

# memorandum

GEOPRES No:  
40I13-51



To: Mr. W.G. Sawyer  
Area Construction Engineer  
Southwestern Region

Date: 81 04 09

Attention: W.H. O'Dell  
Construction Supervisor

From: Pavement & Foundation Design Section  
Room 313, Central Building  
Downsview

Re: Culverts 68 & 69 and Embankment  
Construction at Stas. 580+ to 584+  
Hwy. 402, Contract 80-77  
District #2, (London)

This will confirm verbal recommendations given to you by the writer during our visit to the above mentioned site on 81 03 12.

- (1) Due to the fact that granular type fill material will be used to construct the embankment at the above mentioned location it will not be necessary to provide a 12 inch layer of Granular 'B' as described in Note 2 on Sheets 67 and 68 of the Contract Drawings.
- (2) Settlements of up to 12 inches are anticipated to occur under the embankment where the culverts will be constructed. At the toe of slope the settlement will be zero and under the shoulder, and at the full height portion of the embankment it will be 12 inches. Between the toe and shoulder edge it will vary uniformly from zero to 12 inches. The culverts (68 and 69) should be cambered to take care of this settlement which will occur after they are constructed.

A handwritten signature in black ink, appearing to read "K.G. Selby".

K.G. Selby  
Senior Foundations Engineer

KGS:ea



Ministry of  
Transportation and  
Communications

# Memorandum

CONTRACT 80-77

To: Mr. M. J. Duckett,  
Senior Project Manager,  
Planning & Design Section,  
Southwestern Region.

From: Pav't. & Foundation Design Section,  
Engineering Materials Office,  
Room 315, Central Building,  
Downsview, Ontario.

Attention:

Date: 79 10 10

Our File Ref.

In Reply to

Subject:

Re: Hwy. 402 from Con. Rd.#6  
to Hwy. 81 (Delaware).  
Culvert and Embankment  
at Sta. 582 +.  
District 2, London.  
W.P. 40-66-01.

Further to our meeting of 79 08 17 regarding the abovementioned project, we have reviewed the soil conditions and our previous recommendations taking into account the fact that you are unable to acquire sufficient property to accomodate the stabilising berms. In our view, it will be possible to construct the 55 foot high embankment without berms provided that it is built in stages over a period of about 12 to 14 months. Specifically our recommendations are as follows:

1. Remove topsoil over entire plan area of embankment within the ravine including the side slopes of the ravine.
2. Install culverts as per our recommendations in our memo dated 79 05 30.
3. Place a 12 inch blanket of material with gradation complying with requirements for Granular 'B' on the ravine floor over the area below the embankment and construct the embankment using non-cohesive fill up to a height of 35 feet. During construction of the embankment, a 12 inch layer of Granular 'B' should be placed against the ravine slopes to act as a drainage medium. If the non-cohesive material for the embankment has a gradation close to the requirements for Granular 'B', it will not be necessary to provide imported Granular 'B'.
4. Prior to placing any fill above the 35 foot height, it will be necessary to wait until the induced pore pressures below the embankment have dissipated to a safe level. We estimate that a minimum period of six months will be required for this. The remainder of the fill may consist of cohesive type material (except for the Granular 'B' drainage blanket against the ravine slopes) and it will be necessary to place it in 12 inch layers at a rate which will

cont'd. .... 2

be dependant on the time taken for pore pressures in the soil below the embankment which are induced during this filling operation to dissipate. For contract purposes, it should be assumed that a 5 foot lift can be placed every 40 days thus the total estimated waiting time for completion of the embankment will be 6 months plus 120 days. This Section and the Regional Geotechnical Section will install all necessary instrumentation and will provide guidance and advice for control of the rate of fill placement during construction of the embankment.

5. With regard to the end treatment for the culverts we do not see the need for concrete headwalls unless this is a requirement for hydrological reasons. We suggest that Armco type sheeting be used for this purpose and that the pipes themselves be 'square ended'.

KGS/cy

c.c. J. Forester  
Files

*K. G. Selby*

K. G. Selby,  
Senior Foundation Engineer.



## Memorandum

To: SOILS MECHANICS SECTION  
Central Bldg., 1201 Wilson Avenue  
DOWNSVIEW, Ontario

From: Planning and Design Section  
Southwestern Region, London

Attention: K. G. Selby

Date: 1979 08 21

Our File Ref.

In Reply to

Subject: W.P. 40-66-01 Hwy. #402 from Concession Road #6  
Southerly to Hwy. 81 (Delaware) District No. 2 - London  
"Culvert Recommendations STA 582+"

Further to our recent meeting regarding the above location, please be advised that a number of items have been checked and reviewed. Referring first to the memo from your office dated 79-05-30, and the recommendations contained therein:

- 1) As per our discussion, due to property limitations, it is impossible to accommodate the 50' mid-height berms. Attached, please find one sepia of the relevant contract sheet indicating culvert location and property lines;
- 2) Differential settlement of 1' to 100' refers to areas under maximum load, and we, therefore, may expect settlement in the order to 1' at centreline, reducing to zero at the ends;
- 3) It was agreed that the two feet of sub-excavation would be below the line of stripping and removal of debris. The use of a filter cloth under the granular bedding was discussed, and it was agreed that this would not be required at this location, as the possibility of the granular material settling into the silty is minimal;
- 4) Due to the potential problems in this area, it was agreed that the two culverts at this location will be changed from concrete to circular multi-plate pipes. The sizes will be 11.0' diameter and 7.0' diameter respectively;

In view of the foregoing, the question of staging the earth construction has been discussed and it is agreed that some degree of staging can be incorporated. The exact degree will be determined later and covered by special provision.

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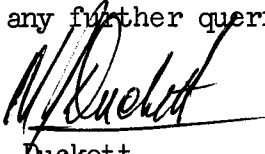
K. G. Selby  
August 21, 1979  
Page 2

Another point discussed was the availability of sandy-type material for fill in this area. It has been determined that 25' of cover can be accommodated with sandy material being taken from the vicinity of Highway 81. Once again, the exact amount can be determined later and possibly this depth can be increased.

At our meeting, it was suggested that if the entire area cannot be filled with a sandy-type material, then the ravine slopes above the sand backfill should have some form of granular blanket. The type and depth of this blanket was not clearly defined at this time.

In order to avoid or minimize the impact of high fills as it relates to the ends of the pipes, consideration could be given to placing cut-off or headwalls to allow for additional loading on the ends of the pipes.

I believe that the foregoing covers the various points raised at our meeting. Would you please review and forward your comments and revised recommendations at your earliest convenience. Copies of this memo are to be forwarded to those present at the meeting. Should you have any further queries, please feel free to contact me at any time.

  
M. J. Duckett  
Senior Project Manager  
for: A. Wittenberg, Head  
Planning and Design Section

AW:MJD:gw





## Memorandum

To: Mr. J.G. Forster  
Soils Engineer  
Geotechnical Section  
Southwestern Region, London  
Attention: Mr. J. McKeown

From: Soil Mechanics Section  
Engineering Materials Office  
Room 315, Central Building

Date: 79 08 02

Our File Ref.

In Reply to

Subject:

Re: Culvert Installations on Hwy. 402  
from Hwy. 81 Westerly to Con. Rd. 6  
W.P. 40-66-01, District 2, London

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Due to the depressed grade of Hwy. 402 in this area a number of culverts will be installed below the existing groundwater level in granular soils. Precautions must be taken that the underlying soil is not loosened by boiling due to an unbalanced hydrostatic head during the unwatering of these sites. It is recommended that these conditions be brought to the attention of the contractor by an S.P. and that unwatering items be placed in the contract for these locations.

Culvert bedding should consist of granular 'A' with a minimum thickness of six inches. Comments on the specific sites listed in your memorandum are as follows.

C.P.R. Crossing - Station 416+23

10' X 6' Conc. Box Culvert

- unwatering items and special provisions required

36" CSP's to be installed by jacking

- unwatering items and special provisions required
- due to the severity of the consequences of loss of ground during tunnelling it should be required that the groundwater be lowered to a minimum one foot below the profile grade of the culvert over its entire length prior to commencement of jacking and that it be held thus until the operation is complete.

C.N.R. Crossing - Station 492+42

8' X 4' Conc. Box Culvert

- unwatering items and special provisions required
- culvert must be constructed prior to abutment footing.

48" CSP

- unwatering probably will not be necessary
- culvert should be constructed after the pier footing.

Co. Rd. 14 Station 511+40

4' X 4' Conc. Box Culvert

- unwatering will probably not be necessary
- construct culvert prior to abutment footing
- culvert should be 10' from abutment piles

8' X 4' Conc. Box Culvert

- unwatering items and special provisions required
- culvert should be 10'± from abutment piles
- construct culvert prior to abutment footing
- culvert excavation should be backfilled with granular 'C' or better to avoid settlement under the structure approach.

Assistance in writing the special provisions may be obtained from the Soil Mechanics Section if desired.

*P. J. Stuart*  
For P.J. Stuart  
Project Engineer

For: K.G. Selby  
Supervising Engineer

PJS/KGS/gaa

cc: M. Duckett  
J. Keen

Files /

Mr. J.G. Forster  
Soils Engineer  
Geotechnical Section  
Southwestern Region, London

1979 05 30

From: Soil Mechanics Section  
Engineering Materials Office  
Room 315, Central Building

Re: W.P. 40-66-01, Hwy. 403  
1) 10' x 6' Concrete Box Culvert, Sta. 526+  
2) 14' x 6' & 8' x 4' Concrete Box Culverts, Sta. 582+

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As requested a soil investigation was recently carried out at the above culvert sites. The following is a brief description of the subsoil encountered and applicable foundation recommendations at each respective site. A detailed foundation investigation and design report will be forwarded in the near future.

Site 1, Sta. 526+20, 10' x 6' Concrete Box Culvert

At this site the subsoil immediately below the valley floor consists of an extensive deposit of silt to silty sand with traces of organics in the upper four feet. The denseness of this deposit generally varies from very loose in the top four to seven feet to compact at depth. The deposit was explored to a depth of 51.5 feet below the ground surface. Groundwater was observed to be seeping from the valley slopes at various locations.

Recommendations

- 1) No stability problems are anticipated for fills constructed at 2:1 and approximately 35 feet in height. The fill should consist of fully compacted acceptable material.
- 2) If the fill is not composed of free draining granular material a two foot thick granular blanket should be placed against the valley slopes and floor to intercept the groundwater.
- 3) Due to the very loose state of the subsoil immediately below the proposed culvert invert, it is recommended that the culvert be founded on two feet of fully compacted granular material.

Site 2, Sta. 582+, Two Concrete Box Culverts (14' x 6' & 8' x 4')

At this site four boreholes were advanced up to 51.5 feet below the valley floor. Immediately below the valley floor, up to 7.0 feet of very loose to loose silty sand containing organic



inclusions and traces of clay was encountered. Underlying this granular deposit and extending to the limit of the borehole is a stratum composed of irregular layers of clayey silt to silty clay and silt. The consistency of this deposit generally increased in depth from soft to very stiff.

#### Recommendations

- 1) Fill up to about 50 feet in height will be required above the valley floor. The fill should be constructed using fully compacted acceptable granular material. To ensure a stable fill the side slopes should be constructed at 2:1 with a 50 foot mid-height berm. This will necessitate longer culverts and minor relocation.
- 2) Differential settlements of up to 12 inches in a horizontal distance of 100 feet may occur. Therefore, flexible and waterproof joints should be installed to accommodate this movement.
- 3) Due to the loose or soft state of the subsoil at the proposed invert elevation it is recommended that 2 feet of fully compacted granular bedding be provided.
- 4) Alternatively, an equivalent sized circular multi-plate steel plate pipe may be employed. This pipe should be installed according to standard DD-8-8-A, Type 5, (Rev. 6) with two feet of compacted granular bedding below the uncompacted zone and a minimum bedding width of 10 feet plus the diameter of the pipe.

If there are any further enquiries, please contact this office.

*C. T. Johnson*

C.T. Johnson  
Project Engineer

For: K.G. Selby  
Supervising Engineer

CTJ/KGS/gs

cc: Files ✓



## Memorandum

To: Mr. C. Mirza,  
Head, Soil Mechanics Office,  
Downsview, Ontario

From: Geotechnical Section,  
London, Ontario

Attention: K. Selby

Date: 78 12 19

Our File Ref.

In Reply to

Subject:

Re: W.P. 40-66-01, Highway #402  
Culvert Sites at Station 526± and  
Station 582± Caradoc Twp.

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Preliminary checks were made of the above sites on December 18, 1978 using hand auger equipment. Both sites are located in ravines with a 10' x 6' concrete box culvert proposed at site #1, station 526 and 2 culverts (14'x6' and 8'x4') station 582, site #2.

A saturated silty sand to silt loam was encountered to a depth of 4 feet below the bottom of the streambed in the ravine at site #1 while it was also noted that the same type of material was present along the side slopes of the ravine. Heavy seepage occurred from the slopes to a level of about 6 feet above the bottom of the ravine.

The upper layers of soil in the bottom of the ravine contained layers of topsoil to a depth of about 30", followed by the saturated silty sands to silt loams.

At site #2 borings at the bottom of the ravine encountered approximately 40" of topsoil and gravel mix underlain by a saturated medium clay which was soft to firm.

In view of the conditions described above as well as the large fills that will be placed over the culverts, it is recommended that a more detailed investigation be carried out by the soils mechanics office.

It is our understanding that the design for these culvert sites is to be completed by March, 1979.

We are submitting a Drawing of the proposed culvert sites and if further information or assistance is required please contact our office.

JM/s

c.c. A. Watt  
M. Duckett  
J. McKeown  
File

J. McKeown  
for J.G. Forster  
Soils Engineer



*Record then  
pass on to  
K. A. Selby please.*