

November 21, 2012

PML Ref.: 11KF058A-1  
Index No.: 183ADD  
GEOCRES No. 31M-97

Mr. Al Rose, P.Eng.  
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Dear Mr. Rose

**Technical Memorandum No. 1**  
**Addendum to Foundation Design Report**  
**Milberta Creek Culvert Replacement**  
**Highway 65**  
**Site No. 47-290/C**  
**GWP 5126-05-00**  
**Township of Hudson**  
**New Liskeard Area, Ontario**

This technical memorandum provides the Revised Appendix FDR-3 'Supply and Installation of embankment Monitoring Equipment' for the Milberta Creek Culvert Replacement Foundation Design report.

The attached NSSP document supersedes the original document and reflects the details of the final proposed sequence and scope of the culvert replacement. The revisions were prepared following discussions and revisions by Mr. Al Rose, P.Eng. of AECOM and Ms. Marcia Mora, P.Eng. of the MTO Pavements and Foundations Section.

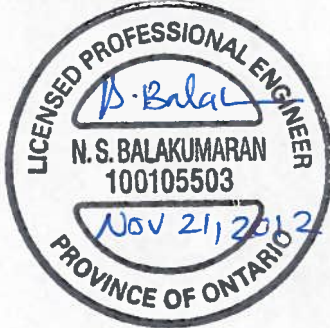
This technical memorandum was prepared by Mrs. N.S. Balakumaran, P.Eng. and reviewed by Mr. C.M.P. Nascimento, P.Eng., Project Manager and MTO Designated Principal Contact.



We trust that the foregoing is sufficient for your present requirements.

Yours very truly

Peto MacCallum Ltd.



Nesam S. Balakumaran, P.Eng.  
Project Engineer



Carlos M.P. Nascimento, P.Eng.  
Project Manager and MTO Designated  
Principal Contact

NB/CN/mi

Enclosure(s):

Appendix FDR-3 Supply and Installation of Embankment Monitoring Equipment

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## **SUPPLY AND INSTALLATION OF EMBANKMENT MONITORING EQUIPMENT**

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### **Non Standard Special Provision**

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#### **1.0 SCOPE**

This special provision covers the requirements for the supply and installation of the following geotechnical instruments:

- Surface Movement Markers (SMM)

The purpose of SMM instruments is to monitor ground movements along the top of the existing embankment during staged construction. The data will be used for the planning and construction of the Milberta Creek culvert replacement. Ground movements are measured by surveying with total station equipment at the top of the SMM.

#### **2.0 DEFINITIONS**

For the purposes of this special provision the following definitions apply:

**Foundations Engineering Consultant:** means a Foundations Engineering Consulting firm registered in the MTO consultant acquisition system (RAQS) with specialty rating 'Geotechnical (Structures and Embankments) - Medium Complexity'. The Geotechnical Consultant shall not be the same consultant that has been retained by the Contract Administrator.

**Geotechnical Engineer:** means a Geotechnical Engineer employed by the Foundations Engineering Consultant and having experience and expertise to provide design and inspection services to the Contractor for installation of the geotechnical instruments.

#### **3.0 SUBMISSION AND DESIGN REQUIREMENTS**

##### **3.1 Working Drawings**

All submissions shall bear the seal and signature of the Geotechnical Engineer.

The Contractor shall submit details of proposed installations, including:

- Design and construction drawings, including equipment layout;
- Installation methodology and timing;
- Equipment and material specifications, data sheets;
- Location and types of survey benchmarks; and
- Installation schedule.

Submissions shall be made to the Contract Administrator a minimum of 15 days before the start of instrument installation.

### 3.2 Subsurface Conditions

A Foundation Investigation Report that describes the subsurface conditions at the instrumentation locations is available, as specified in the Contract. The Owner warrants that the information provided in the report can be relied upon with the following exceptions:

1. Any interpretations of data or opinions expressed in the report are not warranted; and
2. Although the raw measured data presented is warranted, the Contractor must satisfy himself as to the sufficiency of the information presented and obtain any updating or additional information, and perform any studies, analysis or investigations the Contractor deems necessary in order to prepare his design, at no additional cost to the Owner.

### 3.3 Certificate of Conformance

Upon completion of the SMM installation, the Contractor shall submit to the Contract Administrator a Certificate of Conformance sealed and signed by the Geotechnical Engineer stating that the materials and work have been supplied and installed in general conformance with the working drawings and Contract documents. This requirement may be waived if the SMM points include simple installations, such as roofing nails and survey tape driven on paved roadway surfaces.

## 4.0 MATERIALS

### 4.1 Equipment Operation and Weather Conditions

All installation and monitoring equipment and associated materials shall be capable of withstanding the range of temperatures possible for their location within the ground or on the surface. The instruments shall be capable of operating within the manufacturer's stated accuracy throughout the temperature range. The contractor is advised that the equipment shall remain in place at the completion of the contract and should be accessible for continued monitoring.

### 4.2 Instrumentation Requirements

A summary of instrumentation requirements is given in Tables 1 and 2 for each staged construction.

Table 1 - Instrument Locations

Stage 1 (Assumed) – Removal of north end (outlet) and installation of north end of culvert

INSTRUMENT I.D.	STATION	OFFSET	NO. OF INSTRUMENTS
			SMM
SMM1A	15+447	1.0 m Rt	1
SMM2A	15+457	2.0 m Rt	1
SMM3A	15+467	1.0 m Rt	1
SMM4A	15+477	2.0 m Rt	1
SMM5A	15+487	1.0 m Rt	1
<b>Total SMM</b>			<b>5</b>

Note: Offsets are approximate and referenced to roadway protection system. Instruments (SMM) are to be installed where practical and where approved by the geotechnical engineer.

**Table 2 - Instrument Locations**

Stage 2 (Assumed) – Removal of south end (inlet) of existing culvert and installation of south end of culvert. Note that this part of the monitoring may be discontinued by the Geotechnical Engineer based on the outcome of the Stage 1 excavation and as agreed by the Contract Administrator.

INSTRUMENT I.D.	STATION	OFFSET	NO. OF INSTRUMENTS
			SMM
SMM1B	15+447	1.0 m Lt	1
SMM2B	15+457	2.0 m Lt	1
SMM3B	15+467	1.0 m Lt	1
SMM4B	15+477	2.0 m Lt	1
SMM5B	15+487	1.0 m Lt	1
		<b>Total SMM</b>	<b>5</b>

Note: Offsets are approximate and referenced to roadway protection system. Instruments (SMM) are to be installed where practical and where approved by the geotechnical engineer.

The Contractor shall supply 38mm x 38mm wood stakes or 20 mm steel rods at least 1.2 m in length for SMM installations in fill materials. Where the asphalt pavement or concrete is in place SMMs made up with roofing nails driven through red survey tape pieces may be used.

## **5.0 CONSTRUCTION**

### **5.1 General**

The purpose of the surface movement markers is to monitor settlements and horizontal movements of the surface of the embankment fill. The vertical and horizontal movements are measured by survey of the top of the markers with reference to stable, non-settling benchmarks.

### **5.2 Locations of Surface Movement Markers**

The locations of the surface movement markers are shown in Tables 3 and 4.

**Table 3 - Approximate Surface Movement Markers Locations for Stage 1**

INSTRUMENT I.D.	STATION	OFFSET (1)	APPROXIMATE INSTALLATION (2)	
			DEPTH (m)	ELEVATION (m)
SMM1A	15+447	1.0 m Rt	1.0	246.9
SMM2A	15+457	1.0 m Rt	1.0	246.9
SMM3A	15+467	1.0 m Rt	1.0	246.9
SMM4A	15+477	1.0 m Rt	1.0	246.9
SMM5A	15+487	1.0 m Rt	1.0	246.9

(1) Offset from roadway protection system.

(2) Refers to wooden stakes or steel rods. Roofing nails with survey tape are surface installed.

**Table 4 - Approximate Surface Movement Markers Locations for Stage 2**

INSTRUMENT I.D.	STATION	OFFSET (1)	APPROXIMATE INSTALLATION (2)	
			DEPTH (m)	ELEVATION (m)
SMM1B	15+447	1.0 m Lt	1.0	246.9
SMM2B	15+457	2.0 m Lt	1.0	246.9
SMM3B	15+467	1.0 m Lt	1.0	246.9
SMM4B	15+477	2.0 m Lt	1.0	246.9
SMM5B	15+487	1.0 m Lt	1.0	246.9

- (1) Offset from roadway protection system.
- (2) Refers to wooden stakes or steel rods. Roofing nails with survey tape are surface installed.
- (3) Note that the Phase 2 instrumentation may be discontinued by the Geotechnical Engineer based on the outcome of the Stage 1 culvert installation and as agreed by the Contract Administrator.

### **5.3 Survey Benchmarks**

The Contractor shall provide local, stable and non-settling survey benchmarks. The number and locations of benchmarks shall be such that direct sighting is possible from all surface movement markers (SMM) to at least one bench mark. Elevations shall be surveyed to an accuracy of  $\pm 2$  mm or better.

Prior to the installation of instruments, the Contractor shall accurately survey and stake the location of each instrument and obtain a ground elevation at each instrument location.

### **5.4 Installation**

All instruments shall be adequately protected by the Contractor such that they are not damaged during construction. Any instrument damaged by the Contractor's work shall be immediately replaced and re-surveyed at the Contractor's cost.

The surface movement markers (SMM) shall be placed prior to commencement of the Stage 1 and Stage 2 excavations. The markers shall be driven/placed to at least 1.0 m below grade where they will not interfere with traffic. All monitoring points shall be painted yellow and clearly labeled. A roofing nail shall be driven flush with the top of each wooden stake (if these are used) to be used as the survey reference point. Where the asphalt pavement is in place SMM made up with roofing nails driven through red survey tape pieces may be used. The SMM units shall be located as shown on Tables 3 and 4 or where approved by the Geotechnical Engineer to avoid traffic interference.

### **5.5 Monitoring**

Monitoring of the surface movement markers will be performed by the Contract Administrator. Monitoring will be conducted for each staged construction. Note that the Phase 2 instrumentation may be discontinued by the Geotechnical Engineer based on the outcome of the Stage 1 culvert installation and as agreed by the Contract Administrator.

## **6.0 BASIS OF PAYMENT**

Payment at the Lump Sum price for this tender item shall be full compensation for all labour, equipment and material to do the work.