

G.I.-30 SEPT. 1976

GEOCRES No. _____

DIST. _____ REGION _____

W.P. No. 44-94-01

CONT. No. _____

W. O. No. _____

STR. SITE No. 11-45HWY. No. 7LOCATION Hwy 7 & Moira River
Bridge Rehab.No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____REMARKS: _____

CON 3
LOT 7

CON 3
LOT 7

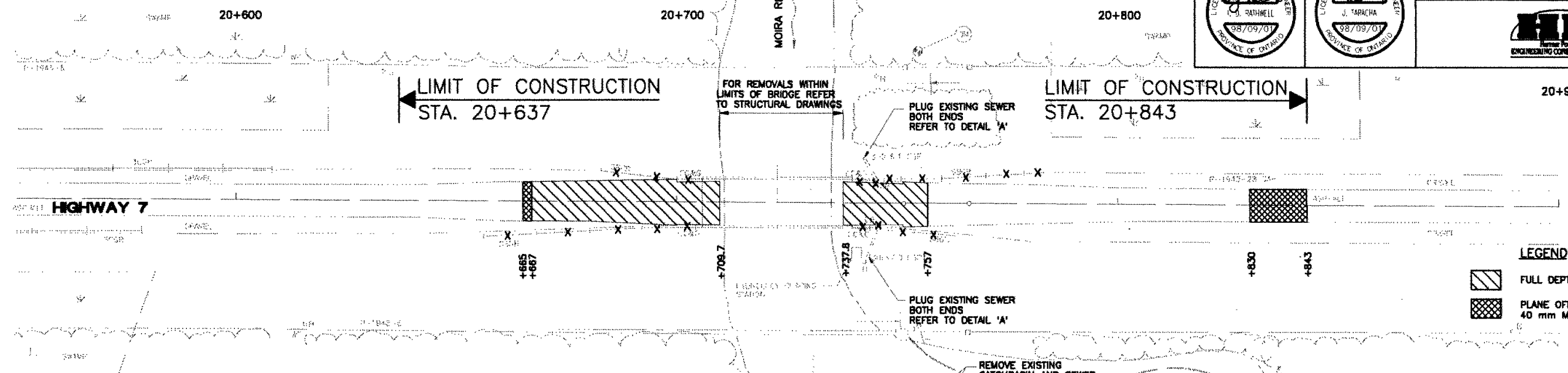
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DIST. 41
CONT No
WP No 44-94-01



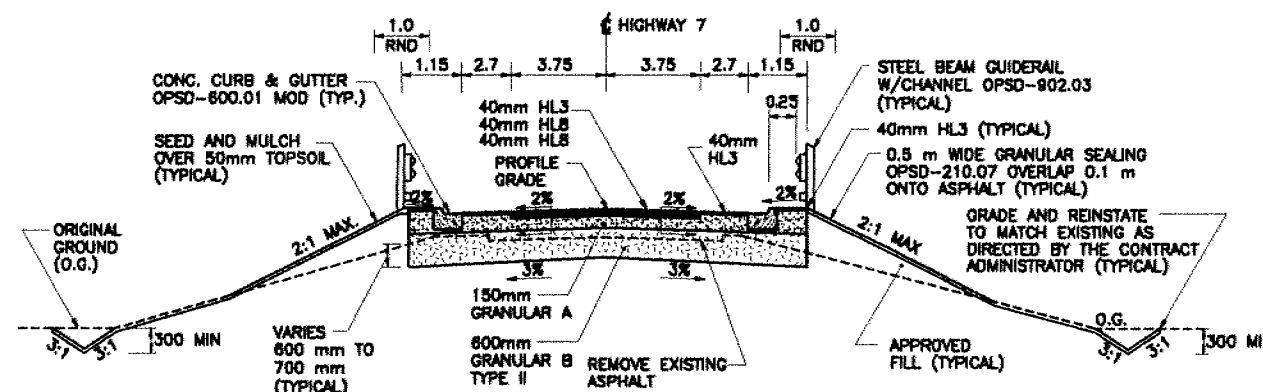
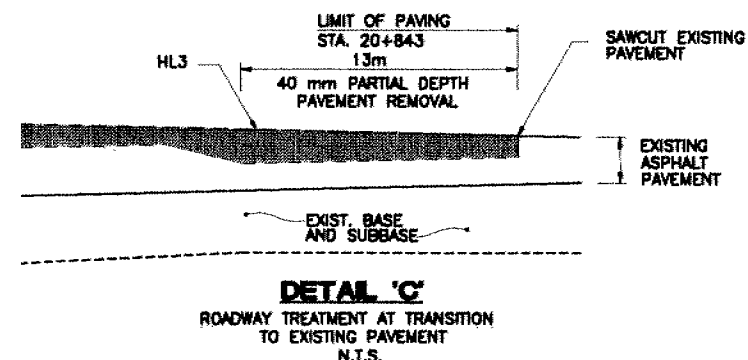
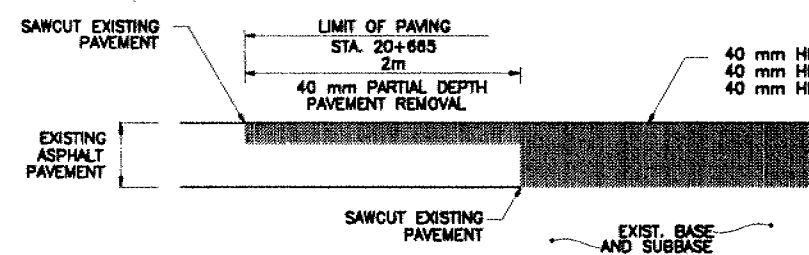
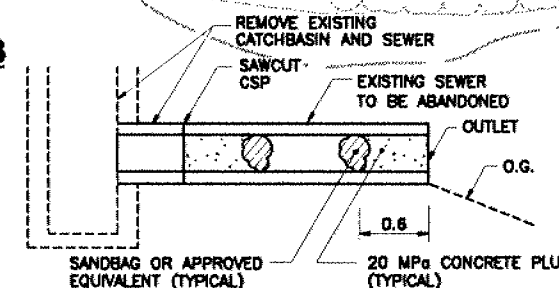
MOIRA RIVER BRIDGE
REMOVALS, TYPICAL SECTIONS

SHEET
1



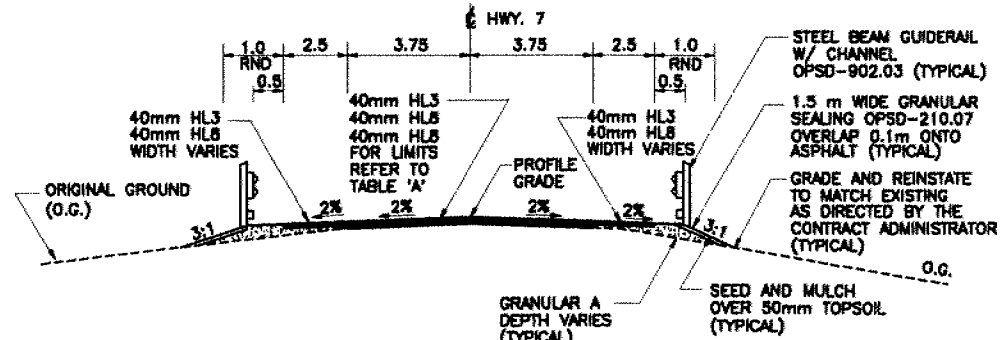
- LEGEND**
- FULL DEPTH ASPHALT REMOVAL
 - PLANE OFF EXISTING ASPHALT
40 mm MINIMUM DEPTH

REMOVALS
1:500



TYPICAL SECTION - CURB AND GUTTER

STA. 20+690 TO STA. 20+700.5
STA. 20+747 TO STA. 20+757
N.T.S.

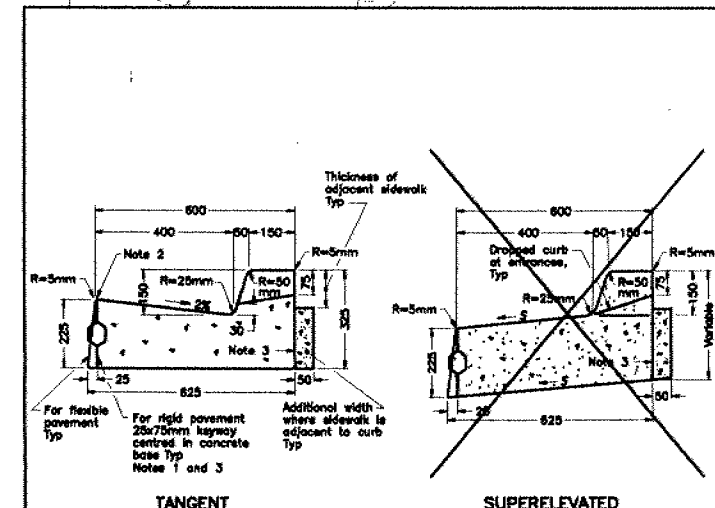


TYPICAL SECTION - RURAL

STA. 20+665 TO STA. 20+690
STA. 20+837 TO STA. 20+843
N.T.S.

NOTE:
GRAVEL SHOULDERS TO BE
GRADED AT 8% CROSSFALL
STA. 20+837 TO 20+843 AND
STA. 20+782 TO 20+843
AS PER OPSD-206.01

TABLE 'A': PAVING LIMITS	
ASPHALT COURSE	LOCATION STA. TO STA.
HL3 40 mm SURFACE COURSE	20+665 - 20+843
HLB 40 mm UPPER BINDER COURSE	20+667 - 20+820
HLB 40 mm LOWER BINDER COURSE	20+667 - 20+800



- NOTES:**
- When curb and gutter is adjacent to concrete pavement or base, this drawing is to be used in conjunction with OPSD-552.01 and 552.02.
 - Flexible and composite pavement shall be 5mm above the adjacent edge of gutter.
 - For slipforming procedure, a 5% batter is acceptable.
 - Treatment at entrances shall conform with OPSD-351.01.
 - Outlet treatment shall conform with OPSD-510 Series.
 - The length of transition from one curb type to another shall be 3.0m, except in conjunction with guide rail, it shall conform to OPSD-900 Series.
 - All dimensions are in millimetres unless otherwise shown.

LEGEND:	
5 - Rate of pavement superelevation in percent, %	
MODIFIED	
ONTARIO PROVINCIAL STANDARD DRAWING	
Date	1990 09 14 Rev 2
CONCRETE BARRIER CURB WITH WIDE GUTTER	
OPSD - 600.01	

MEMORANDUM



To: D. Kerr, P. Eng.
Structural Engineer

September 23, 1998

From: Pavements and Foundations Section
Room 315, Central Bldg.

Tel: (416) 235-5267
Fax: (416) 235-5240

Re: Hwy 7 - Moira River Bridge Rehabilitation
Technical Package Review Comments
WP 44-94-01, Site 11-45

As requested in your memorandum dated September 17, 1998, our office has reviewed the foundation related components of the proposed structural rehabilitation and related works for the above mentioned project. Our review comments are contained in this memorandum.

Roadway Protection

Temporary roadway protection is required to facilitate the staged construction proposed at the site. Roadway protection limits have been illustrated on the contract drawings and a Non Standard Special Provision has been included in the contract documents. Our office has prepared an End Result Specification for Protection Schemes and it is recommended that this specification be included in the contract documents. A copy of the specification is attached to this memorandum.

Geogrid Reinforced Retaining Walls

Geogrid reinforced retaining walls are illustrated on the contract drawings and a Non Standard Special Provision has been included in the contract documents. This design proposal is not in accordance with current MTO policy regarding retained soil system design and construction. The Ministry requires that retained soil systems be prequalified through a process that has been established by the RSS committee. This process has been structured to ensure that durability and performance requirements are met. Accordingly, it is recommended that the design of the geogrid reinforced retaining walls be carried out in accordance with the Generic Criteria for Retained Soil System. The application requirement, geometry requirements and minimum performance requirements shall be included in the contract documents. The contractor would then be responsible for retaining an approved retained soil system as identified in the Designated Source of Materials list.

It is recommended that a non standard special provision for retained soil systems be included in the contract documents. A copy of this specification is attached.

If you have any questions regarding the comments in this memorandum, please do not hesitate to contact this office.


T. Sangiuliano, P. Eng.
Foundation Engineer

for
D. Dundas, P. Eng.
Senior Foundation Engineer

cc. T. Kazmierowski

MEMORANDUM



To: H. Kleywegt, P. Eng.
Area Structural Engineer

January 24, 1997

From: Pavements and Foundations Section
Room 315, Central Bldg.

Tel: (416) 235-5267
Fax: (416) 235-5240

Re: Hwy 7 - Moira River Bridge Rehabilitation
Foundations Review
WP 44-94-01, Site 11-45

As requested in your memorandum dated January 9, 1997, our office has reviewed the structural design report for the Moira River Bridge Rehabilitation and submit the following comments.

BACKGROUND

General

Harmer Podolak Engineering Consultants Inc. (HPEC) have been retained by the MTO to perform the design of the Moira River Bridge Rehabilitation. The existing bridge, built in 1934, is a reinforced elliptical arch that is 11.43 m in width and has a clear span of 24.40 m. HPEC have carried out an investigation of the existing bridge conditions and have summarized their observations in the above mentioned structural design report. In general, the bridge has been described to be in fair condition. The vertical cracks present in the spandrel walls and in the main arch barrel appear to be associated with numerous construction joints used during the original construction. Some concrete delamination and deterioration, and corrosion of reinforcing steel seems to be related to the surface water penetrating original cracks that existed in the concrete. There was no waterproofing used in the construction of the bridge.

Foundation related settlements have not been observed at the site.

Subsurface Conditions

The subsurface conditions at the site were determined immediately north of the existing abutments as a result of a foundation investigation conducted by the MTO in 1967. The subsurface conditions as described in the Foundation Investigation Report For Proposed Extension of the Existing Structure on Hwy #7 over Moira River (WJ 67-F-21) consists of a surficial deposit of organic material. On the west side, approximately 0.3 m to 1 m of organics were encountered. On the east side, approximately 2.7 metres of organic silt or sand with organics was encountered. The organic material at both west and east locations is underlain by a stratum of clayey silt to silty clay. The clayey silt to silty clay stratum has a thickness of approximately 2.4 m to 3.3 m on the west side and approximately 5.2 m on the east side. The consistency of this material is described as firm to very stiff.

The overburden at the site is underlain by sound schist bedrock. The bedrock is approximately 3.3 metres below the ground surface at the west abutment and approximately 8 metres below the ground surface at the east abutment.

Groundwater levels were found to correspond to the river water level (approximately Elevation 181.8)

Foundations

There are no records available that identify the type of foundation that is supporting the existing structure. The founding elevation of the foundations (spread footing or pile cap) illustrated on the contract drawings is Elevation 178. This founding elevation corresponds to the bedrock surface on the west side and the clayey silt to silty clay stratum on the east side.

The HPEC report also makes reference to a note included on the original contract drawings.

Depth of foundation subject to revision by Engineer. If depth of footing varies by more than two feet from depth shown on the plan or if after excavation is made, it is found necessary to use piles where none are shown on the plan, the bridge Engineer must be notified before any concrete is poured.

DISCUSSION AND RECOMMENDATIONS

General

Two rehabilitation alternatives are given in HPEC's report. The first type is identified as a basic rehabilitation and the second type is the rehabilitation combined with the widening. Rehabilitation measures are primarily related to the superstructure but consideration is also given to the improvement of the existing foundations.

From a foundation perspective, considerations that require evaluation for either alternative include:

Option 1-Acceptance of Existing Foundations Without Additional Loadings

Option 2-Acceptance of Existing Foundations With Additional Loadings

Option 2-Improvement of Existing Foundations To Support Additional Loadings

The option that optimizes technical feasibility, construction practicality, risk management and cost shall be chosen. These options are discussed below and recommendations are provided.

In addition, foundation recommendations for the bridge widening and temporary roadway protection schemes are discussed.

Foundation Design Options

Option 1-Acceptance of Existing Foundations Without Additional Loadings

The fact that the structure has not experienced any foundation problems over the last 60+ years is evidence that the existing foundations are performing satisfactorily. Based on the factual information given regarding the subsurface conditions and the limited information regarding the bridge foundation design, we agree with the HPEC report that the west abutment is probably founded on spread footings on bedrock and the east abutment is probably founded on deep foundation units end bearing on bedrock. However, it is our opinion that it would be prudent to conduct an investigation to confirm this. We realize that an investigation will be restricted due to the site conditions, but it is our recommendation that consideration be given to the excavation of test pits at the sides of the structure and perhaps drilled boreholes through the foundation.

Verification of the type and integrity of the existing foundations will increase the level of confidence that the existing structure foundations can support a rehabilitation alternative that has no increase in the vertical load. Such an investigation will also contribute to lessening any risk in using the existing foundation.

The scope of the investigation recommended will not permit the determination of the foundation capacity if the foundations are founded on deep foundation units but a limited investigation will establish reasonable assumptions for a detailed rehabilitation design. It is agreed that an extensive investigation to evaluate the foundation capacity of deep foundation supported abutments is not practical nor economical.

Option 2-Acceptance of Existing Foundations With Additional Loadings

In the case of marginal additional loadings, consideration can be given to accepting the existing foundations to support these additional loadings. However, an extensive investigation will be necessary to confirm the type, configuration and integrity of the existing foundations. Such an investigation will require difficult and expensive procedures in view of the site conditions.

Option 3-Improvement of Existing Foundations To Support Additional Loadings

Should it be required to apply significant additional structural loadings to the foundations, and not having full knowledge of the existing foundation design, it is recommended that the improvement of the existing foundations be in the form of a new foundation design. No change at the west abutment is anticipated but design changes are expected at the east abutment.

The design will require inherent flexibility to avoid conflict with existing foundation elements which may arise during construction. Any existing deep foundation units will have to be carefully located and exposed prior to the installation of the new replacement foundation units.

The new design will basically consist of an underpinning methodology. Concrete caissons or minipiles are two methods that can be considered at the site. The underpinning would require stage construction and temporary shoring to facilitate the construction.

Comparison of Options

Underpinning operations associated with Option 3 - *Improvement of Existing Foundations To Support Additional Loadings* are costly, time consuming and must be meticulously executed to minimize risk of inducing damage to the existing piles.

Option 2 - *Acceptance of Existing Foundations With Additional Loadings* will require an extensive investigation of the existing foundations, which would be very difficult, costly and possibly uneconomical.

Option 1 - *Acceptance of Existing Foundations Without Additional Loadings*, is considered to be the least costly and of the lowest risk. Further risk mitigation can be achieved by carrying out an investigation to confirm the type of existing foundations.

It is therefore concluded that the preferred rehabilitation option is to avoid imposing additional structural loading on the existing foundations.

Bridge Widening Options

Two basic approaches to bridge widening are considered in HPEC's report:

1. Placement of one 3 m wide strip on one side of the bridge
2. Placement of two separate 1.435 m strips on either side of the bridge

From a foundation point of view, both options are considered feasible. New foundations could be constructed to support additional arch strips. The new foundations would be as recommended in the Foundation Investigation Report prepared by the MTO in 1967.

The HPEC report, however, identifies advantages with the option of placing two separate 1.435 m strips on either side of the bridge. The most noticeable is a net weight reduction associated with employing a cantilever design and changing the type of arch from a spandrel filled arch to an arch bridge with opened spandrel space. This alternative provides an opportunity for acceptance of the existing foundations without any need to construct new foundation. Major consideration should be given to exploring this option.

Temporary Shoring

To facilitate a staged rehabilitation process whilst maintaining traffic, a conventional temporary shoring wall will be required. A shoring system of soldier piles and timber lagging supported by rock anchors or rakers could be used at the site.

It can be concluded from our review that several technical issues must be reviewed and discussed prior to the finalization of the rehabilitation design of the Moira River Bridge. In view of the foundation considerations associated with the rehabilitation design, our office is interested in attending the meeting that is presently being planned. We can be made available after February 3,

1997 upon your request.

If you have any questions regarding the comments in this memorandum, please do not hesitate to contact this office.

A handwritten signature in black ink, appearing to read 'T. Sangiuliano', with a stylized, flowing script.

T. Sangiuliano, P. Eng.
Foundation Engineer

for

D. Dundas, P. Eng.
Senior Foundation Engineer