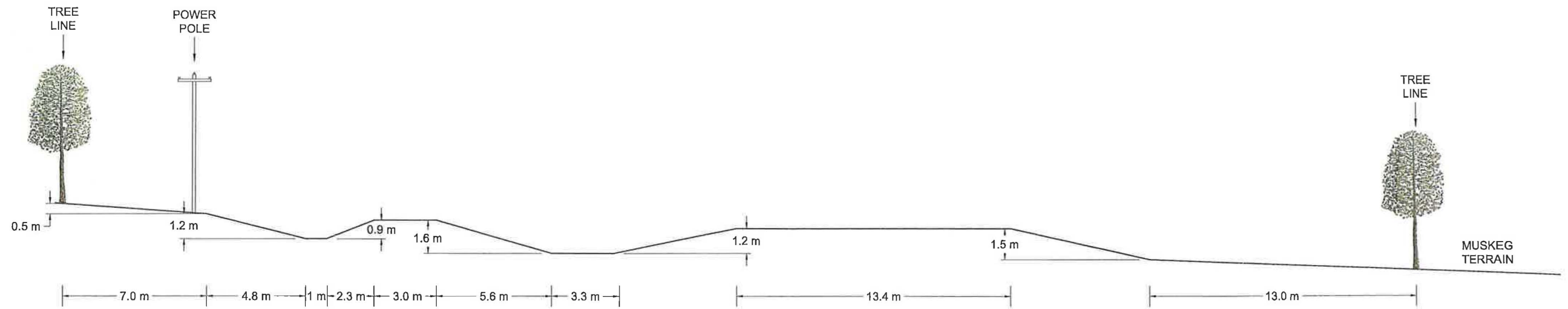
**NORTH CENTRAL REGION (ATHABASCA AREA)
- 2012 GEOHAZARD ASSESSMENT**

**NC73: HWY 2:46 MITSUE FROST HEAVE
SITE PLAN**

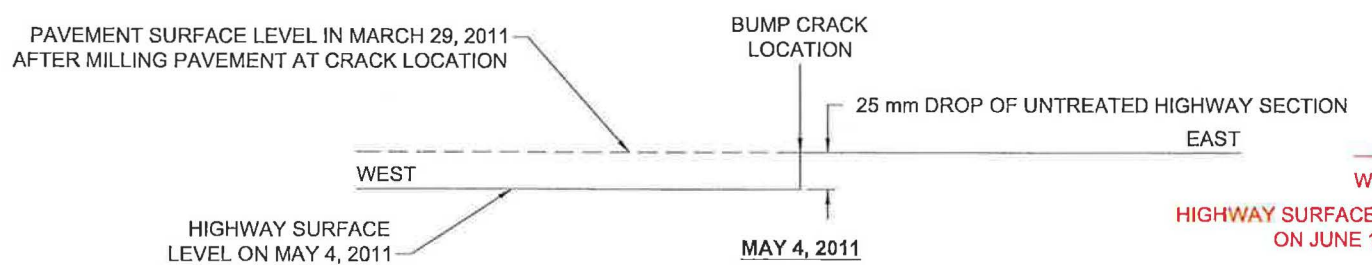
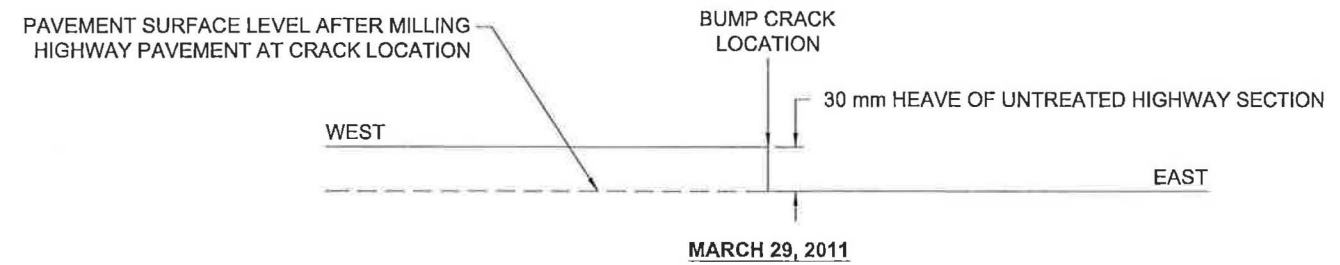
FIGURE NC73-1

DRAWN BY	ML
DESIGNED BY	TSA
APPROVED BY	DWP
SCALE	1:500
DATE	NOVEMBER 2012
FILE No	15-16-275

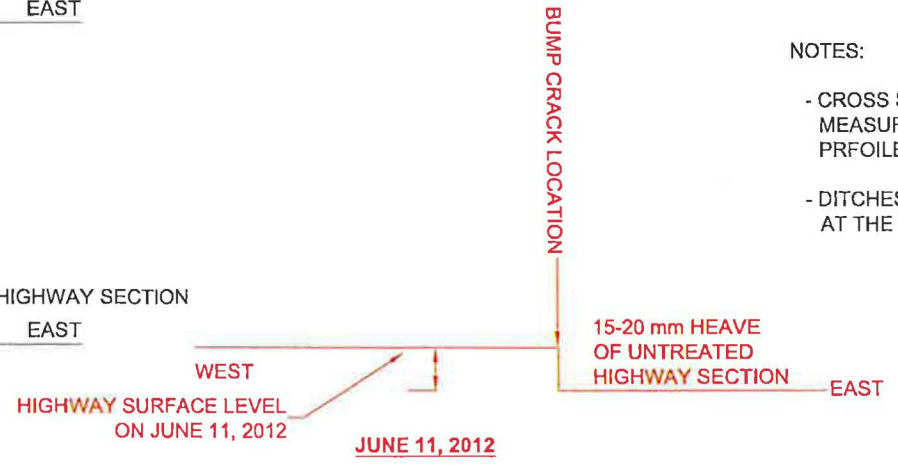
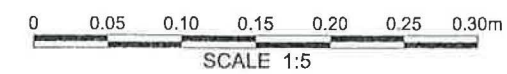
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CROSS SECTION A-A'
SCALE 1:200



CROSS SECTION B-B' - PROFILE ALONG
HIGHWAY SURFACE AT BUMP CRACK LOCATION
SCALE 1:5



NOTES:

- CROSS SECTION A-A' IS BASED ON APPROXIMATE SIMPLE FIELD MEASUREMENTS AND MAY NOT REPRESENT THE ACTUAL PROFILE AT THE AREA OF CONCERN.
- DITCHES AND SIDE SLOPES WERE COVERED WITH DEEP SNOW AT THE TIME OF SITE VISIT IN MARCH 2011.



NORTH CENTRAL REGION (ATHABASCA AREA)
- 2012 GEOHAZARD ASSESSMENT

NC73: HWY 2:46 MITSUE FROST HEAVE
CROSS SECTIONS A-A' & B-B'

FIGURE NC73-2

DRAWN BY	ML
DESIGNED BY	TSA
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	NOVEMBER 2012
FILE No.	15-16-275



SPECIAL PROVISIONS

The Contractor will be responsible for re-seeding any disturbed areas resulting from the disposal operation in accordance with Specification 2.20, "Seeding".

Methods and equipment for this Work will be subject to the approval of the Consultant.

Payment for this Work will be made at the applicable unit prices bid and will be considered full compensation for all labour, materials, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Consultant.

3.10 FROST HEAVE REPAIR

At approximately kilometre 39.40 there is a frost heave which requires repair. The repair shall consist of the excavation of existing pavement structure and subgrade materials, installation of 150 mm of extruded polystyrene insulation ("STYROFOAM Brand High Load 100" or approved equivalent) on existing subgrade or base, 500 mm of granular base course and 220 mm of asphalt concrete pavement. Plan and sections are shown in Plan No. 7217-4. Exact limits of the repair will be staked in the field by the Consultant.

3.10.1 Materials

Insulation: Dow Chemical's "STYROFOAM Brand High Load 100" or approved equivalent.

3.10.2 Construction

The Contractor shall sawcut, excavate and dispose of the existing pavement, base and subgrade to a depth of 800 mm below existing surface. The Contractor shall take ownership of the waste asphalt pavement.

The Contractor shall level and compact the exposed surface. Then the insulation shall be installed in three (3) layers, overlapping the boards such that there are no continuous joints through the insulation layer. The granular base course shall then be placed on top of the insulation. The Contractor shall ensure that no equipment or vehicles are operated on the exposed insulation. After the granular base is placed and compacted, the Contractor shall place the asphalt concrete pavement.

The base work will be performed in accordance with Specification 3.6 - "Granular Base Course". The paving work will be performed in accordance with Specification 3.50 - "Asphalt Concrete Pavement - EPS".

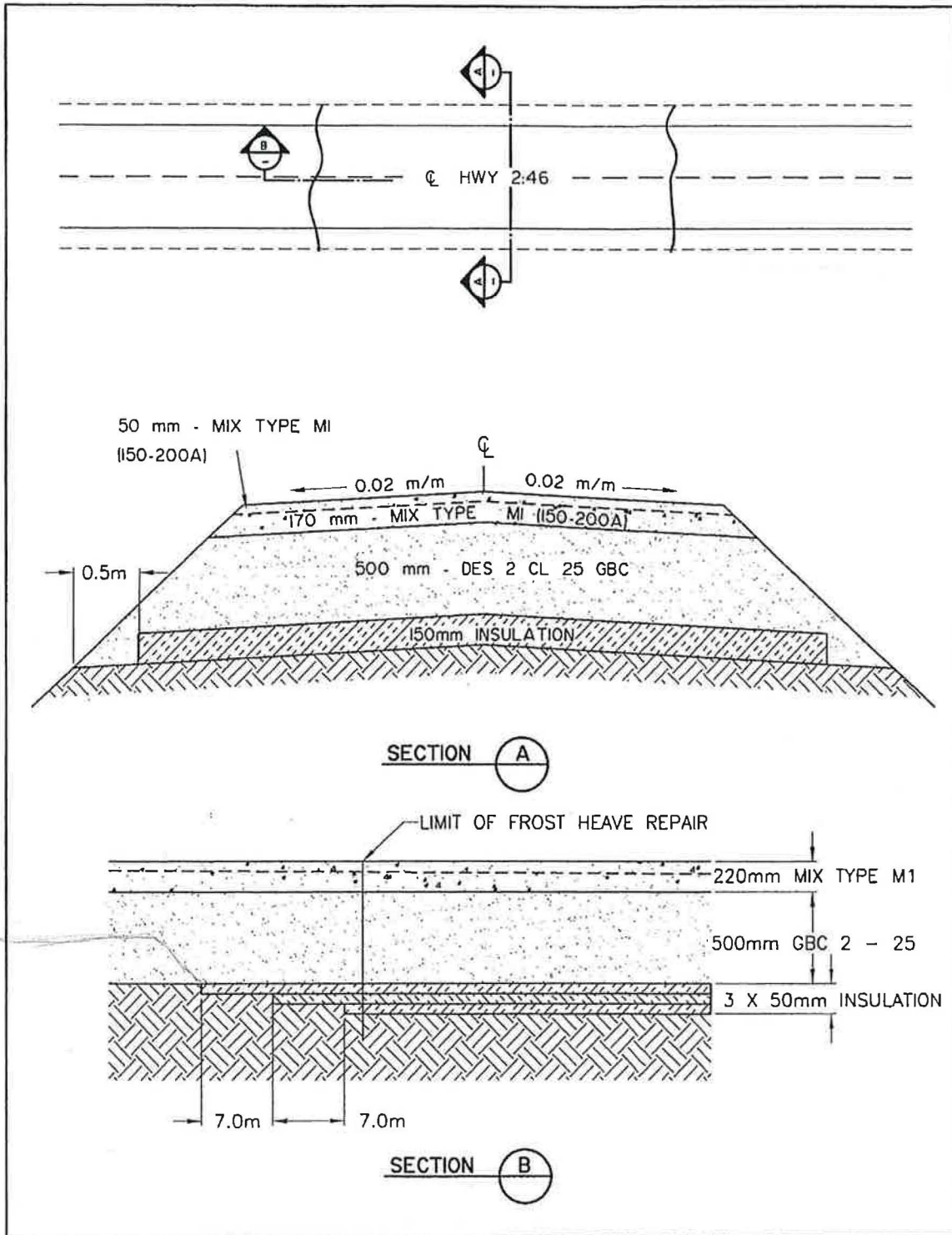
3.10.3 Measurement and Payment

Rigid board insulation will be measured by the square metre per 50 mm thickness, based on the area of material installed, excluding the area associated with laps.

Payment for rigid board insulation will be made at the unit price bid for "Rigid Board Insulation - 50mm Thickness - Supply and Install". This payment will be compensation in full for supplying and installing the insulation and all equipment, labour, tools and incidentals necessary to complete the work.

Payment for the excavation and removal of the existing asphalt pavement, base course and subgrade will be made at the applicable unit price bid for "Subgrade Excavation". Any necessary pavement cutting will be considered incidental to the work.

PLANS AND PERMITS



	PLAN AND SECTIONS OF FROST HEAVE REPAIR				
	Region	Dwn. By	Check	Plan No. 7217-4	
	North Central	JCB	LM	03/13/07	

Week 15 (September 14, 2008 to September 20, 2008)

In-Line completed placing granular base course in the following locations: NW, NE & Westbound Passing Lane of the Poplar Lane intersection, SW & SE of the West Mitsue intersection, Eastbound Climbing Lane at km 48.60, SW, SE & Westbound Passing Lane of the Mitsue Gravel Pit intersection, and SW, SE, & Median of the East Mitsue intersection.

Highline Electrical Contractor completed anchoring the street light pole bases at East Mitsue intersection.

Week 16 (September 21, 2008 to September 27, 2008)

Highline Electrical Contractor completed auguring underground cable lines for the street lights at East Mitsue intersection.

In-Line completed grouting mortar on the pipe liners and the abandoned culverts at km 41.116, km 42.23, km 46.556, and km 57.179.

Week 17 (September 28, 2008 to October 4, 2008)

In-Line completed removing ACP from NE of the East Mitsue intersection and flattened the sideslope after saw cutting the excess shoulder width from the exit ramp.

Subgrade construction and GBC placement was completed at NW, SW & North Passing Lane of the Boreal intersection.

E-Construction mobilized on October 3, 2008 and started bottom lift paving at the improved intersections.

Week 18 (October 5, 2008 to October 11, 2008)

In-Line completed subgrade construction and GBC placement at the North Passing Lane of the Devonshire intersection. Frost heave repair was started on Hwy 2:46 from km 39.459 to km 39.545. Undercut was excavated to a depth of 0.82 metre below the asphalt surface and Styrofoam insulation was installed before backfilling with GBC and ACP. Topsoil, roots and stumps were noticed in some part of the excavated material at the bottom of this frost heave affected area.

E-Construction was paving bottom lift on Hwy 2:46.

Week 19 (October 12, 2008 to October 18, 2008)

Frost heave repair was completed on Hwy 2:46 from km 39.459 to km 39.545. Subgrade construction and GBC placement at NE & NW of the West Mitsue Intersection was also completed. Hwy 88:02 and Hwy 2:46 NE curve improvement was completed by excavating the existing GBC shoulder and backfilling with ACP-M1.

In-Line also started placing borrow material at the flare ends for guardrail installation. Excavation was started for drainage improvement at the SWSP outside the paving limit.

E-Construction was paving bottom lift and top lift on Hwy 2:46 main alignment.

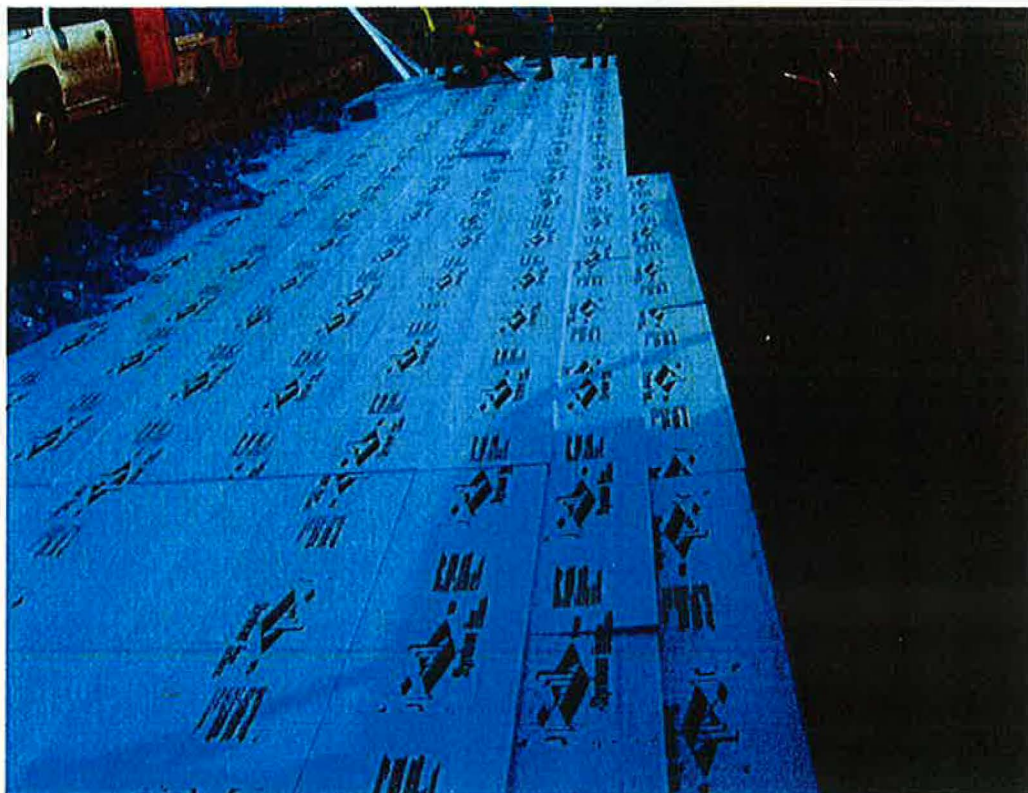
Interim Inspection for the slide repair was conducted on October 16, 2008.

Week 20 (October 19, 2008 to October 25, 2008)

In-Line completed subgrade construction and GBC placement at SW of the Devonshire Lane intersection. E-Construction paved bottom lift at the super-elevated taper of the Devonshire Lane intersection to protect the subgrade and GBC from rain. Sideslope improvements were completed from km 45.66 to km 45.74 EB, km 45.77 to km 45.85 EB, km 45.749 to km 45.850 WB, km 45.45 to km 45.53 WB, and km 48.21 to km 48.36 EB. Also, GBC placement were completed on approaches at km 48.39, km 43.26, and km 43.71 on Hwy 2:46. Approach removal



Picture -15 Subgrade Excavation for Frost Heave Repair (km 39.459 to km 39.545)



Picture -16 Styrofoam Installation for Frost Heave Repair (km 39.459 to km 39.545)