THURBER ENGINEERING LTD.

To: Maria King, P.Eng.
Dillon Consulting Limited
1155 North Service Road West Unit 14
Oakville, ON L6M 3E3

June 22, 2022

From: Renato Pasqualoni, P.Eng.
Alireza Hejazi, Ph.D., P.Eng.
Michael Eastman, P.Eng.

Thurber File No.: 26370

FINAL
TECHNICAL MEMORANDUM
DESKTOP STUDY GEOTECHNICAL AND HYDROGEOLOGICAL ASSESSMENT
ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA
TORONTO, ONTARIO

Thurber Engineering Limited (Thurber) has been retained by Dillon Consulting Limited (Dillon) to conduct a desktop study in support of the Rouge Park Bridges Transportation Master Plan Environmental Assessment (EA) for the development of a rehabilitation strategy for five municipal bridges in Toronto, Ontario.

It is a condition of this memorandum that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

1 SITE DESCRIPTION

The project study area is shown on Figure 1 and is located within Ward 25-Scarborough-Rouge National Urban Park (RNUP), located in the north-eastern part of the City of Toronto, generally bounded by Morningside Avenue/Neilson Road to the west, Scarborough Pickering Townline to the east, Steeles Avenue East to the north, and Highway 401 to the south. The project focus areas are located at radii of 500 m from each of the five bridges within the study area. The bridges are in an urban setting surrounded by undeveloped land consisting of forests, at the locations presented on Figure 1.

The five municipal bridges consist of the following:

1. Maxwell's Bridge (Bridge 802): The existing structure is a single-span cast-in-place concrete bridge supported on two abutments that carries Twyn Rivers Drive over Little Rouge Creek. The structure has a total length of 19 m and a deck width of 7.5 m. The structure was noted to have rehabilitation work to the abutments and deck elements completed between 1998 and 2013.
2. Stott's Bridge (Bridge 803): The existing structure is a single-span steel truss bridge supported on two abutments that carries Twyn Rivers Drive over Rouge River. The structure has a total length of 22.1 m and a deck width of 4.7 m. The structure was noted

to have rehabilitation work to the wingwalls, floorbeams and lacing/bracing members completed in 2013.

3. Hillside Bridge (Bridge 806): The existing structure is a single-span steel truss bridge supported on two abutments that carries Meadowvale Road over Little Rouge Creek. The structure has a total length of 24.7 m and a deck width of 5.1 m. The structure was noted to have rehabilitation work to the abutments and grading completed in 1986.

4. Sewell's Suspension Bridge (Bridge 812): The existing structure is a three-span steel suspension bridge supported on two piers and two abutments that carries Sewells Road over Rouge River. The structure has a total length of 48.8 m and a deck width of 5 m. The structure was noted to have rehabilitation work to the piers, towers and deck elements completed between 1980 and 1987.

5. Milne Bailey Bridge (Bridge 813): The existing structure is a two-span steel truss bridge supported on one pier and two abutments that carries Old Finch Avenue over Rouge River. The structure was noted to have rehabilitation work to the pier, abutments and deck elements completed between 1988 and 2013.

2 REVIEW OF AVAILABLE INFORMATION

2.1 Site Physiographic, Geologic, and Hydrogeologic Settings

The study area is situated within two physiographic regions generally known as Iroquois Plain and South Slope. A physiographic region map of the focus areas and surrounding area is shown on Figure 2. The Iroquois Plain physiographic region is located in the southern portion of the study area (Bridges 802 and 803) and represents the former shoreline of glacial Lake Iroquois. It is generally located at the perimeter of Lake Ontario and cuts into the previously deposited clay and till. It is partly underlain with sand deposits, sloping gently upward north from Lake Ontario. The South Slope to the north (Bridges 806, 812, and 813) is typically a drumlinized area consisting of areas of thin (<1 m) aeolian sand deposits underlain by glacial deposits, primarily till (Chapman and Putnam, 1984).

According to available geologic mapping obtained from the Ontario Geological Survey (OGS), while most of the area is underlain by glacial till (Leaside Formation of the late Wisconsinan period), glaciolacustrine deposits of sand and gravel are found in the Iroquois Plain, glaciolacustrine clays are found in the early peripheral lakes and modern alluvial deposits of sand and gravel are found in the valleys of the Rouge River and its tributaries. The mapped surficial geology of the study area is illustrated on Figure 3. Published bedrock mapping indicates that the study area is underlain by shales of the Georgian Bay and Blue Mountain Formations (Figure 4).

The majority of the study area and specifically the project focus areas are located within the Rouge River Watershed and falls under the jurisdiction of the Toronto and Region Conservation Authority (TRCA). The regional topography slopes southerly toward the Rouge River, and eventually drains into Lake Ontario. Groundwater flow is interpreted to follow the existing topography, with the study area draining southeasterly to Rouge River. One prominent landform in the Rouge Watershed, south of Finch Avenue, is an escarpment representing the shoreline of Lake Iroquois. The Iroquois Plain south of this shoreline consists of deposits of nearshore beach sands and gravels, and silts and clays that were laid down in deeper aquifer. The sand and gravel deposits associated with the Lake Iroquois shoreline are important for local recharge, with estimated infiltration rates of approximately 200 mm/year. The portion of the shoreline nearest Lake Ontario is a local discharge area, where upward gradients from deeper aquifers can result in significant discharge. The silt and clay deposits of the Lake Iroquois plain are less permeable (TRCA, 2007).

The South Slope forms a higher upland to the Iroquois Plain within the study area. The Rouge River and Little Rouge Creek Valleys have incised deep valleys within the study area, with localized steep slopes and erosion features.

2.2 MTO Geocres Library

A desktop study search of available subsurface information within the study area from the MTO Geocres library found the following existing geotechnical reports prepared by others (these reports are included in Appendix A):

1. MTO Report with Geocres No. 30M14-161 titled “East Metro Freeway Feasibility Study” dated September 26, 1978.
2. MTO Memo with Geocres No. 30M14-244 titled “Slope Stability, Station 175+00 to 200+00” dated March 19, 1980.

In general terms, the encountered stratigraphy near Finch Avenue consisted of sand and gravel overlying uniform fine sand underlain by sandy silt to silty sand overlying shale bedrock.

Deep foundations consisting of steel H-piles driven to bedrock were recommended to support the piers and the west abutment. Shallow foundations were recommended to support the east abutment.

2.3 Previous Investigations

Existing available subsurface information was compiled for the study area from previous geotechnical investigations carried out by Thurber. The following report was reviewed in the assessment of site conditions for the study area (this report is included in Appendix B):

1. Thurber Report titled “Geotechnical Investigation, Proposed Zoomobile Bridge Near Indo-Malayan Pavilion, Toronto Zoo, Scarborough, Ontario” dated April 12, 1999.

The field investigation was carried out between March 17 and 22, 1999. The investigation involved drilling four boreholes to depths ranging from 1.7 to 7.7 m.

In general terms, the encountered stratigraphy consisted of topsoil overlying silt and sand to sandy silt till underlain by silty clay to clayey silt tills.

Based on the subsurface conditions encountered at this site, shallow foundations were considered suitable for support of the new bridge abutments and piers.

2.4 Bridge Design Drawings

Design drawings for the existing bridges were reviewed and are included in Appendix C.

The design drawings indicate the existing bridge abutments are supported on shallow foundations. The foundation type for the piers is uncertain.

Borehole logs for the Milne Bailey Bridge prepared by B P Walker are included on Drawing No. 26200-T1 (5013-S-1). Borehole logs for the other four bridges were not included on the design drawings.

In general terms, the encountered stratigraphy at the Milne Bailey Bridge consisted of pavement structure or topsoil overlying fill underlain by clayey silt till overlying cohesionless layers of sand and gravel or silty sand.

2.5 Well Records and Existing Permits

A search of the Ministry of the Environment, Conservation and Parks (MECP) well records database conducted within the study area returned a total of 535 records. Out of 535 records, 21 wells were located within the project focus areas. A well record map is provided as Figure 5. Based on the well records, twelve of the nearby wells are listed as supply wells for either domestic, livestock or public use. The remaining nine wells are listed as either abandoned or not used. The water levels also ranged at depths from 4.9 m to 26.4 m below the ground surface. A review of the water well record database indicates that the depth to bedrock surface is approximately 42 m and two bedrock wells were identified within the project focus areas. A search of water taking permits conducted in September 2020 identified only one active Permit to Tale Water (PTTW) record within the project focus areas. A search of MECP's Access Environment mapping returned no Environmental Activity and Sector Registry (EASR) registrations within the project focus areas. The detailed water well record search results are included in Appendix D.

2.6 Environmental Setting

Based on regional-scale source protection mapping, the study area is not located within a Wellhead Protection Area (WHPA); however, the project focus areas are located within a Significant Groundwater Recharge Area (SGRA) and a Highly Vulnerable Aquifer (HVA). They are also located within the TRCA regulated areas. Based on a review of Ministry of Natural Resources and Forestry (MNRF) online mapping, natural features in the vicinity of the project focus areas include the following:

a) Rouge River and Little Rouge Creek and/or tributaries traverse the focus areas; multiple tributaries of Morningside Creek and Highland Creek also flow southerly within the study area.

b) Areas of Natural and Scientific Interest (ANSIs) – A Provincially Significant Life Science area exist within the focus areas between Twyn Rivers Drive and Steels Avenue East.

c) Natural Heritage Areas are located within the project focus areas between Scarborough Pickering Townline and Rouge River.

d) Wetlands are located at various locations in the vicinity of the focus areas.

e) Large areas of woodlands also exist within the study area.

According to the *City of Toronto Official Plan (Map 22)*, the land use adjacent to the focus areas is natural area or other open space area (including golf courses, cemeteries, and public utilities). The nearby areas of natural significance are illustrated on Figure 6.

3 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

We understand that the proposed rehabilitation strategy may involve replacement of all five existing municipal bridges as part of the improvements in this area.

Based on the limited subsurface information found through the desktop study and summarized in Section 2, it is expected that the subsurface conditions at each bridge will vary significantly and could include shallow unconsolidated recent alluvium as well as deeper competent glacial deposits. Groundwater piezometric levels are expected to be significantly influenced by the local stream levels. It is not possible to recommend foundation types for the bridge replacements based on the limited information currently available. It is likely that new foundations (i.e. abutments and piers) for the proposed new bridges will need to be founded on either spread footings or steel H-piles driven to refusal in the overburden or on the bedrock. A geotechnical investigation for the new foundation elements will be required as described in Section 3.1.

Other geotechnical data gaps that may need to be considered include geotechnical stability for the stream valley slopes and for existing approach embankments. The valley slopes in the study area are well know for having significant localized erosion, particularly where the stream meanders encroach on the slope toe. Investigations into the stability of the valley slopes may require only a site observation or may require intrusive investigation such as additional boreholes. Investigation, analysis and reporting relating to the stability of the valley slopes will likely need to meet TRCA and/or MNR requirements as detailed in the MNR Technical Guide titled "River & Stream Systems: Erosion Hazard Limit". The conditions of the existing approach embankments are unknown, and may require improvements, particularly where grade changes or bridge designs warrant.

It is important to note that a field investigation will need to be carried out at each bridge location to verify the subsurface conditions and confirm suitable foundation options (i.e. shallow and/or deep), requirements for approach improvements, as well as to assess valley slope conditions and need for remedial efforts. A preliminary field drilling program is proposed below.

3.1 Proposed Field Investigation

The following presents preliminary geotechnical investigation recommendations related to bridge foundations only, and assuming that bridge sizes and elevations do not change significantly. The field investigation should involve drilling at least 26 boreholes as summarized below:

1. Maxwell's Bridge: Two boreholes at each abutment (**four total**)
2. Stott's Bridge: Two boreholes at each abutment (**four total**)
3. Hillside Bridge: Two boreholes at each abutment **(four total**)
4. Sewell's Road Bridge: Two boreholes at each abutment and pier (**eight total**)
5. Milne Bailey Bridge: Two boreholes at each abutment and pier (**six total**)

The above recommendations for the number of boreholes assumes that the new bridges will have the same number of spans as the existing bridges. Additional approach boreholes may also be required if there is a fill or cut.

The boreholes should be drilled to a minimum of 3 m below refusal. If bedrock is encountered, a minimum of 50% of the boreholes should be cored for a minimum depth of 3 m.

Standard Penetration Tests (SPTs) should be carried out at regular intervals of depth. Thin wall (Shelby) tube sampling and field vane testing should be performed in cohesive soils, where applicable.

Routine geotechnical laboratory testing, including natural water content, Atterberg Limits, and grain size distribution analyses (hydrometer and/or sieve) should be conducted on select soil samples.

One-dimensional consolidation testing should be carried out if soft to firm compressible cohesive soils are encountered.

Unconfined compressive strength (UCS) and point load (PL) testing should be carried out on select rock core samples.

4 PRELIMINARY HYDROGEOLOGICAL RECOMMENDATIONS

As described in detail in Sections 2.1 and 2.2, the project focus areas are underlain by heterogeneous materials consisting of sand and gravel, sandy silt to silty sand, silt and sandy silt till. The heterogeneous materials were underlain by shale bedrock. A preliminary review of the MECP well records database also indicated that the water levels ranged at depths from 4.9 m to 26.4 m below the ground surface. However, given the proximity of the structures to local streams, it is anticipated that the groundwater levels will be influenced by stream levels and recent precipitations events. Hydrogeological field investigations will be required to accurately assess the hydrogeological conditions at each bridge location, and these efforts should be coordinated with the geotechnical field work.

Depending on the bridge and foundation designs, at least one monitoring well per foundation element should be installed and a stabilized groundwater level should be measured.

If groundwater conditions indicate the potential need for dewatering, additional stabilized water levels should be measured at the monitoring wells, and in-situ hydraulic conductivity testing should be completed to estimate the permeability of the screened soils. Groundwater quality sampling should also be undertaken. Groundwater quality samples should be analyzed against the Provincial Water Quality Objectives (PWQOs) for select metals and inorganics criteria, as well as for any anthropogenic contaminants if there are visual or olfactory signs of impact from the investigation.

Following completion of the tests, a report summarizing the findings of the hydrogeological investigation should be prepared. The report would characterize the existing geological and hydrogeological setting and provide recommendations for the requirement of an EASR or Category 3 PTTW based on detailed design. Potential short-term and long-term impacts to the natural features and groundwater users as a result of construction related activities need to be investigated.

If it is determined that an EASR or Category 3 PTTW is required, preparation of an application and supporting report should be undertaken. To support application for PTTW, a detailed hydrogeological assessment report should be completed outlining detailed monitoring and reporting requirements along with any required mitigate and management measurement for the pre-construction, construction and post-development phases. Potential environmental impacts to streams from construction dewatering will require assessment by additional experts, including

THURBER

5 CLOSURE

We trust this memo meets your requirements. If you have any questions or require further information, please do not hesitate to contact us.

Yours truly,

Thurber Engineering Limited

Renato Pasqualoni, P.Eng.
Principal

Alireza Hejazi, Ph.D., P.Eng.
Senior Hydrogeologist

6 REFERENCES

Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of Southern Ontario*, Third Edition. Ontario Geological Survey, Ontario Ministry of Natural Resources.

City of Toronto Official Plan – Map 22 – Land Use Plan, February 2019

Ministry of the Environment, Conservation and Parks. 2020. Source Intake Protection Atlas.

Ministry of the Environment, Conservation and Parks. 2019. Permit to Take Water Database.

Ministry of the Environment, Conservation and Parks. 2019. Water Well Information System.

Ministry of Natural Resources and Forestry, Natural Heritage Information Centre database – Make a Heritage Map. Accessed November 2016, Queen's Printer for Ontario, 2015.

Ontario Geological Survey. *Bedrock Geology of Ontario Seamless Coverage Data Set 6*. 2005.

Ontario Geological Survey. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14. 1997.

Toronto and Region Conservation Authority, Rouge river Watershed Plan, Towards a Healthy and Sustainable Future, Report of the Rouge Watershed Task Force, 2007.

FIGURES

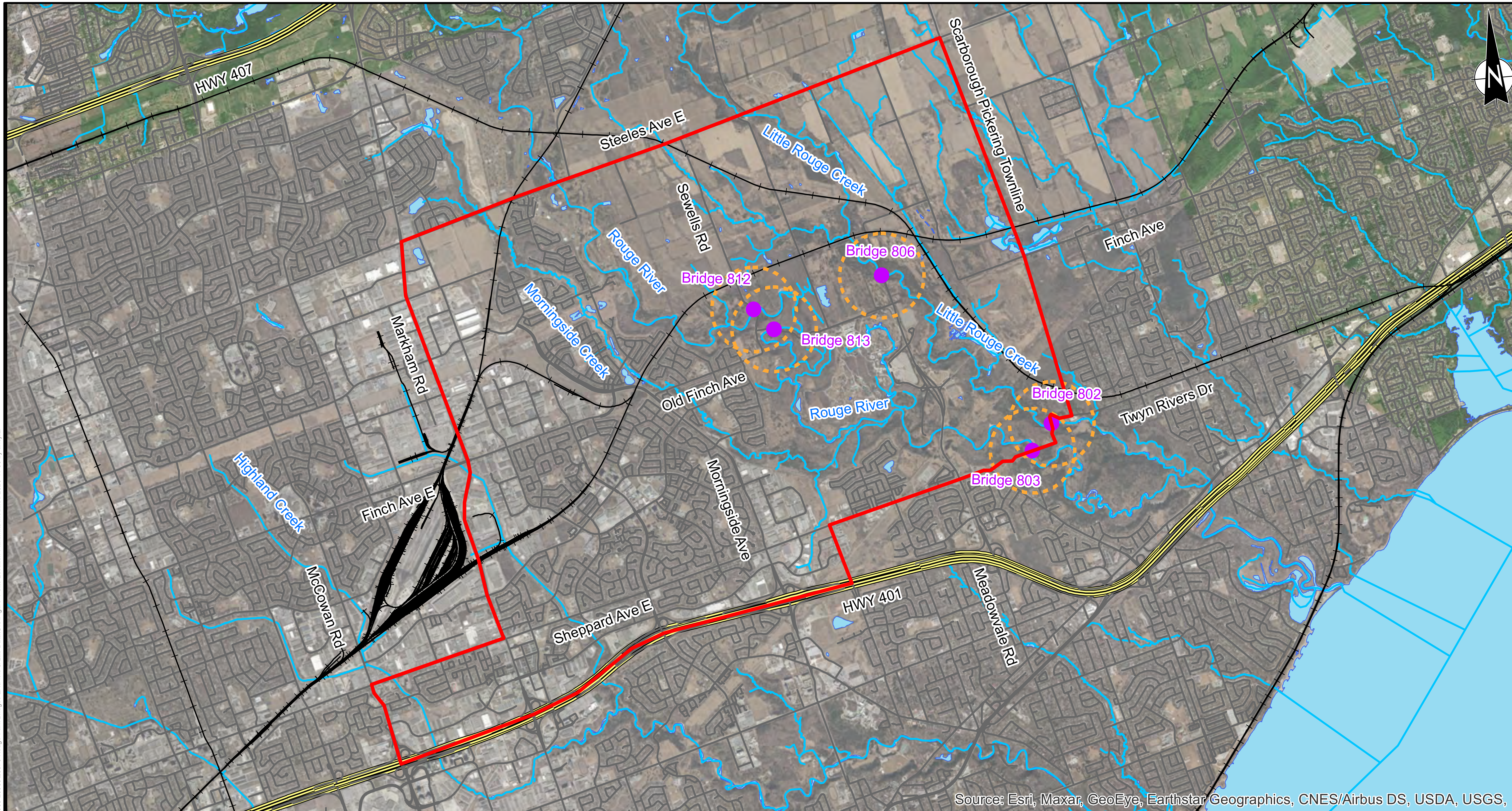
Site Location Plan
Physiographic Regions
Surficial Geology
Bedrock Geology
MECP Well Records

APPENDICES

Appendix A	MTO Geocres Library
Appendix B	Previous Investigations
Appendix C	Bridge Design Drawings
Appendix D	MECP Water Well Records

THURBER

Figures



LEGEND:

	Study Area		Freeway
	Bridges		Road
	Focus Areas (500 m buffer)		Watercourse
	Railway		Waterbody

1,000 500 0 1,000 m

UTM 17 NAD 83

DILLON CONSULTING LIMITED

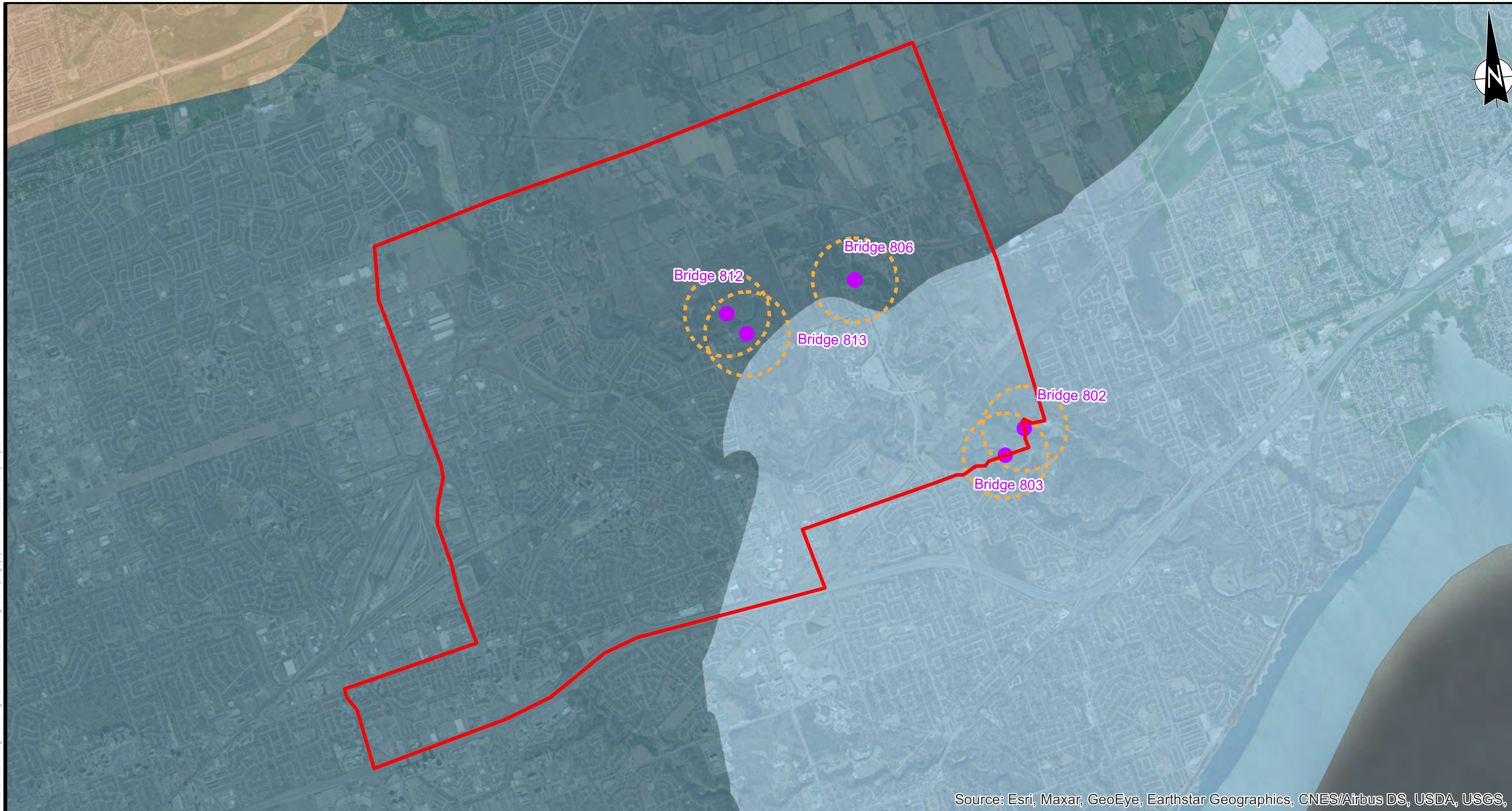
DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

SITE LOCATION PLAN

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	FIGURE NO. 1



LEGEND:

- Study Area
- Bridges
- Focus Areas (500 m buffer)

REGION

- Iroquois Plain
- Peel Plain
- South Slope

Data Source: Ontario Geological Survey (OGS)

DILLON CONSULTING LIMITED

DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

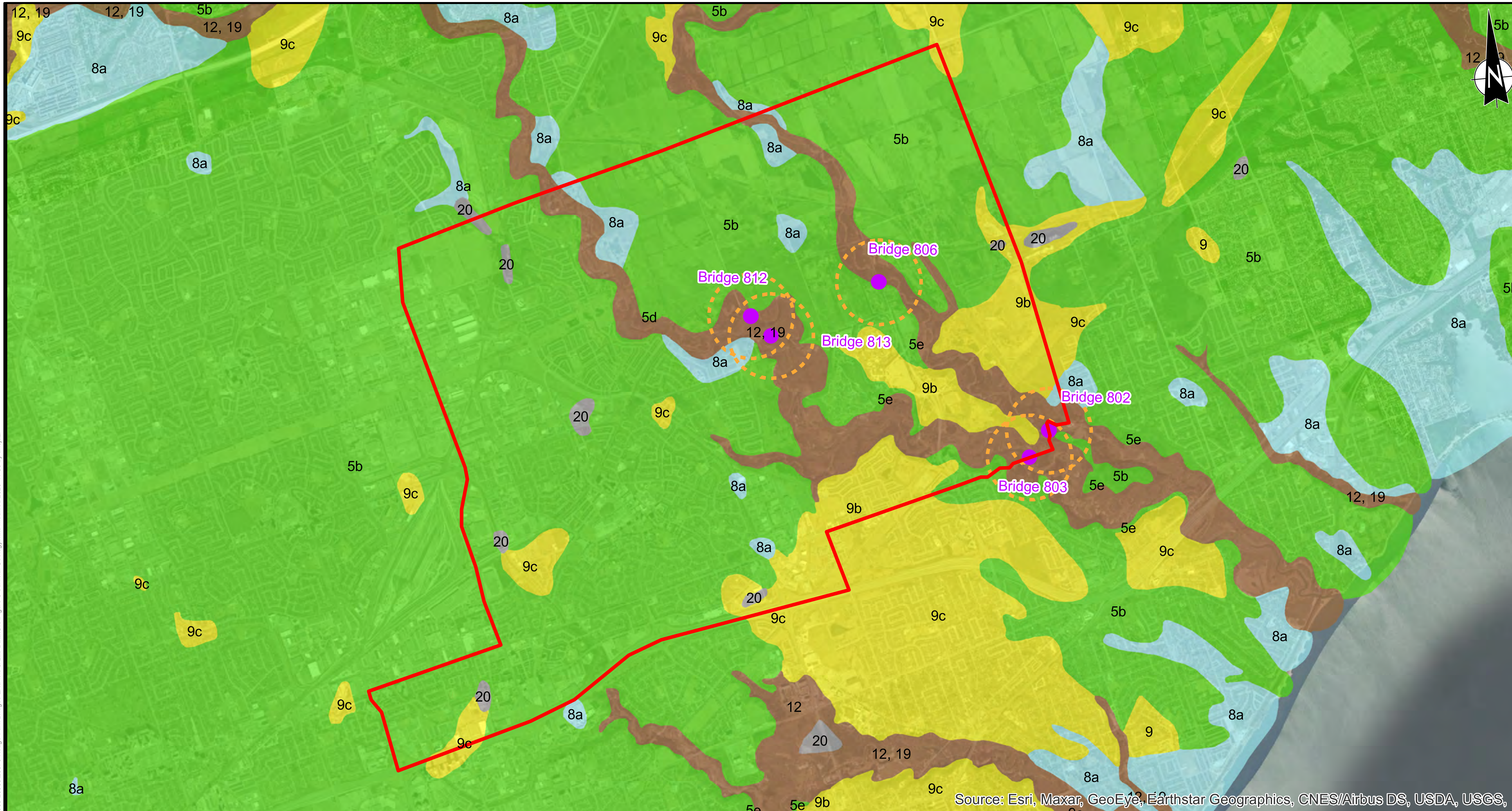
PHYSIOGRAPHIC REGIONS

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED: AH	DRAWN: AH	APPROVED: DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	FIGURE NO. 2

\\tor-fs01.thurber.local\Share01\Projects\20000-29999\26000-26999\26370 Rouge Park Bridges EA\Field & Lab Data\GIS\Figure 2 Physiography.mxd modified 2020-11-30 by ahejazi



1,000 500 0 1,000 m

UTM 17 NAD 83

LEGEND:

Study Area

Bridges

Focus Areas (500 m buffer)

Surficial Geology

8a Fine Textured Glaciolacustrine Deposits

5b,5d,5e Till

9, 9b, 9c Corase Textures Glaciolacustrine Deposits

12 Older Alluvial

19 Modern Alluvial

20 Organic Deposits

Data Source: Ontario Geological Survey (OGS)

DILLON CONSULTING LIMITED

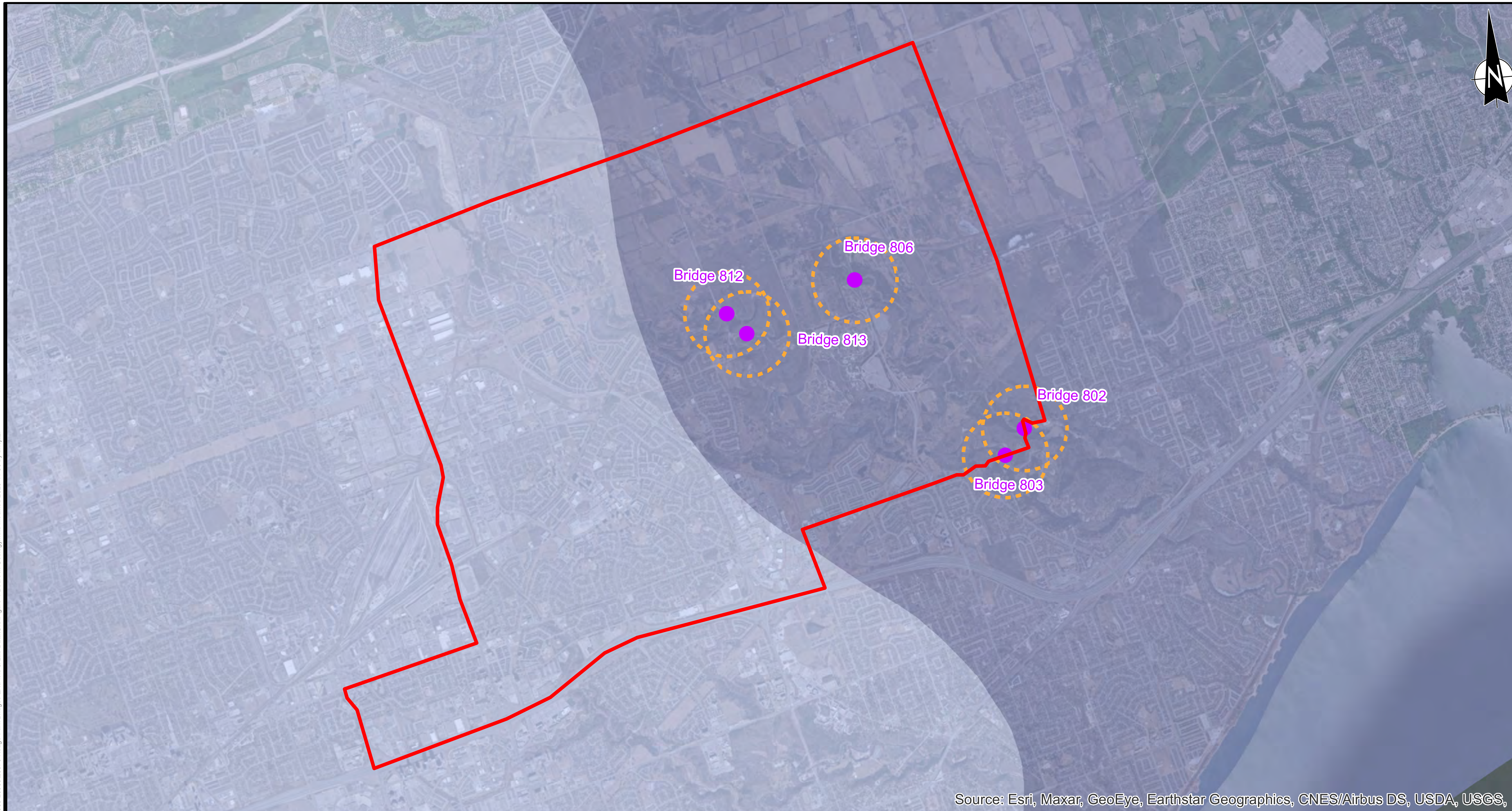
DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

SURFICIAL GEOLOGY

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	FIGURE NO. 3



LEGEND:

- Study Area
- Bridges
- Focus Areas

FORMATION

- Blue Mountain
- Georgian Bay

Data Source: Ontario Geological Survey (OGS)

1,000 500 0 1,000 m

UTM 17 NAD 83

DILLON CONSULTING LIMITED

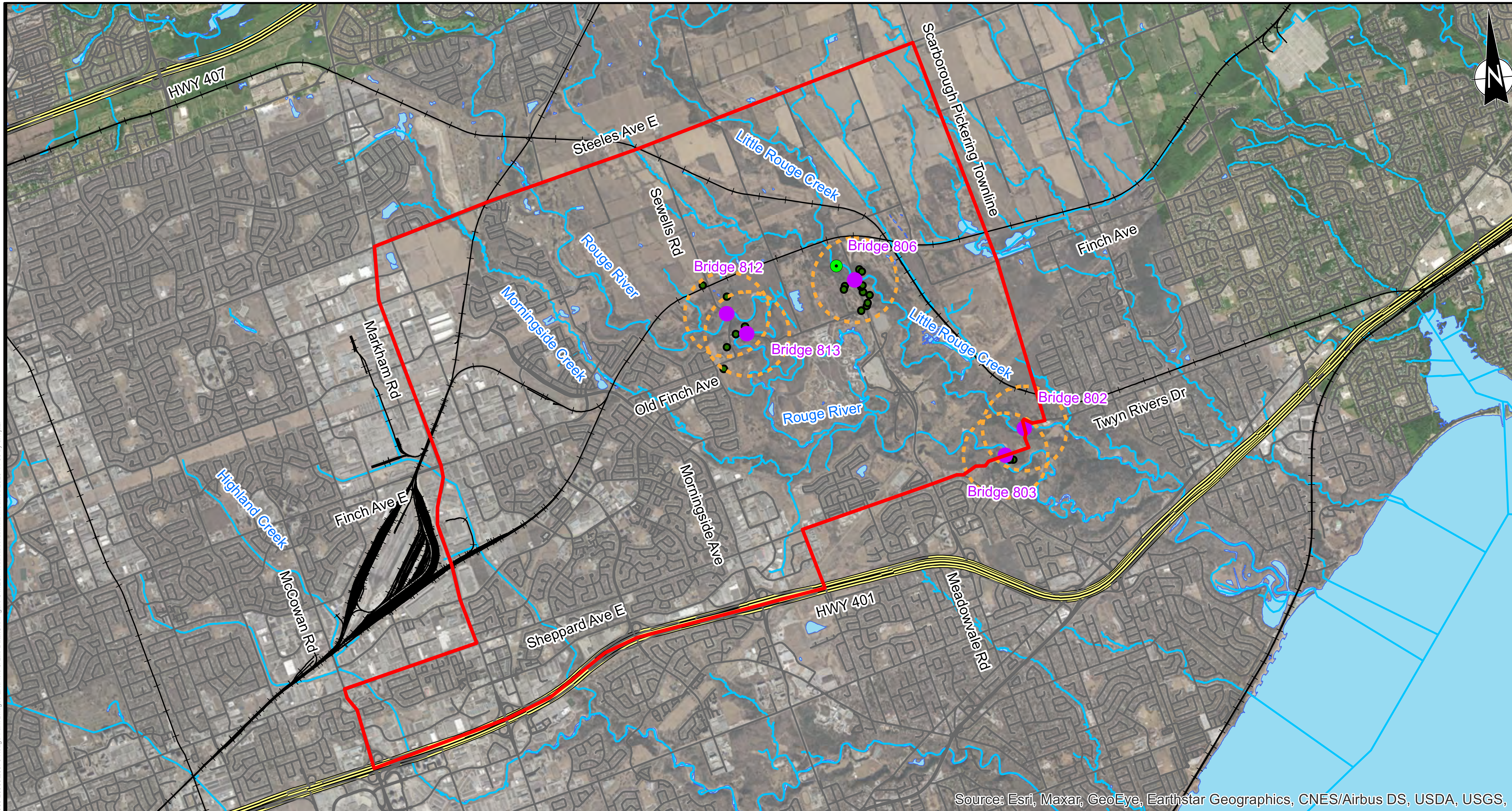
DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

BEDROCK GEOLOGY

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED: AH	DRAWN: AH	APPROVED: DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	DRAWING NO. 4



LEGEND:

- Study Area
- Bridges
- Focus Areas (500 m buffer)
- MECP Wells
- PTTW Well
- Railway
- Freeway
- Road
- Watercourse
- Waterbody

Data Source: Ministry of the Environment, Conservation and Parks Well Records

Note: Well records are only shown within the focus areas

DILLON CONSULTING LIMITED

DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

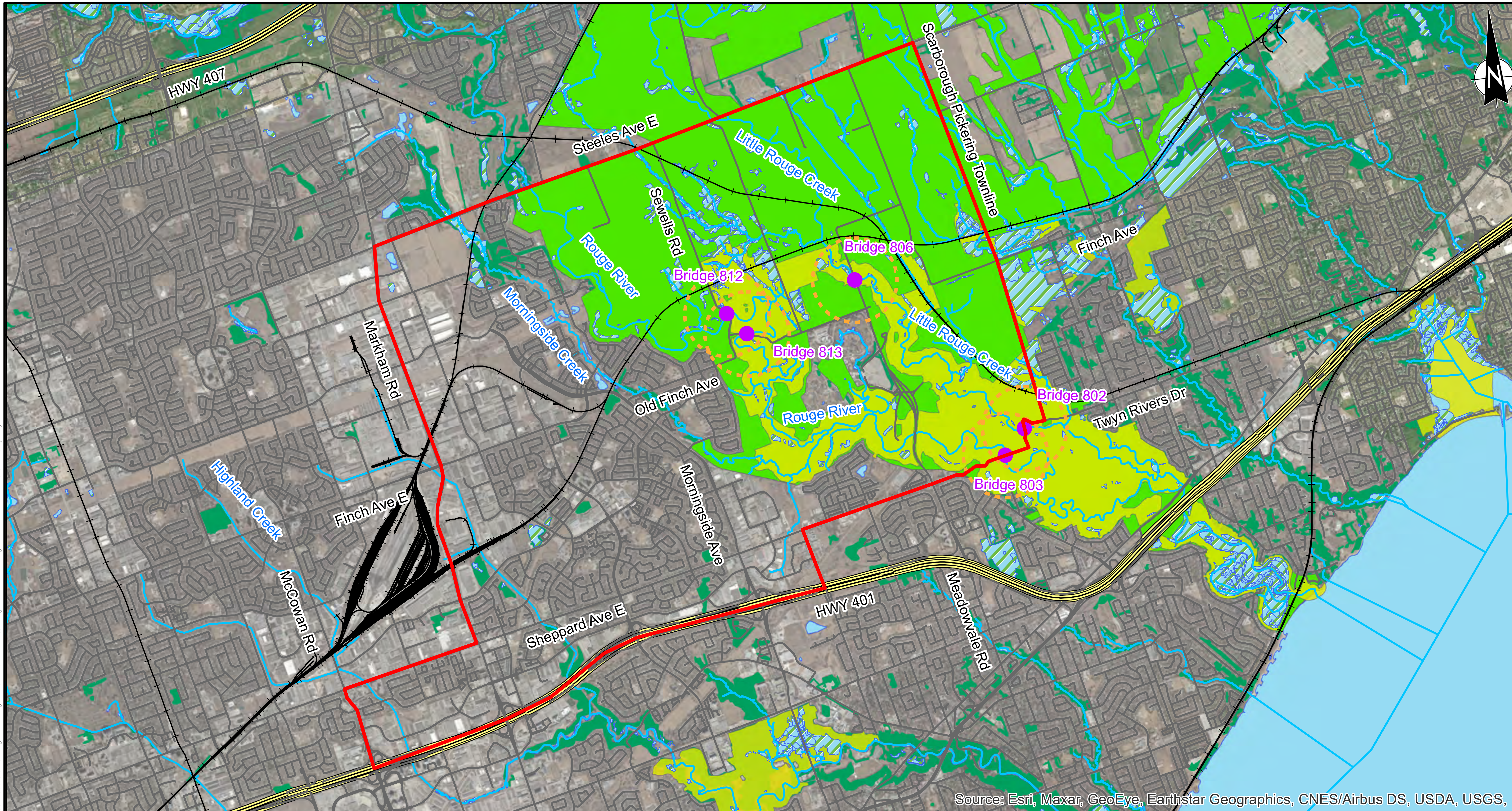
MECP WELL RECORDS

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
AH	AH	DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	FIGURE NO. 5

\\tor-fs01.thurber.local\Share01\Projects\20000-29999\26000-26999\26370 Rouge Park Bridges EA\Field & Lab Data\GIS\Figure 5 MECP Well Records.mxd modified 2020-11-30 by ahejazi



\\tor-fs01.thurber.local\Share01\Projects\20000-29999\26000-26999\26370 Rouge Park Bridges EA\Field & Lab Data\GIS\Figure 6 Natural Hertage Areas.mxd modified 2020-11-30 by ahejazi

LEGEND:

- Study Area
- Bridges
- Focus Areas (500 m buffer)
- Railway
- Freeway
- Road
- Watercourse
- Wetland
- ANSI
- Natural Heritage System
- Waterbody
- Woodland

Data Source: Ontario Ministry of Natural Resources and Forestry - Provincial Mapping Unit

1,000 500 0 1,000 m

UTM 17 NAD 83

DILLON CONSULTING LIMITED

DESKTOP REVIEW OF GEOTECHNICAL AND GROUNDWATER HYDROLOGY, ROUGE PARK BRIDGES TRANSPORTATION MASTER PLAN EA, TORONTO, ONTARIO

NATURAL HERITAGE AREAS

PROJECT No. 26370

THURBER ENGINEERING LTD.

DESIGNED: AH	DRAWN: AH	APPROVED: DH
DATE: OCTOBER 29, 2020	SCALE: 1:45,000	FIGURE NO. 6

Appendix A

MTO Geocres Library

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M14-161

DIST. 6 REGION

W.P. No. 25-69-00

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. E.M.F.

LOCATION East Metro Freeway Feasbility study

No of pages -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

Ministry of Transportation and Communications
Ontario

Memorandum

To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region
3501 Dufferin Street, Downsview

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

Attention:

Date: 78 09 26

Our File Ref.

In Reply to

Subject: Re: Feasibility Study, East Metro Freeway
W.P. 25-69-00, District 6, Toronto

Introduction

At the request of the Structural Planning Section of the Central Region, the Soil Mechanics Section carried out a foundation investigation for the feasibility study of the proposed East Metro Freeway (E.M.F.). Due to the urgency of this project, our findings and preliminary geotechnical recommendations were given to the Region verbally on August 31, 1976 and are summarized here in this report. A complete foundation report for the feasibility study will be issued in December, 1978 according to the Region's schedule.

Site and Geology

The proposed East Metro Freeway which runs basically north and south, is located partly in Scarborough, Metro Toronto and partly in Markham, County of York. The area under investigation is bounded to the south by Hwy. 401 between Conlins Road and Dean Park Road and to the north by Hwy. 7 just west of Conc. 10E. Most of the area is on a broad crest of high land projecting southward from an elevated plain north of Toronto. The presence of a high upland close to Lake Ontario has caused streams to cut deep youthful valleys. The Rouge River is the major stream of the area, entering near Buttonville in the northwest and reaching Lake Ontario just east of Rouge Hill in Pickering. The overall area is situated in three physiographic regions generally known as Iroquois Plains, South Slope and Peel Plain. According to available geological information, while most of the area is underlain by a glacial till (Leaside Formation of the late Wisconsinan period), lacustrine deposits of sand and gravel are found in the Iroquois Plain, lacustrine clays in the early peripheral lakes and recent terrace deposits of sand and gravel in the valleys of the Rouge River and its tributaries.

SUBSURFACE CONDITIONS AND RECOMMENDATIONS

In general, the subsurface conditions along the proposed route are favorable from a soil mechanics' point of view, except certain cut sections contemplated in the sand and gravel areas where groundwater problems may be anticipated. The subsurface conditions at the various structure sites and the corresponding recommendations are summarized as shown on the following pages.

cont'd...........

Location	Subsurface Conditions	Recommendations
Area 1 - Hwy. 401 and Proposed E.M.F.	0'-13' Very dense sand and gravel 13'-22' Very dense glacial till 22'-43' Very dense sandy silt to silty fine sand 43'-51' Hard clayey silt Groundwater level at 9 feet	Cut sections in granular soils below the groundwater level will require extensive temporary and permanent dewatering schemes and slope treatments. In addition, if cuts are contemplated, a detailed hydro-geological study should be carried out to evaluate the consequences of such cuts on the groundwater. In view of the above, a structure to carry E.M.F. over Hwy. 401 is preferred. Subsoil is competent. The structure can be supported on spread footings placed within the undisturbed natural subsoil with an allowable bearing pressure up to 3.0 tsf. The required fills can be constructed with 2:1 side slopes.
Area 2 - E.M.F. and C.P.R. Spur (near Sheppard Ave.)	0'- 9' Random landfill 9'-13' Loose to compact silty sand 13'-23' Very stiff to hard clayey silt 23'-96' Hard glacial till Groundwater level at 6 feet	The proposed subway crossing will be acceptable; however, some slope treatments consisting of filter or granular blankets, together with permanent subdrain systems will be required. The subway structure can be supported on spread footings placed within the glacial till with an allowable bearing pressure of 3 tsf. The required cuts can be either retained by retaining walls founded in the till or constructed with 2:1 slopes.

Location	Subsurface Conditions	Recommendations
Area 3 - E.M.F. and CPR spur (North crossing)	0'-86' Hard glacial till Groundwater level at 12 feet	The proposed subway crossing should pose no problems. Cuts up to 30 feet in height can be constructed with 2:1 slopes; cuts of 30 feet and up to 40 feet in height, however, should be provided with a half height 10 feet wide bench incorporating an intercepting ditch. The subway structure can be supported on spread footings placed within the glacial till with an allowable bearing capacity of 3 tsf.
Area 3A - E.M.F. and Tributory of Rouge River	0'-27' Very dense silty fine sand 27'-38' Very dense glacial till 38'-43' Very dense sandy silt 43'-52' Hard clayey silt 52'-70' Very dense silty sand to sandy silt Groundwater level at 18 feet	The approach fills can be constructed with 2:1 slopes. The piers of the structure can be supported on spread footings placed within the undisturbed overburden with an allowable capacity of 3 tsf. The abutments can be supported on spread footings either placed within the undisturbed overburden or perched within the approach fills on a compacted granular 'A' pad with an allowable design bearing pressure of 2.5 tsf.
Depressed Section of E.M.F. Between Area 3A and Area 4	Very dense glacial till	Similar to the recommendations for the cuts in Area 3.
Area 4 - E.M.F. and Finch Ave. E.	0'-17' Very stiff silty clay 17'-51' Very dense glacial till Groundwater level at 15 feet	The required cuts of up to 25 ft. in depth can be constructed with 2:1 slopes. The structure can be supported on spread footings placed within the glacial till with an allowable bearing pressure up to to 3 tsf.

Location	Subsurface Conditions	Recommendations
Area 5 - Finch Avenue Crossing of Rouge River	(In the river valley) 0'- 4' Very dense sand and gravel 4'-17' Compact to very dense uniform fine sand 17'-62' Sandy silt to silty sand shale bedrock at 62 feet Groundwater level at 5 feet	The proposed high level profile grade will require a very long structure and very high fills and, therefore, it is not preferred. In the alternative low profile scheme, the west approach may require fills up to 40 feet high. The fills should be constructed with 2:1 slopes and a 20 foot wide mid-height berm in both longitudinal and transversal directions. The piers and the west abutment which will be perched in the fills should be supported on steel H piles driven to bedrock. The east abutment can be supported on spread footings placed within the over-burden with an allowable pressure of 3 tsf. The footings, however, should be kept at least 50 ft. from the cliff.
Area 6 - E.M.F. Crossing of Rouge River	0'- 8' Compact sand and gravel 8'-33' Hard clayey silt to silty clay 33'-43' Silty sand and clayey silt interbedded. Very dense or hard 43'-66' Very dense silty sand Groundwater level at 6 feet	Recommendations for the fills will be similar to those for fills in Area 5. The footing elements of the structure should be supported on end bearing steel H piles. Estimated pile tip elevations around 40 feet below ground surface.

Location	Subsurface Conditions	Recommendations
Area 7 - E.M.F. Crossing of Relocated Finch Ave.	0'-36' Compact to very dense sand 36'-62' Hard silty clay to clayey silt Groundwater level at 20 feet	No stability problems are anticipated for the proposed cuts and fills. The structure can be supported on spread footings in the overburden with a design pressure of 3 tsf. This crossing is preferred to the Rouge crossing.
Area 8 - E.M.F. Subway at CPR	0'-81' Very dense glacial till Groundwater level at 40 feet	Cuts up to 25 ft. deep will be required and can be constructed with 2:1 slopes. The structure can be supported on spread footings within the glacial till with a design pressure of 3 tsf.
Area 9 - E.M.F. Subway at CNR	0'-42' Very dense glacial till 42'-46' Very dense silt Groundwater level at 13 feet	Similar to Area 8
Area 9A - E.M.F. Crossing Steeles Ave.	0'- 7' Compact silty fine sand 7'-13' Hard clayey silt to silt some clay 13'-21' Very dense silt to sandy silt, interbedded 21'-33' Hard clayey silt to silt some clay 33'-48' Very dense silt 48'-52' Very dense sand Groundwater level at 14 feet	The cuts can be constructed with 2:1 slopes but should be protected with filter or granular blankets. The structure can be supported on spread footings in the overburden with an allowable pressure of 3 tsf.

Location	Subsurface Conditions		Recommendations
Area 9B - Existing Steeles Ave. Subway at CNR	0'- 7' 7'-27'	Sand Glacial Till	This crossing can be left as it is. The existing structure is on spread footings.
Area 9C - E.M.F. Over Tributary to Little Rouge River	0'- 7' 7'-46'	Stiff clayey silt Very dense glacial till	No stability problems for the 10 ft. fills
Area 10 - E.M.F. Overhead at CPR	0'- 9' 9'-21' 21'-31' 31'-47' 47'-51'	Hard clayey silt to silt some clay Very dense sandy silt to silty sand Very dense glacial till Fine to medium sand under sub-artesian pressure Hard glacial till	Because of a water bearing sandy stratum and a sand stratum under sub-artesian condition, it is preferrable to have E.M.F. go over the existing CPR. The abutments should be perched within the fills on end bearing steel H piles. Estimated tip elevations around 15 feet below ground surface.
Area 11 - E.M.F. and Hwy. 407	0'-46'	Very dense glacial till	No stability problems for either cuts or fills. Structure can be supported on spread footings placed within the glacial till with an allowable pressure of 3 tsf.

The various comments outlined in this report are for feasibility study purposes based on very limited information. It will be necessary to carry out detailed subsurface investigations at each site of the proposed structure and related approaches and in some areas groundwater studies, together with pumping tests, may be necessary when the design details and geometrics are finalized. A complete report with borehole log sheets and drawings will be submitted at a later date by this Section.

B. Ly

B. Ly, P. Eng.
Senior Engineer

For: M. Devata, P. Eng.
Supervising Engineer

BL/MD/gs

cc: M. Thompson
I. Williams
Files

Structural Section,
Central Region,
3501 Dufferin Street,
Downsview, Ontario.
M3K 1N6
Telephone: 248-3097

September 1, 1978

M.M. Dillon Limited,
Consulting Engineers & Planners,
P.O. Box 219,
Station "K",
Toronto, Ontario.

Atten: Mr. Ian Williams,
Project Manager

Dear Sir:

RE: East Metro Transportation Corridor
from Highway 401 to Highway 7,
Preliminary Foundations Information Request,
District 6

We have now received preliminary (verbal) geotechnical information from our Soil Mechanics Section regarding the above project. More detailed findings and recommendations (in writing) will be received by this section on or shortly after September 15th, at which time their findings will also be forwarded to you.

In the interim we report the following geotechnical information:

Area 1 - Hwy. 401 & Proposed E.M.F.

This crossing should be an underpass (i.e. E.M.F. should go over the existing Hwy. 401) as the water table is quite high (granular subsoil). Spread footings on natural ground would be acceptable; no stability problems for fill slopes with standard side-slopes are anticipated.

.....2

PROPOSED STRUCTURE AREAS

Area 2 - E.M.F. & C.P.R. spur (South Crossing)

The proposed subway crossing (E.M.F. under C.P.R.) will be acceptable; however, some treatment of the cut-slopes will be necessary (i.e. filter or granular blanket). Permanent sub-drains may also be necessary. Spread footings and 2:1 side slopes will suffice.

Area 3 - E.M.F. & C.P.R. spur (North Crossing)

The proposed subway (E.M.F. under C.P.R.) should encounter no serious problems. Cuts up to 30' with 2:1 side slopes, will not need berms. However, a 35' deep cut may need 10' wide berms. Spread footings should be adequate.

Area 3A - E.M.F. & Tributary of Rouge River

No serious problems should be encountered here; this also goes for fills up to 25' in height. The structure may be founded on spread footings, from a geotechnical point of view.

X Depressed Section of E.M.F. between Area 3A & Area 4

It is anticipated that relatively good soil conditions exist here allowing the E.M.F. to be in a cut; however, berms may be needed.

Area 4 - E.M.F. & Finch Ave. E.

No problems should be encountered with cuts up to 20'; structures may be founded on spread footings.

Area 5 (Relocated) Finch Ave. Crossing of Rouge River (along existing R.O.W.)

The subsoil is granular. A structural scheme keeping a high profile grade for Finch Ave. would necessitate a long structure and high fills; the abutments should not be closer than 1½:1 from the toe of the slopes at the river. A high fill would require multiple berms; piles should be driven through fill to natural soil. It is doubtfull if the Conservation Authority would allow placing of substantial amounts of fill in the Rouge River valley. If a low grade for the Finch Ave. extension is planned, the Soil Mechanics Section would want to do further investigation.

.....3

Area 6 - E.M.F. Crossing Rouge River

High fills will need berms (eg. 40'-45' high fills will require 20' wide berms, each side). The abutments may be founded on piles to natural ground.

Area 7 - E.M.F. Crossing of a Relocated Finch Ave. (South of C.P.R.)

The proposed profile puts Finch Ave. in a small cut while the E.M.F. is on 20' of fill; no problems are anticipated. Spread footings are acceptable.

Area 8 - E.M.F. Subway at C.P.R.

Cuts up to 25' should not encounter any problems; spread footings are acceptable.

Area 9C - E.M.F. over Tributary to Little Rouge River

Fills up to 10' high should not encounter any problems.

Area 9 - E.M.F. at C.N.R.

Cuts up to 20' should not encounter any problems.

Area 9A - E.M.F. Crossing Steeles Ave.

A 20'-25' cut should not encounter any problems.

Area 9B - Existing Steeles Ave. Subway at C.N.R.

No foundation problems were encountered in the construction of this bridge; it is founded on spread footings. The subsoil consists of dense glacial till.

Area 10 - E.M.F. Overhead at C.P.R.

Due to a water bearing sand stratum at approximately 21' below ground, it is preferable to have E.M.F. go over the existing C.P.R. The structure should be founded on piles driven into the till.

Area 11 - E.M.F. and Hwy. 407 Interchange

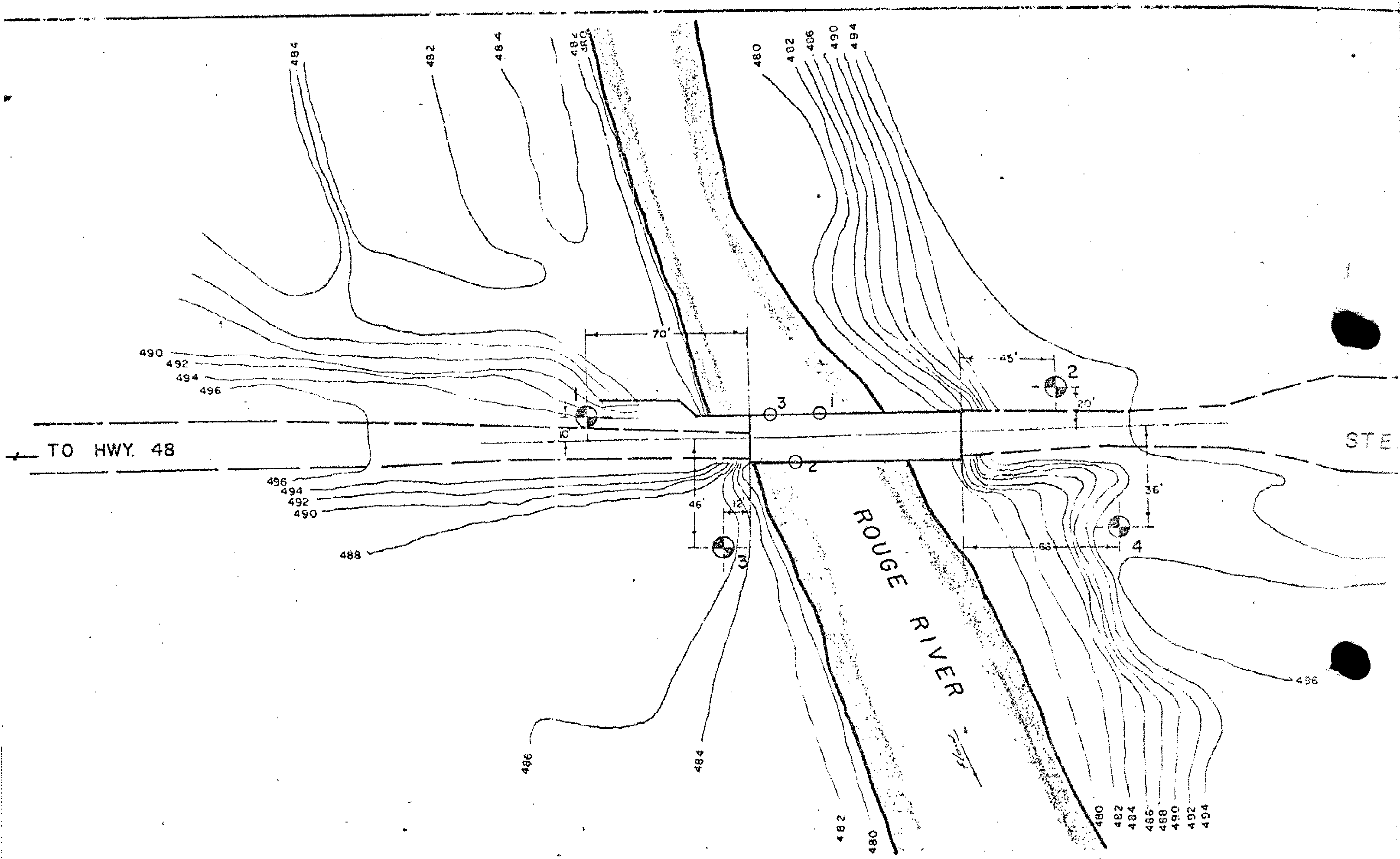
No major problems with cuts or fills. Spread footings may be adequate.

Yours truly,

VFB:gj

V.F. Boehnke,
Area Engineer-Structures,
for:
G.C.E. Burkhardt,
Head, Structural Section.

c.c. M. Thompson
B. Ly ✓



TO HWY. 48
ROUGE RIVER
STE
70'
45'
20'
10
46'
12
36'
66
484
482
484
480
482
486
490
494
490
492
494
496
496
494
492
490
488
486
484
482
480
480
482
484
486
488
490
492
494
496

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING NO. 2
PROJECT NO. J3742

BOREHOLE NO. 1
PROJECT Proposed Bridge Replacement
LOCATION Freeman Bridge - Steeles Avenue East - Rouge River.
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 495.3 feet
DATUM See Dwg. 1

LEGEND

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE

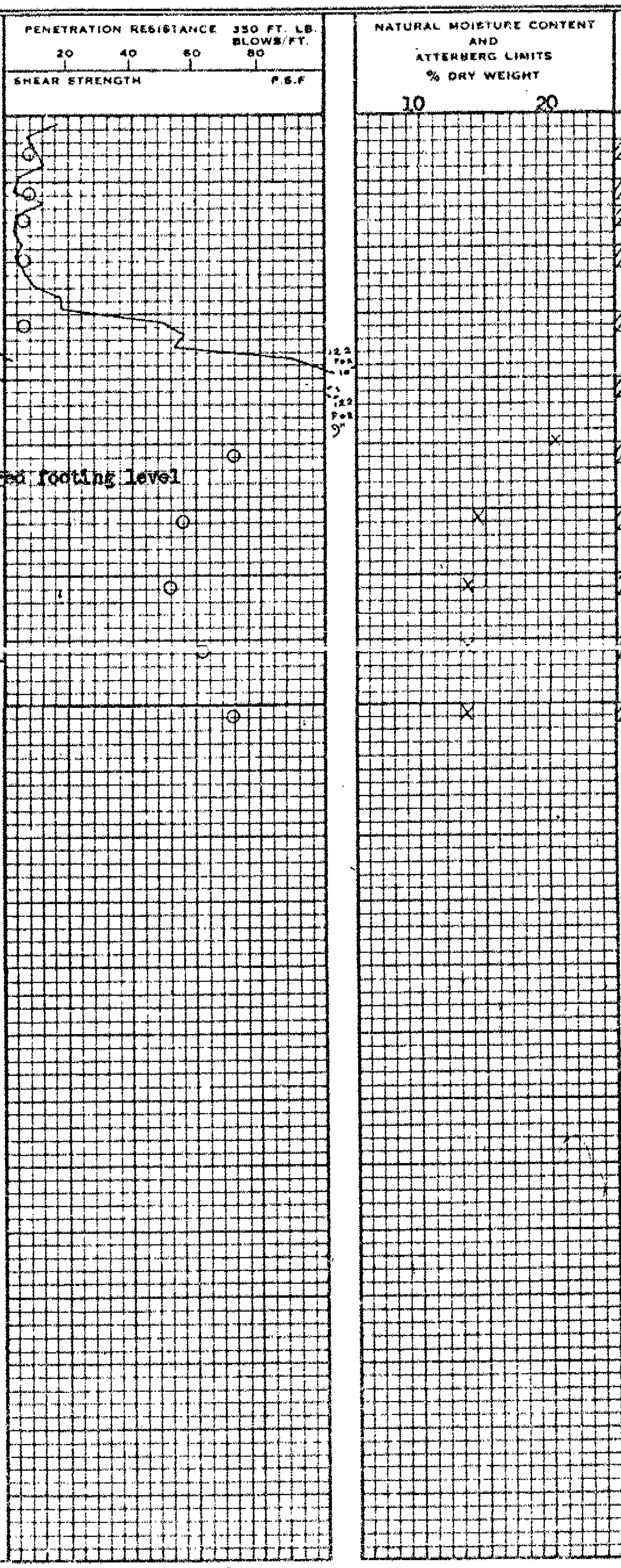
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^{LI}

ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
	495.3	0		
ROAD EMBANKMENT-silty sand, till, compact, somewhat dirty, dry.			1	
			2	
			3	
		10	4	
	480.		5	
	475.	20	6	
SANDY SILT-very dense, fine, moist, wet below 22 feet depth; caving below 21 feet depth.	468.		7	130.9
Required footing level				
SILT TILL-moist, very dense, some gravel sizes, slightly cohesive.		30	8	138.5
			9	140.5
		40	10	[illegible]
End of hole	[illegible]			
			11	139.2
		50		
		60		
		70		
		80		
		90		
		100		
		110		



NOTES:

1) Boring by machine auger, hole uncased to full depth.

2) Water level at 20 feet depth, open to 21 feet depth at end of bore.
Water at 15 feet depth, open to 21 feet depth after 5 days.
River elevation = 478.5 feet, June 20, 1967

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No. 3

PROJECT No. J3742

LEGEND

BOREHOLE No. 2

PROJECT Proposed Bridge Replacement

LOCATION Freeman Bridge - Steeles Avenue East - Rouge River

HOLE LOCATION See Dwg. 1

HOLE ELEVATION 495.7 feet

DATUM See Dwg. 1

PENETRATION RESISTANCE
- 2" O.D. SPLIT TUBE
- 2" I.D. SHELBY TUBE
- 2" DIA. CONE

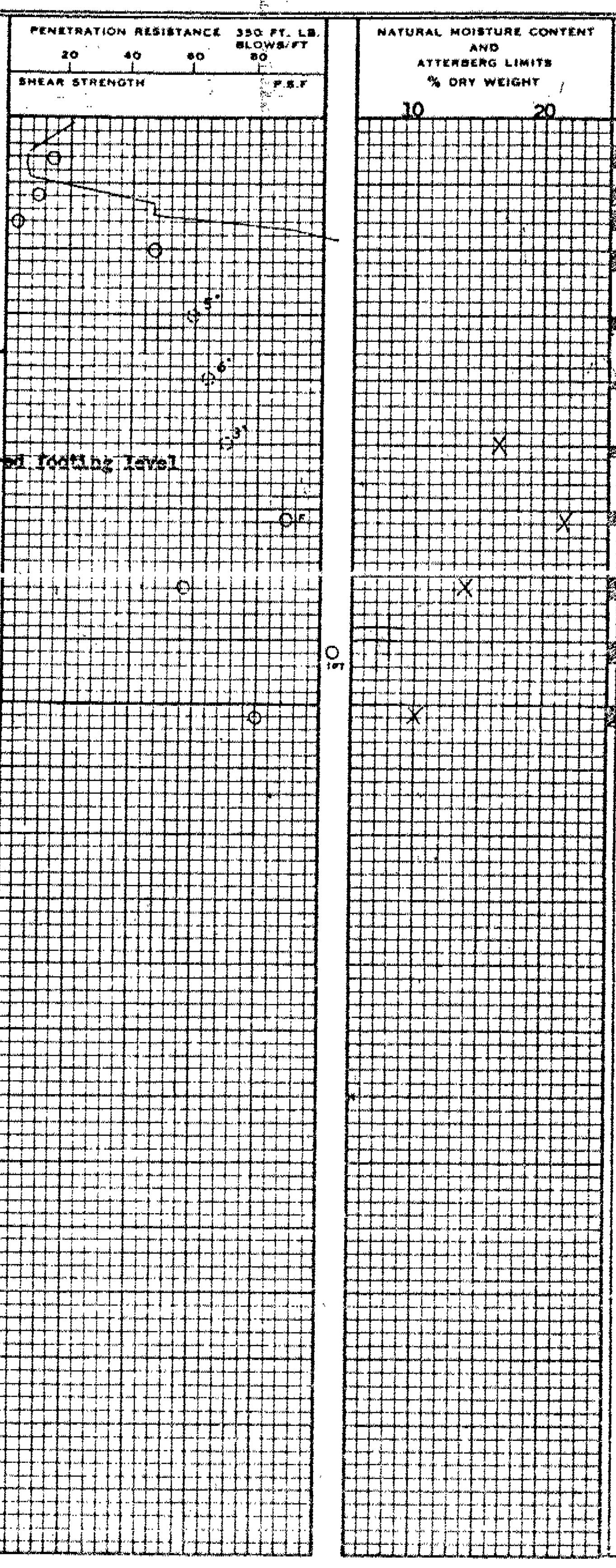
SHEAR STRENGTH
- UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
- UNCONFINED COMPRESSION
- VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X[LI]

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

SAMPLE TYPE
- 2" O.D. SPLIT TUBE
- 2" I.D. SHELBY TUBE
- 3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	SAMPLE TYPE AND No.	NATURAL UNIT WEIGHT P.C.F.
F	FILL-moist, sandy, gravel, stone sizes.	495.7	0	1	
F	Sandy fill.	487.7		2	
		484.7	10	3	
	SANDY SILT-moist, very dense, some fine sand.			4	
				5	
			20	6	
	SANDY SILT TILL-moist, very dense, cohesive.	470.7		7	
		468 Required footing level	30	8	123.3
				9	
			40	10	147.7
	End of Hole	449.2		11	142.4



Depth scale: 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110

NOTES:

1) Boring by machine auger, hole uncased to full depth.

2) Water level at 36.4 feet depth, hole open to 41 feet depth at end of bore.
8 feet depth hole open to 12 feet depth after 5 days.

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING NO. 4
PROJECT NO. 13742

LEGEND

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE

SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)

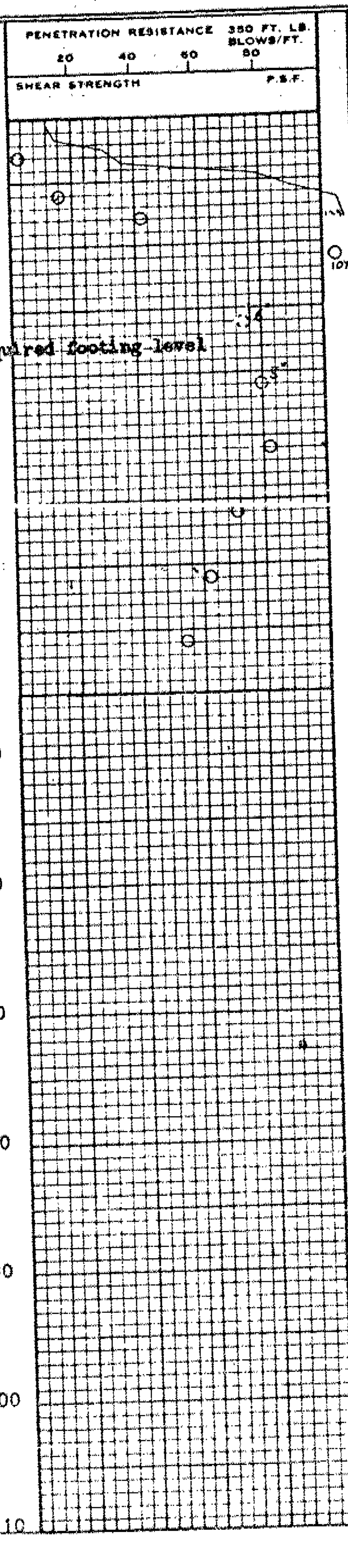
NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^{LI}

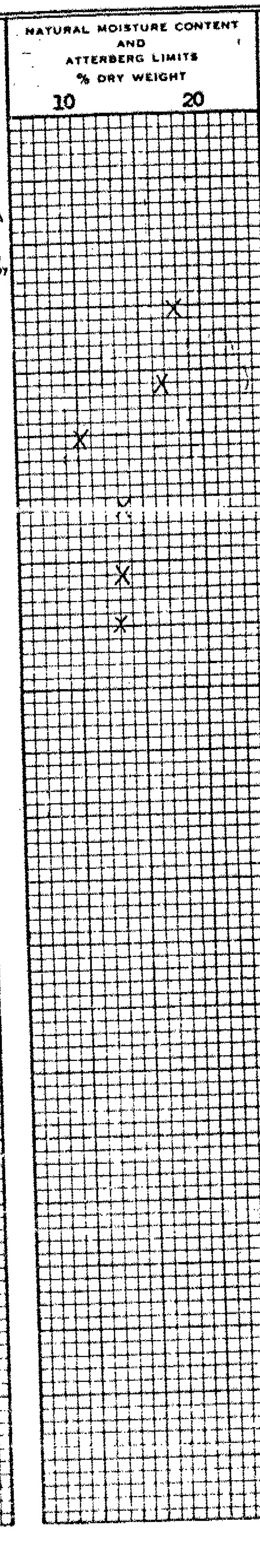
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT

SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

BOREHOLE NO. 3
PROJECT Proposed Bridge Replacement
LOCATION Freeman Bridge - Steeles Avenue East - Rouge River
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 486.8 feet
DATUM See Dwg. 1

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET
		486.8	0
F F	FILL-sand, gravel sizes.	484.3	
	SAND-moist, loose, gravel sizes, (river alluvium)	479.7 (water level)	
		479.	
	SAND-grey, fine, very dense, silty.	475.	10
	SILT TILL-moist, very dense, cohesive.		
	468 Required footing level	468	20
			30
			40
	End of Hole	445.3	





SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
1	
2	
3	
4	
5	134.0
6	135.6
7	
8	137.8
9	138.0
10	137.6

NOTES:

1) Boring by machine auger, hole uncased to full depth.

2) Water level = 7.1 feet depth, open to 7.4 feet depth after 4 days.

Depth scale: 50, 60, 70, 80, 90, 100, 110

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No. 5
PROJECT No. J3742

LEGEND

PENETRATION RESISTANCE
- 2" O.D. SPLIT TUBE —o—o—o—
- 2" I.D. SHELBY TUBE —x—x—x—
- 2" DIA. CONE ———

SHEAR STRENGTH
- UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕
- UNCONFINED COMPRESSION ⊗
- VANE TEST AND SENSITIVITY (S) +S

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^{LI}

ATTERBERG LIMITS
- LIQUID LIMIT —o
- PLASTIC LIMIT |—

SAMPLE TYPE
- 2" O.D. SPLIT TUBE
- 2" I.D. SHELBY TUBE
- 3" O.D. SHELBY TUBE

BOREHOLE No. 4
PROJECT Proposed Bridge Replacement
LOCATION Freeman Bridge - Steeles Avenue East - Rouge River
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 496.8 feet
DATUM See Dwg. 1

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET
		496.8	0
F O F O	FILL-sandy, boulders.	495.	
	ALLUVIUM-moist, sand, gravel sizes, decayed material approximately 6 feet depth.	490.	
	SANDY SILT-wet, fine, very dense.	488.	10
			20
	SILT TILL-moist, very dense, slightly cohesive.	473.8	
	468 Required footing level		30
			40
	End of Hole	455.3	

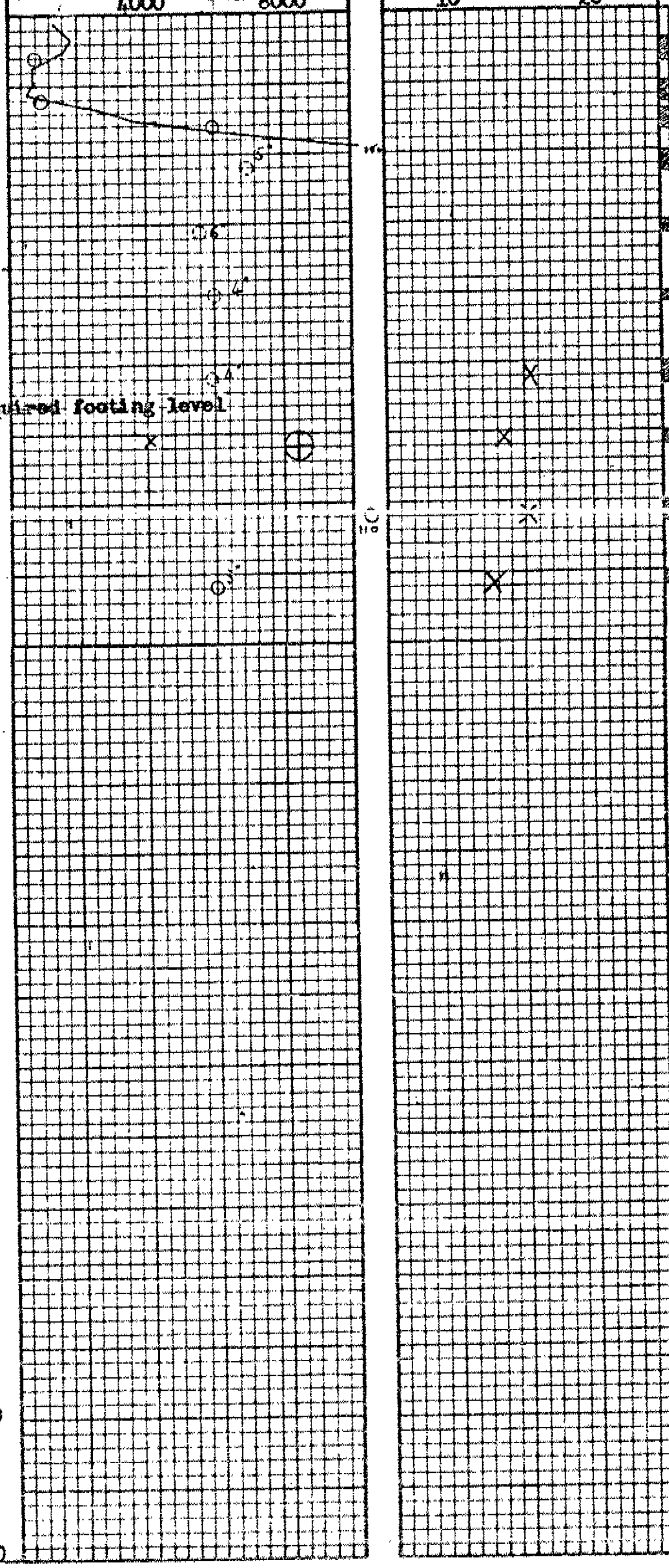
NOTES: 1) Boring by machine auger, hole uncased to full depth.

2) Water level = 21.4 feet depth, open to 25.6 feet depth at end of bore. Water at 9 feet depth, open to 12.7 feet depth after 1 day.

PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT. 20 40 60 80

SHEAR STRENGTH P.S.F. 4000 8000

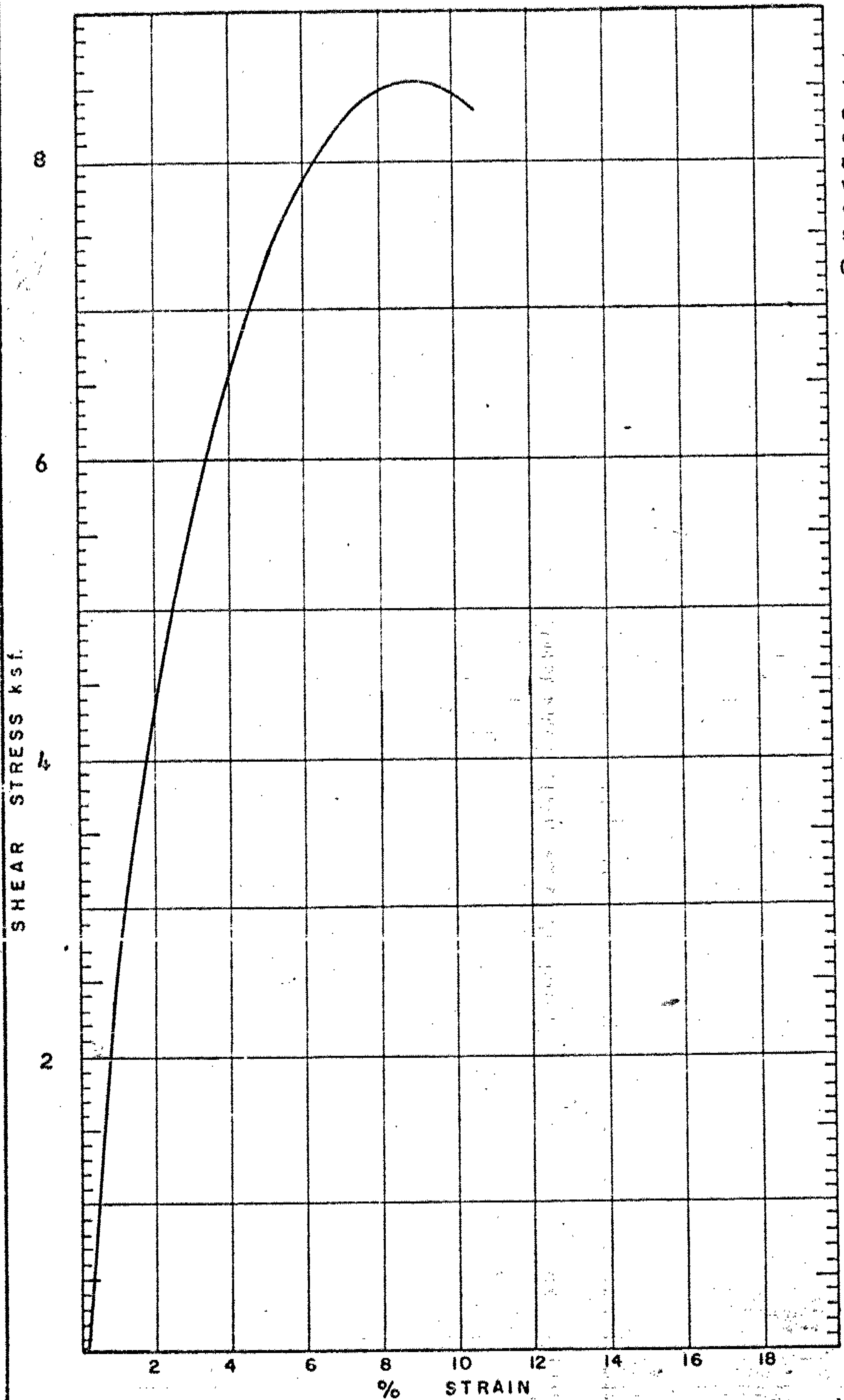
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT 10 20



SAMPLE TYPE AND No.	NATURAL UNIT WEIGHT P.C.F.
1	
2	
3	
4	
5	
6	
7	137.0
8	140.3
9	[illegible]
10	139.0

DEPTH FEET: 50 60 70 80 90 100 110

Project J3742 Drawing Nº 6



TEST Nº 1
TEST Undrained
B.H. 4 DEPTH 30-31'
C = 8500 P.S.F.
γ = 140.3 P.C.F.
W = 13.6 %
σ_3 = 29.2 P.S.I.
SOIL
Grey Silty Clay

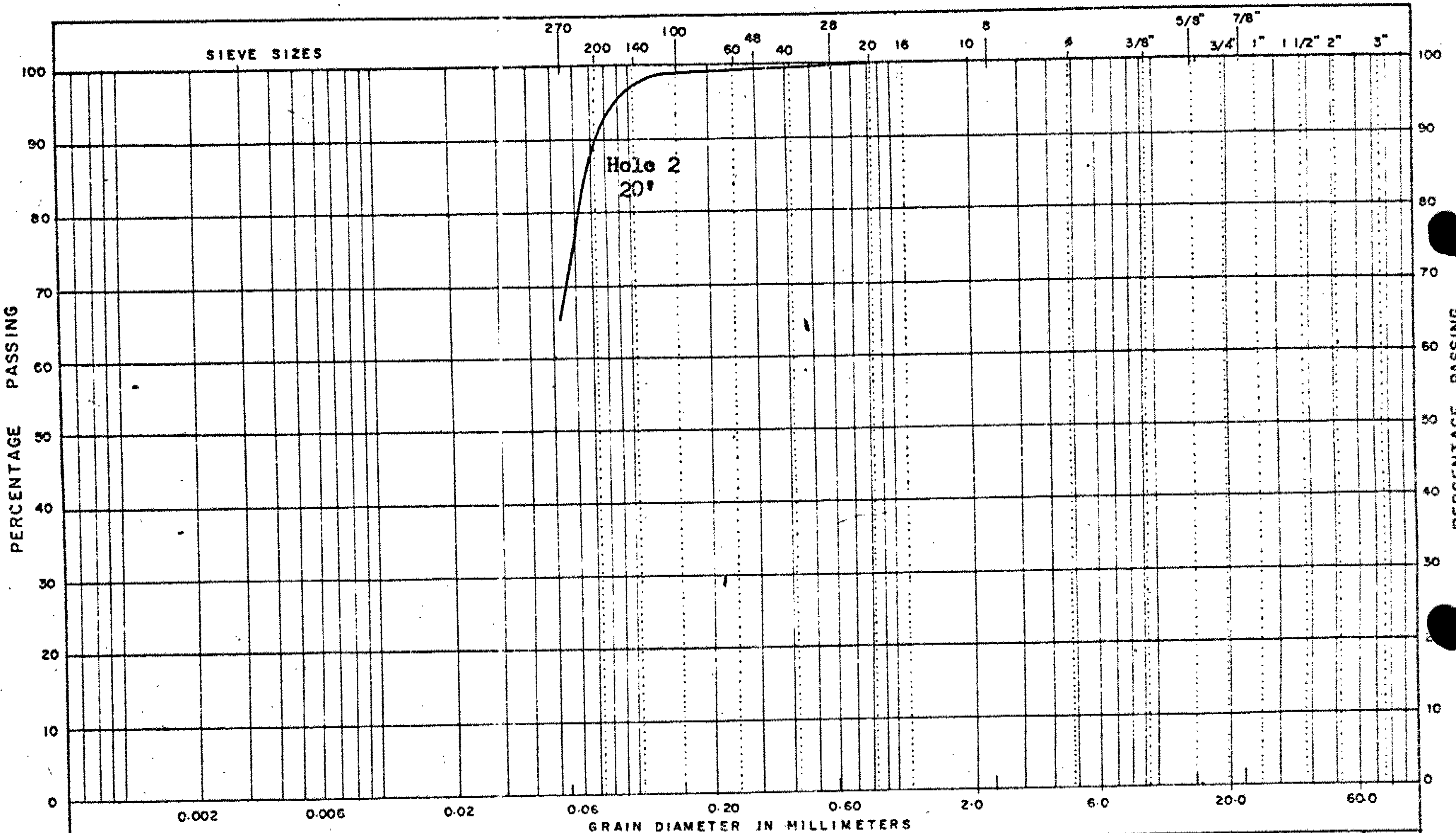
TEST Nº
TEST
B.H. DEPTH
C = P.S.F.
γ = P.C.F.
W = %
σ_3 = P.S.I.
SOIL

TEST Nº
TEST
B.H. DEPTH
C = P.S.F.
γ = P.C.F.
W = %
σ_3 = P.S.I.
SOIL

TRIAXIAL TEST RESULTS

Project: J3742

MECHANICAL ANALYSIS



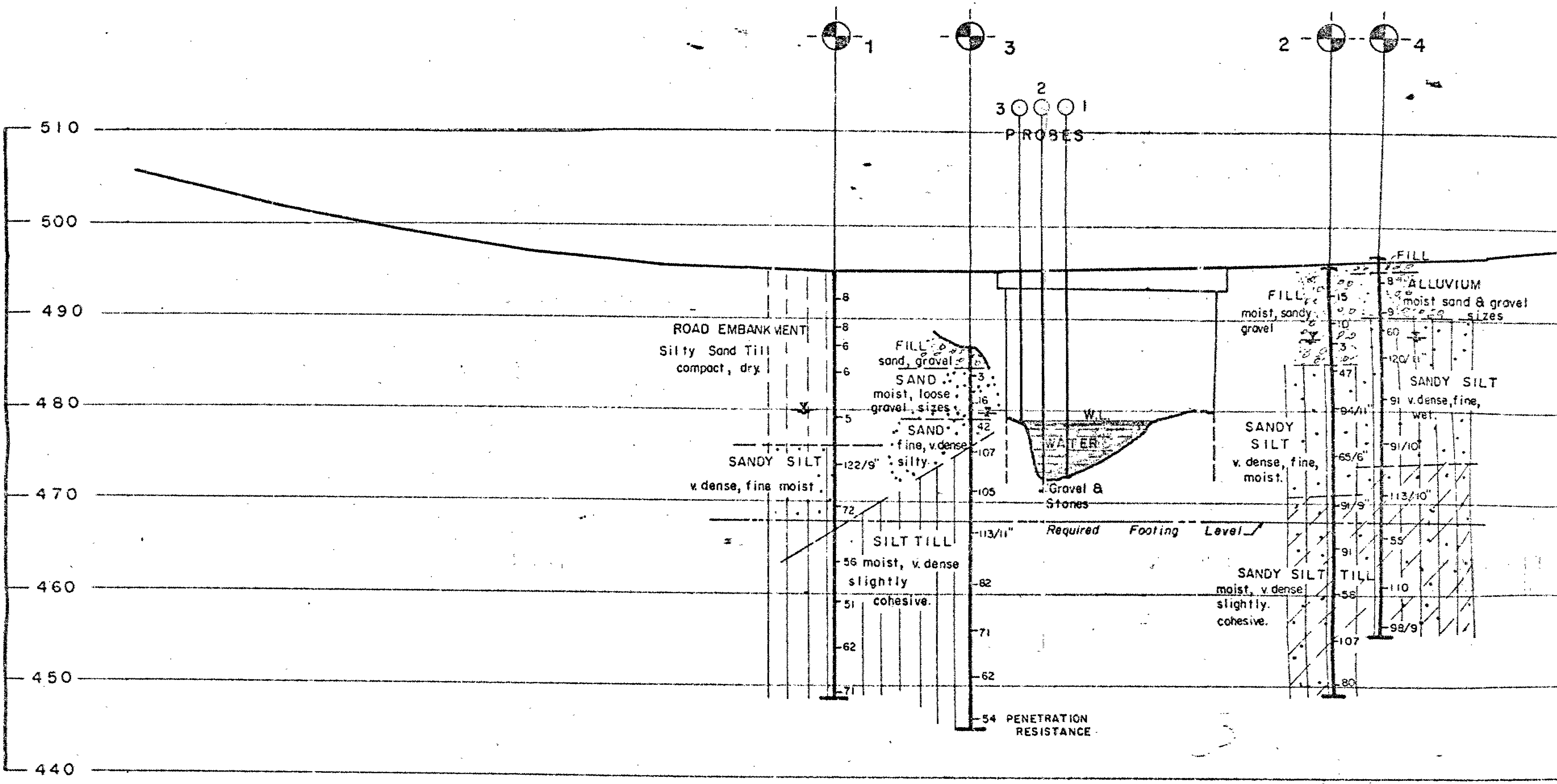
CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
	SILT			SAND			GRAVEL		

MODIFIED M.I.T. CLASSIFICATION

GRAIN SIZE CURVE TO NO. 270 SCREEN FOR A SAMPLE OF SILT
HOLE 2 - 20 FEET

WILLIAM TROW ASSOCIATES LTD.

Dwg. 7



INTERPRETED SUBSOIL STRATIGRAPHY

SCALE: HOR. 1 IN. = 40 FT.
VERT. 1 IN. = 10 FT.

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M14-161 30M14-227 30M15-85

DIST. 6/7 REGION

W.P. No. 282-86-01 326-88-01 25-69-00

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 407

LOCATION HWY 407 ROUTE ENVIRONMENTAL STUDY (FROM HWY 48 TO HWY 35/115)

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

ENGINEERING MATERIALS OFFICE
SOIL MECHANICS SECTION

WP 25-69-00 DIST 6

HWY EMF STR SITE N/A

Feasibility Study
East Metro Freeway

DISTRIBUTION

G.C.E. Burkhardt (3)
R.D. Gunter
M.R. Ernesaks
D.E. Thrasher (2)

C. Grebski
G.A. Wrong
B.J. Giroux
R.S. Pillar

R. Hore

R. Fitzgibbon)
J. Anderson) cover only
G. Sloan)

Files ✓

SAMPLE DISPOSITION NOTICE

TYPE	DISCARD AFTER	RECOMM. BY
JARS	79 01 12	M.D
TUBES	—	—
ROCK CORES	—	—

GEOCRES 30M14-161

DATE JAN 1 0 1979

FOUNDATION INVESTIGATION REPORT

For

Feasibility Study, East Metro Freeway
W.P. 25-69-00
District 6, Toronto

INTRODUCTION

This report contains the results of our foundation investigation carried out for the feasibility study of the proposed East Metro Freeway. The fieldwork was done during the period of August 8, 1978 to August 16, 1978 consisting of a total of 14 sampled boreholes advanced by means of an auger machine equipped with 3¼ inch I.D. hollow stem continuous flight augers. The borings ranged in depth from 45 feet to 96 feet below ground surface.

The results of three borings put down by CNR in 1964 for the subway structure at Steeles Avenue are also included here.

SITE AND GEOLOGY

The proposed East Metro Freeway which runs basically north and south is located partly in Scarborough, Metro Toronto and partly in Markham, County of York. The area under investigation is bounded to the south by Hwy. 401 between Conlins Road and Dean Park Road and to the north by Hwy. 7 just west of Conc. 10E. Most of the area is on a broad crest of high land projecting southward from an elevated plain north of Toronto. The ground surface of the general area varies from elevation 650 to 450 feet. The presence of a high upland close to Lake Ontario has caused streams to cut deep youthful valleys. The Rouge River is the major stream of the area, entering near Buttonville in the northwest and reaching Lake Ontario just east of Rouge Hill in Pickering.

The land is mainly used for industrial development in the southern section, parks and recreation near the Rouge River, residential development and farming in the northern section.

The overall area is situated in three physiographical regions generally known as Iroquois Plains, South Slope and Peel Plain. According to the available geological information, while most of the area is underlain by a glacial till (Leaside formation of the late Wisconsinan period), lacustrine deposits of sand and gravel are found in the Iroquois Plains, lacustrine clays in the early peripheral lakes and recent terrace deposits of sand and gravel in the valleys of the Rouge River and its tributaries.

SUBSURFACE CONDITIONS

Factual borehole data are shown in the Record of Borehole Sheets. The locations and elevations of the boreholes, together with the estimated stratigraphical profile, are shown in Drawing 256900-A, B and C. A brief description of the subsurface conditions along the route of EMF is as follows.

Area 1: This site is located in the Iroquois Plain. Subsoil here consists of 13 feet of very dense sand and gravel followed by 14 feet of very dense glacial till which is composed of a heterogeneous mixture of sand, silt and trace of gravel and clay. The glacial till is underlain by 16 feet of very dense silt to sandy silt and then followed by a stratum of hard silty clay. The groundwater was observed to be at elevation 424±.

Area 2: This site is located in the beach area of Lake Iroquois. This area is underlain by a thin layer of loose sand, about 5 feet thick and then followed by an extensive stratum of hard glacial till. The glacial till has a cohesive matrix of low plasticity being composed of a heterogeneous mixture of clayey silt, sand and some gravel. In certain places random landfill about 9 feet thick has been left on the ground surface. The groundwater level was observed to be at elevation 445±.

Area 3: Subsoil at this site consists of an extensive deposit of glacial till which is at least 86 feet thick. The glacial till is composed of a heterogeneous mixture of clayey silt, sand and gravel and has a consistency varying from very stiff to hard with depth. The upper 15 feet of the glacial till stratum is brown and desiccated; below that depth the glacial till is grey. Within the desiccated zone a one foot thick sand layer was encountered at a depth of about 10 feet below ground surface. The groundwater was observed to be at elevation 463±.

<u>Area 3A</u>: This site is at a tributary of Rouge River. The upper portion of the overburden at this location is a 25 foot thick stratum of dense to very dense fluvial fine to medium sand. This granular stratum is underlain by a 13 foot thick deposit of very dense glacial till (a heterogeneous mixture of sand, silt, some gravel and trace of clay) and then followed by a 5 foot thick layer of very dense silty fine sand. The lower granular layer overlies an 8 foot thick deposit of hard silty clay, which in turn overlies another stratum of very dense silty sand containing seams of silt and clay. The groundwater was observed to be at elevation 426±.

<u>Area 4</u>: This site is located in a peripheral lake during the Pleistocene epoch. The upper 17 feet of the overburden is a lacustrine silty clay of intermediate plasticity. The silty clay was found to have a desiccated crust of about 13 feet. The consistency of the silty clay varies from very stiff to hard in the crust to stiff in the undesiccated zone. The silty clay is underlain by a stratum of hard, cohesive glacial till which is at least 34 feet thick. The groundwater was observed to be at elevation 457±.

<u>Area 5</u>: This site is at the Rouge River. While the river valley banks are composed of a glacial till, the river valley floor is underlain by stream terrace deposits. Subsoil at the river valley floor consists of 3 feet of sand and gravel, followed by 15 feet of compact to very dense uniform fine sand and then followed by 43 feet of sandy silt to silty sand. The above sequence of subsoil is underlain by shale bedrock. The groundwater was observed to be at elevation 374±, corresponding to the water level in the Rouge River.

<u>Area 6</u>: The predominant subsoil at this site is a 35 foot thick deposit of clayey silt. This cohesive deposit is overlain by an 8 foot thick stratum of compact [illegible] by a stratum of very dense silty sand which was found to be at least 23 feet thick. The clayey silt is grey and has a low plasticity. Within the cohesive deposit there are seams and thin layers of sand and silt. The groundwater was observed to be at elevation 416±.

Area 7: Subsoil at this site consists of 36 feet of compact to very dense silty fine sand with occasional seams of clay, followed by a stratum at least 25 feet thick of hard clayey silt of intermediate plasticity. The groundwater was observed to be at elevation 433±.

Area 8: Subsoil here consists of two sheets of glacial till. The upper sheet is about 48 feet thick and has a non-cohesive matrix. The lower sheet was investigated to a depth of 81 feet below ground surface and has a cohesive matrix with a low plasticity. The non-cohesive glacial till has a relative density of very dense, whereas the consistency of the cohesive glacial till is hard, generally increasing with depth. Within both glacial till sheets there are occasional seams and pockets of sand. The groundwater was observed to be at elevation 496±.

Area 9: Subsoil here consists of 7 feet of silt with clay followed by a stratum of glacial till which was investigated to a depth of 46 feet below ground surface. The glacial till has a non-cohesive to slightly cohesive matrix and has a very dense relative density. The groundwater was observed to be at elevation 510±.

Area 9A: Subsoil at this site consists of 7 feet of compact silty sand followed by 26 feet of generally hard clayey silt with a low plasticity. The cohesive deposit is underlain by a 15 foot thick stratum of very dense silt with trace of clay which in turn is followed by a stratum of very dense silty sand with seams of clay. The groundwater was observed to be at elevation 520±.

Area 9B: The major subsoil type is a non-cohesive glacial till which is composed of a heterogeneous mixture of sand, silt, gravel and clay. The glacial till is overlain by 3 to 8 feet of sands and silts.

Area 9C: The site is underlain by a stratum of glacial till which was investigated to a depth of 46 feet below ground surface. The glacial till is composed of a heterogeneous mixture of sand, silt, some clay and gravel. Within this deposit there are occasional layers and seams of sand. The relative density of the overall stratum varies from compact to very dense with depth, being very dense below a depth of 25 feet below ground surface.

Area 10: The subsurface condition is rather complex at this site. From ground surface downward, subsoil consists of 9 feet of hard clayey silt, followed by 12 feet of very dense silty sand to sandy silt, which in turn is followed by 10 feet of very dense glacial till composed of a heterogeneous mixture of sand, silt, some gravel and clay. The glacial till is underlain by 16 feet of fine to medium sand and then another stratum of hard cohesive glacial till. The deposit of fine to medium sand sandwiched between the two glacial till sheets is under subartesian pressure, with a head stabilized below ground surface at around elevation 571±.

Area 11: The site is underlain by a stratum of glacial till which was investigated to a depth of 45 feet below ground surface. The glacial till is composed of a heterogeneous mixture of clayey silt, sand and gravel. The glacial till has a cohesive matrix with a low plasticity and a hard consistency. Because of the low permeability of the subsoil, the groundwater level did not stabilize during the course of investigation.

DISCUSSIONS AND RECOMMENDATIONS

The proposed alignment and profile of E.M.F., together with the proposed structure locations, are shown on Drawing 256900-A and 256900-B. In general, the subsurface conditions along the route are favourable from a soil mechanics point of view, except certain cut sections contemplated in the sand and gravel areas where groundwater problems may be anticipated. In most cases, the structures can be supported by spread footings placed within the undisturbed overburden, except a few locations where it may be more advantageous to perch the abutments within the very high approach fills on end-bearing piles. Our recommendations for the structure foundations and the related earthworks at the various sites are summarized on the following pages.

The various comments outlined in this report are for feasibility study purposes based on very limited information. It will be necessary to carry out detailed subsurface investigations at each structure location when the design details and geometries are finalized. In some areas groundwater studies, together with pumping tests, may also be necessary.

B. Ly

B. Ly, P. Eng.
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
B-L. LY
PROVINCE OF ONTARIO

M. Devata

M. Devata, P. Eng.
Supervising Engineer

January, 1979

APPENDIX

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 1 LOCATION Hwy. 401 & EMF

ORIGINAL GROUND ELEV. 433±

SUBSURFACE CONDITIONS	RECOMMENDATIONS: STRUCTURE	RECOMMENDATIONS: APPROACHES	REMARKS
Reference Boreholes BH1 0'-13' very dense sand and gravel 13'-27' very dense glacial till 27'-43' very dense silt to sandy silt 43'-51' hard silty clay Groundwater Elev. 424±	Spread footings placed within the undisturbed sand and gravel stratum with an allowable bearing pressure up to 3 tsf.	Fill heights up to 30 feet will be stable with forward and side slopes of 2:1.	Cut sections in granular soil below the groundwater level will require extensive temporary and permanent dewatering schemes and slope treatments. Further, if cuts are contemplated, a detailed hydrogeological study should be carried out to evaluate the effects of such cuts on the groundwater. In view of the above, a structure to carry EMF over Hwy. 401 is preferred.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 2 LOCATION EMF and CPR Spur (near Sheppard Ave.)

ORIGINAL GROUND ELEV. 451±

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
Reference Boreholes BH2 0'-9' random landfill 9'-13' loose sand 13'-96' hard glacial till Groundwater Elev. 445±	Spread footings placed within the glacial till stratum with an allowable bearing pressure of 3 tsf.	The proposed cuts can be either retained by retaining walls founded in the till or constructed with 2:1 slopes.	The proposed subway crossing will be acceptable, however, some slope treatments consisting of filter or granular blankets, together with permanent subdrain systems will be required.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA LOCATION Depressed Section of EMF Between Area 3A and Area 4

ORIGINAL GROUND ELEV.

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
<u>Reference Boreholes</u> hard glacial till <u>Groundwater</u>	N/A	Cuts up to 30 feet deep can be constructed with 2:1 slopes. Cuts of 30 feet and up to 40 feet deep should be provided with a half height 10 foot wide bench incorporating an intercepting ditch.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 3 LOCATION EMF and CPR Spur (north crossing)

ORIGINAL GROUND ELEV. 475$\pm$

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH3 0'-86' hard glacial till Groundwater Elev. 463$\pm$	Spread footings placed within the hard glacial till stratum with an allowable load of 3 tsf.	Cuts up to 30 feet deep can be constructed with 2:1 slopes. Cuts of 30 feet and up to 40 feet deep, however, should be provided with a half height 10 foot wide bench incorporating an intercepting ditch.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 3A LOCATION EMF and Tributary of Rouge River

ORIGINAL GROUND ELEV. 444±

SUBSURFACE CONDITIONS	RECOMMENDATIONS: STRUCTURE	RECOMMENDATIONS: APPROACHES	REMARKS
Reference Boreholes BH 3A 0'-25' dense to very dense silty fine sand to medium sand 25'-38' very dense glacial till 38'-43' very dense silty fine sand 43'-55' hard silty clay 55'-70' very dense silty sand Groundwater Elev. 426±	Piers can be supported on spread footings placed within the undisturbed sandy stratum with an allowable pressure of 3 tsf. The abutments can be supported on spread footings either placed within the undisturbed overburden as mentioned earlier or perched within the approach fills on a compacted granular 'A' pad with an allowable pressure of 2.5 tsf.	Fill heights up to 35 feet will be stable with forward and side slopes of 2:1.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 4 LOCATION EMF and Finch Ave. E.

ORIGINAL GROUND ELEV. 472±

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
Reference Boreholes BH4 0'-17' very stiff to hard silty clay 17'-51' hard glacial till Groundwater Elev. 457±	Spread footings placed within the glacial till stratum with an allowable pressure of 3 tsf.	Cuts up to 25 feet deep can be constructed with 2:1 slopes.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 5 LOCATION Crossing of Relocated Finch Ave. E. & Rouge River

ORIGINAL GROUND ELEV. 379±

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH5 0'-4' sand and gravel 4'-18' compact to very dense uniform fine sand 18'-62' silty sand to sandy silt probable shale bedrock at 62 feet Groundwater Elev. 374±	The piers and the west abutment which will be perched in the fills, should be supported on steel 'H' piles driven to bedrock. The east abutment can be supported on spread footings placed within the overburden with an allowable pressure of 3 tsf. The footings, however, should be kept at least 50 feet from the cliff.	Fills up to 30 feet in height will be stable with forward and side slopes of 2:1. Fills of 30 feet and up to 40 feet in height should be constructed with 2:1 slopes and a 20 foot wide mid-height berm in both longitudinal and transversal directions.	The proposed high level profile grade will require a very long structure and very high fills, therefore, it is not preferred. The alternative low profile scheme should be adopted for this crossing.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 6 LOCATION EMF Crossing of Rouge River

ORIGINAL GROUND ELEV. 422±

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH6 0'-8' compact sand and gravel 8'-43' hard clayey silt 43'-66' very dense silty sand Groundwater Elev. 416±	The footing elements should be supported on end-bearing steel H piles. Estimated tip elevations around 381 feet.	Recommendations for the fills will be similar to those for fills in Area 5.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 7 LOCATION EMF Crossing of Relocated Finch Ave. E.

ORIGINAL GROUND ELEV. 453±

SUBSURFACE CONDITIONS	RECOMMENDATIONS STRUCTURE	RECOMMENDATIONS APPROACHES	REMARKS
Reference Boreholes BH7 0'-36' compact to very dense silty fine sand 36'-62' hard clayey silt Groundwater Elev. 433±	Spread footings placed within the sand stratum with an allowable pressure of 3 tsf.	The proposed cuts and fills will be stable if constructed with 2:1 slopes.	This crossing is preferred to the crossing at Rouge River.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 8 LOCATION CPR Subway at EMF

ORIGINAL GROUND ELEV. 506+

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH8 0'-48' very dense glacial till 48'-81' hard glacial till Groundwater Elev. 496±	Spread footings placed within the very dense glacial till stratum with an allowable pressure of 3 tsf.	Cuts up to 25 feet deep can be constructed with 2:1 slopes.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 9 LOCATION CNR Subway at EMF

ORIGINAL GROUND ELEV. 523±

SUBSURFACE CONDITIONS	RECOMMENDATIONS: STRUCTURE	RECOMMENDATIONS: APPROACHES	REMARKS
Reference Boreholes BH9 0'-7' silt to silt with clay 7'-46' very dense glacial till Groundwater Elev. 510±	Spread footings placed within the very dense glacial till with an allowable pressure of 3 tsf.	Cuts up to 25 feet deep can be constructed with 2:1 slopes.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 9A LOCATION EMF Crossing Steeles Ave.

ORIGINAL GROUND ELEV. 534±

SUBSURFACE CONDITIONS	RECOMMENDATIONS – STRUCTURE	RECOMMENDATIONS – APPROACHES	REMARKS
Reference Boreholes 0'-7' compact silty sand 7'-33' silt some clay to clayey silt very stiff to hard 33'-48' very dense silt 48'-52' very dense silty sand **Groundwater** Elev. 520±	Spread footings placed within the clayey silt stratum with an allowable pressure of 3 tsf.	The proposed cuts can be constructed with 2:1 slopes but should be protected with filter or granular blankets.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 9B LOCATION Existing CNR Subway at Steeles Ave.

ORIGINAL GROUND ELEV. 506±

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH 9B1, 9B2, 9B3 3 to 8 feet of silt and sand overlying very dense glacial till Groundwater not established	Existing structure supported by spread fooitngs.		Structure is in a good condition.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 9C LOCATION EMF Over Tributary of Little Rouge River

ORIGINAL GROUND ELEV. 496+

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
Reference Boreholes BH 9C 0'-46' very dense glacial till Groundwater Not established	Structure can be a CSP or a single span CRF supported by spread footings placed within the glacial till with an allowable pressure of 3 tsf.	The proposed 10 foot fills will be stable with 2:1 slopes.	

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 10 LOCATION CPR Overhead at EMF

ORIGINAL GROUND ELEV. 589±

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
Reference Boreholes BH 10 0'-9' hard clayey silt to silt, some clay 9'-21' very dense sandy silt to silty sand 21'-31' very dense glacial till 31'-47' fine to medium sand under subartesian conditions 47'-52' hard glacial till Groundwater Elev. 571±	The abutments could be composed of reinforced earth or perched within the fills on end-bearing steel H piles. Estimated tip elevations around 567 feet.	Fill heights up to 35 feet will be stable with forward and side slopes of 2:1.	Because of a water bearing sandy stratum and a sand stratum under subartesian conditions, it is preferable to have EMF go over the existing CPR.

FOUNDATION DATA SHEET

W.P. 25-69-00 AREA 11 LOCATION EMF and Hwy. 407

ORIGINAL GROUND ELEV. 633

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
Reference Boreholes BH 11 0'-46' hard glacial till Groundwater Borehole was dry	Spread footings placed within the glacial till stratum with an allowable pressure of 3 tsf.	The proposed cuts and fills will be stable with 2:1 slopes.	

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 25-69-00 LOCATION Coords. N 15,914,615, E 1,083,280 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.J.

DATUM Geodetic DATE 78 08 08 CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
433.1	Ground Surface									
0.0	Sand and Gravel Very Dense Brown,					430				
		1	SS	44			50/7"			49 45 (67)
		2	SS	63	▼					
420.1						420				
13.0	Glacial Till, Sandy Silt to Silty Sand With Trace of Clay and Gravel, Very Dense	3	SS	43				(N.P.)		5 44 41 10
		4	SS	120		410				
	Changing to Hard With Slight Plasticity	5	SS	60/ 5"						
406.1										
27.0	Silt to Sandy Silt With Occasional Sand Seams, Grey Very Dense	6	SS	87		400				
		7	SS	60/ 3"						0 11 (89)
		8	SS	60/ 5"						
390.1						390				
43.0	Silty Clay, Grey Trace of Fine Gravel Hard	9	SS	50/ 4"						
381.6		10	SS	104						
51.5	End of Borehole									

Dynamic cone penetration resistance plot scale: 20 40 60 80 100

SHEAR STRENGTH: o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT W_p — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

+3, ×5 : Numbers refer to Sensitivity

15 ⌖ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 25-69-00 LOCATION Coords. N 15 916 870; E 1 081 950 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 08 CHECKED BY [signature]

ELEV DEPTH	DESCRIPTION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
450.8	Ground Surface					
0.0	Fill, Silty Fine Sand, Black, Some Debris and Organics				450	
442.3						
8.5 / 437.8	Sand, Well Graded Loose	1	SS	9	440	9 64 (27)
13.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Sand and Some Gravel Grey, Very Stiff to Hard With Occasional Sand Layers	2	SS	19		9 40 38 13
		3	SS	35	430	
		4	SS	41		9 36 40 15
		5	SS	34	420	
		6	SS	34		
		7	SS	64	410	
		8	SS	51		
		9	SS	63	400	2 39 40 19
		10	SS	55	390	
		11	SS	51	380	
					370	
		12	SS	96		
	Sand				360	
354.3		13	SS	100/10"		
96.5	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30
UNIT WEIGHT γ

$+^3$, $\times^5$: Numbers refer to Sensitivity 15 ◇ 5 (%) STRAIN AT FAILURE 20

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3

W P 25-69-00 | LOCATION Coords. N 15 918 770; E 1 080 510 | ORIGINATED BY J.J.
DIST 6 HWY EMF | BOREHOLE TYPE Hollow Stem Auger and Cone Test | COMPILED BY J.J.
DATUM Geodetic | DATE 78 08 09, 78 09 10 | CHECKED BY [signature]

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
474.8	Ground Surface
0.0	Glacial Till; Sand; Brown / Grey; Heterogeneous Mixture of Clayey Silt, Sand and Some Gravel Very Stiff to Generally Hard
388.3 / 86.5	End of Borehole

SAMPLES

NUMBER	TYPE	'N' VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	21	
2	SS	20	7 37 41 15
3	SS	24	
4	SS	30	
5	SS	38	
6	SS	60	
7	SS	75	
8	SS	80	
9	SS	91	
10	SS	50	4 16 52 28
11	SS	58	
12	SS	51	
13	SS	62	7 40 (53)
14	SS	47	
15	SS	65/4"	
16	SS	35/1"	

GROUND WATER CONDITIONS: water level at approx. elev. 462

ELEVATION SCALE: 470, 460, 450, 440, 430, 420, 410, 400, 390

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: O UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ

$+^3$, $\times^5$: Numbers refer to 20 15 ... (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

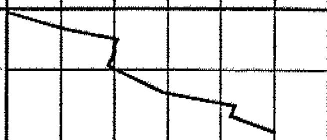
RECORD OF BOREHOLE No 3A

W P 25-69-00 LOCATION Coords. N 15 919 380; E 1 080 130 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.J.

DATUM Geodetic DATE 78 08 09 CHECKED BY [illegible]

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)



SHEAR STRENGTH: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE

PLASTIC LIMIT W_p, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
444.3	Ground Surface								
0.0	Silty Fine Sand to Medium Sand, Dense to Very Dense, Brown	1	SS	33		440			
	Grey	2	SS	57					3 54 33 10
	With Occasional Seams of Clay	3	SS	108		430			
		4	SS	91/ 10"	▼				
419.3 / 25.0	Glacial Till, Heterogeneous Mixture of Sand, Silt, Some Gravel and Trace of Clay, Very Dense	5	SS	134		420			17 64 (19)
		6	SS	62/ 6"					
		7	SS	92		410	N.P.		
406.3 / 38.0	Silty Fine Sand, Very Dense	8	SS	108					0 56 (44)
401.3 / 43.0	Silty Clay, Grey, Hard	9	SS	70/ 5"		400			
		10	SS	87					
389.3 / 55.0	Silty Sand With Seams of Silt and Clay, Very Dense	11	SS	100/ 6"		390			1 65 19 15
						380			
373.8 / 70.5	End of Borehole	12	SS	100/ 5"					

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 -○- 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

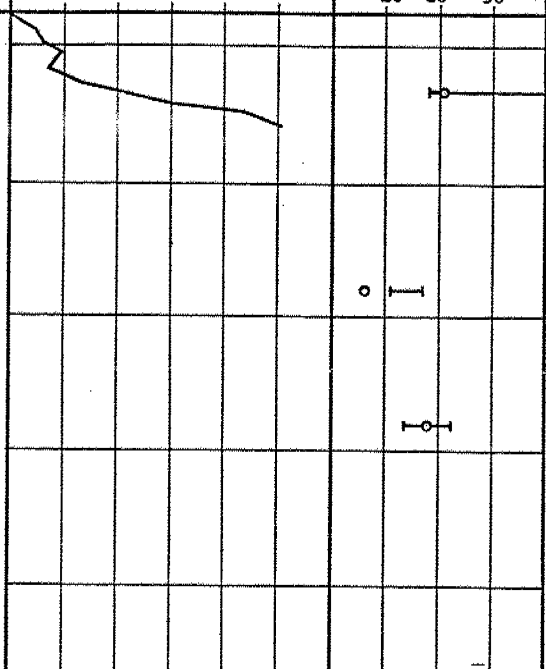
HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W P 25-69-00 LOCATION Coords. N 15 923 190; E 1 078 860 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger and Cone Test COMPILED BY J.J.
DATUM Geodetic DATE 78 08 10 CHECKED BY

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
472.2	Ground Surface						
0.0	Silty Clay, Brownish Grey, Very Stiff to Hard					470	
		1	SS	30			
		2	SS	24		460	
	Grey and Stiff	3	SS	7	▽		
455.2 / 17.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Sand and Gravel With Occasional Boulders and Silt Seams	4	SS	43		450	
		5	SS	98			9 40 (51)
	Hard	6	SS	83		440	
		7	SS	75/5"			
		8	SS	92/6"		430	
		9	SS	94/6"			
421.2		10	SS	132			
51.0	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30
UNIT WEIGHT γ



$+^3, \times^5$: Numbers refer to Sensitivity   15 ◇ 5 (%) STRAIN AT FAILURE (20 / 10)

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W P 25-69-00 LOCATION Coords. N 15 923 760; E 1 080 100 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.

DATUM Geodetic DATE 78 08 10 CHECKED BY [illegible]

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
378.6	Ground Surface							
0.0	Sand and Gravel							
375.1	Very Dense	1	SS	50				
3.5	Uniform Fine Sand Some Silt, Grey Compact to Very Dense	2	SS	58	▽			
		3	SS	40		370		
		4	SS	22				
	With Occasional Clay	5	SS	36			o	
360.6	Seams					360		
18.0	Silty Sand to Sandy Silt With Occasional Boulders	6	SS	55				
		7	SS	0				0 78 (22)
						350		
		8	SS	0				
		9	SS	9				0 39 (61)
						340		
		10	SS	0				
		11	SS	11				
	Trace of Clay					330		
		12	SS	10				
		13	SS	18				0 51 (49)
						320		
317.1	Probable Shale Bedrock	14	SS	102/2"				
61.5	End of Borehole Note: Auger Refusal at 61.5 feet							

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L; UNIT WEIGHT γ

$+^3$, $\times^5$: Numbers refer to Sensitivity $15 \diamond 5$ (20) (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 6

W P 25-69-00 LOCATION Coords. N 15 924 420; E 1 078 760 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.

DATUM Geodetic DATE 78 08 11 CHECKED BY D.S.

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
422.5	Ground Surface						
0.0	Sand and Gravel Compact					420	
		1	SS	20			
414.5					▽		52 42 (6)
8.0	Seams of Sand	2	SS	80			
	Clayey Silt, Grey Hard					410	
		3	SS	41			
		4	SS	30			
						400	
		5	SS	25			
	Trace of Gravel	6	SS	53			
						390	
	With Thin Layers of Brown Sand and Silt	7	SS	82/6"			
		8	SS	132			
379.5						380	
43.0	Silty Sand, Brown Very Dense	9	SS	74/6"			0 58 (42)
		10	SS	44			
						370	
		11	SS	134/11"			
						360	
356.5	Seams of Silt & Clay	12	SS	100/6"			
66.0	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE

PLASTIC LIMIT W_P — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ

$+^3, \times^5$: Numbers refer to Sensitivity   15 ◇ 5 (%) STRAIN AT FAILURE (20, 10)

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

W P 25-69-00 LOCATION Coords. N 15 925 280; E 1 078 200 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Solid Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 11 CHECKED BY [illegible]

ELEV DEPTH	DESCRIPTION (SOIL PROFILE)	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
452.5	Ground Surface						
0.0		1	SS	27		450	
	Some Gravel	2	SS	22			32 51 (17)
	Silty Fine Sand Brown, Compact to Very Dense With Occasional Clay Seams	3	SS	37			0 80 (20)
		4	SS	51			0 87 (13)
						440	
		5	SS	100/ 10"			
		6	SS	100/ 10"	▼		
						430	
		7	SS	116			0 80 (20)
		8	SS	126/ 5"			
						420	
416.5 / 36.0	Clayey Silt Grey and Hard	9	SS	150/ 6"			
		10	SS	67/ 6"			
						410	
		11	SS	94			0 9 55 36
		12	SS	75			
						400	
391.0 / 61.5	End of Borehole						

Chart headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ; STRAT PLOT

+3, ×5 : Numbers refer to Sensitivity   15 -◇- 5 (20 above, 10 below) (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 8

W P 25-69-00 LOCATION Coords. N 15 926 140; E 1 077 940 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 14 CHECKED BY

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
505.5	Ground Surface							
0.0	Glacial Till. Heterogeneous Mixture of Sand, Silt, Some Clay and Gravel. Very Dense							
		1	SS	74		500		
		2	SS	49			o (N.P.)	9 39 37 15
		3	SS	85		490		
	Brown	4	SS	45				
	Grey	5	SS	92		480		
		6	SS	113			o (N.P.)	15 41 34 10
	Occasional Fine Sand Seams	7	SS	154		470		5 39 (56)
		8	SS	100/5"	▼			
457.5		9	SS	35		460		
48.0	Glacial Till. Heterogeneous Mixture of Clayey Silt, Sand and Some Gravel, Grey. Hard	10	SS	59				
		11	SS	62		450		
		12	SS	83				1 22 49 28
		13	SS	117		440		
	Occasional Pockets of Sand	14	SS	96				
		15	SS	91		430		
424.5		16	SS	93				
81.0	End of Borehole							

Column headings also printed: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; PLASTIC LIMIT W_p, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ

OFFICE REPORT ON SOIL EXPLORATION

$+^3, \times^5$: Numbers refer to Sensitivity   15 -◇- 5 (%) STRAIN AT FAILURE (20 above, 10 below)

RECORD OF BOREHOLE No 9

W P 25-69-00 LOCATION Coords. N 15 931 210; E 1 076 930 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Solid Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 15 CHECKED BY [illegible]

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT Wp, NATURAL MOISTURE CONTENT W, LIQUID LIMIT WL / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
522.7	Ground Surface										
0.0	Silt to Silt With Clay, Brown Very Stiff		1	SS	11		520				
515.7			2	SS	12						
7.0	Glacial Till		3	SS	97				o (N.P.)		6 43 37 14
	Heterogeneous Mixture of Sand, Silt, Some Clay and Gravel Non-Plastic to Slightly Plastic Grey		4	SS	50/3"	▼	510				
			5	SS	50/3"				o ⊢		
			6	SS	100/9"		500				
	Very Dense		7	SS	60/3"				o (N.P.)		8 54 28 10
			8	SS	50/2"		490				
			9	SS	25/2"						
			10	SS	50/4"		480				
476.2			11	SS	50/2"				o⊣		
46.5	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

$+^3, \times^5$: Numbers refer to Sensitivity $15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9A

W P 25-69-00 LOCATION Coords. N 15 931 880; E 1 076 670 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Solid Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 15 CHECKED BY

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
533.9	Ground Surface						
0.0	Silty Sand With Gravel, Grey Compact	1	SS	26		530	8 53 30 9
526.9		2	SS	15			
7.0	Silt, Some Clay to Clayey Silt, Trace of Sand	3	SS	60			
		4	SS	54	▼	520	
	Some Sand	5	SS	61			3 28 (69)
	Very Stiff to Hard	6	SS	50/3"		510	
		7	SS	71			0 8 (92)
500.9		8	SS	100/2"			
33.0	Silt, Trace of Clay Grey, Very Dense	9	SS	108/6"		500	
		10	SS	60/5"		490	
485.9		11	SS	50/4"			
48.0 / 482.4	Silty Sand, Some Clay Seams, Very Dense	12	SS	50/4"			3 50 (47)
51.5	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30
UNIT WEIGHT γ

+3, x5 : Numbers refer to ... 20 15 ◇ 5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9B1

W P 25-69-00 LOCATION Coords. N 15 931 850; E 1 075 920 ORIGINATED BY C.N.R.
DIST 6 HWY EMF BOREHOLE TYPE Soil Information From C.N.R. COMPILED BY J.J.
DATUM Geodetic DATE 64 10 20 CHECKED BY

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH o UNCONFINED + FIELD VANE • QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W_p NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L / WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
506.4	Ground Surface										
0.0	Sand and Silt Brown										
503.4 3.0	Sandy Silt Till Very Dense						500				
491.8 14.6	End of Borehole						490				

OFFICE REPORT ON SOIL EXPLORATION

$+^3, \times^5$: Numbers refer to Sensitivity $15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9B2

W.P. 25-69-90 LOCATION Coords. N 15 931 800; E 1 076 010 ORIGINATED BY C.N.R.
DIST 6 HWY EMF BOREHOLE TYPE Soils Information From C.N.R. COMPILED BY J.J.
DATUM Geodetic DATE 64 10 20 CHECKED BY [illegible]

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
509.0	Ground Surface										
0.0 / 505.0	Silt and Sand Brown										
4.0 / 501.0	Fine Sand With Gravel, Brown						500				
8.0 / 481.4	Sandy Silt Till Grey, Very Dense						490				
27.6	End of Borehole						480				

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \underset{10}{\overset{20}{\diamond}} 5$ (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9B3

W P 25-69-00 LOCATION Coords. N 15 931 760; E 1 076 110 ORIGINATED BY C.N.R.

DIST 6 HWY EMF BOREHOLE TYPE Soils Information From C.N.R. COMPILED BY J.J.

DATUM Geodetic DATE 64 10 20 CHECKED BY ol.(.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W_p NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
506.0	Ground Surface										
0.0	Silt and Sand, Some Fine Gravel, Grey-Brown										
499.0							500				
7.0	Sandy Silt Till Grey, Very Dense										
491.5											
14.5	End of Borehole						490				

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 9C

W P 25-69-00 LOCATION Coords. N 15 930 100; E 1 077 260 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 15 CHECKED BY [illegible]

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
496.9	Ground Surface								
0.0	Glacial Till Heterogeneous Mixture of Sand, Silt, Some Clay and Gravel Very Dense	1	SS	9		490	(N.P.)		15 42 (43)
		2	SS	39					
		3	SS	44		480			13 49 28 10
	Fine to Medium Sand	4	SS	46					
	Fine Sand	5	SS	73/6"		470			8 22 (70)
	Wet Sand Seam	6	SS	4					
		7	SS	90					
		8	SS	74/6"		460			9 31 44 16
		9	SS	110/6"					
450.9		10	SS	60/3"					
46.0	End of Borehole. Note: Groundwater Not Established								

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT W_p, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30

OFFICE REPORT ON SOIL EXPLORATION

$+^3$, x^5 : Numbers refer to Sensitivity   15 ◊ 5 (20, 10) (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 10

W P 25-69-00 LOCATION Coords. N 15 938 160; E 1 075 270 ORIGINATED BY J.J.
DIST 6 HWY EMF BOREHOLE TYPE Solid Stem Auger COMPILED BY J.J.
DATUM Geodetic DATE 78 08 16 CHECKED BY [signature]

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
588.9	Ground Surface							
0.0	Some Organics							
	Clayey Silt to Silt Some Clay, Hard With Occasional Fine Sand Seams	1	SS	31				
		2	SS	88				
579.9		3	SS	101/10"		580		
9.0	Sandy Silt to Silty Sand With Gravel, Grey, Very Dense	4	SS	64/6"				
		5	SS	50/2"	▼		(N.P.)	21 35 (44)
567.9						570		
21.0	Glacial Till Heterogeneous Mixture of Sand, Silt Gravel and Clay Grey, Very Dense	6	SS	50/2"				45 43 (12)
		7	SS	50/2"				
557.9						560		
31.0	Fine to Medium Sand Under Subartesian Pressure	8	SS	95/6"			(N.P.)	21 52 25 2
						550		
541.9								
47.0	Glacial Till Hard					540		
537.4		9	SS	100/4"				8 42 35 15
51.5	End of Borehole							

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; PLASTIC LIMIT W_p, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ

OFFICE REPORT ON SOIL EXPLORATION

+3, ×5 : Numbers refer to Sensitivity   15 ◇ 5 (%) STRAIN AT FAILURE (20)

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 11

W P 25-69-00 LOCATION Coords. N 15 943 790; E 1 074 350 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.J.

DATUM Geodetic DATE 78 08 16 CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
633.0	Ground Surface						
0.0	Glacial Till Heterogeneous Mixture of Clayey Silt, Sand and Gravel Hard				No W.L.	630	
		1	SS	30			
	Brown	2	SS	60/5"			
	Grey					620	
		3	SS	130			6 25 (69)
		4	SS	65/6"			
						610	
		5	SS	70/4"			9 35 (55)
		6	SS	108			
						600	
		7	SS	60/4"			
		8	SS	60/5"			18 37 (45)
						590	
587.5		9	SS	90/6"			
45.5	End of Borehole						

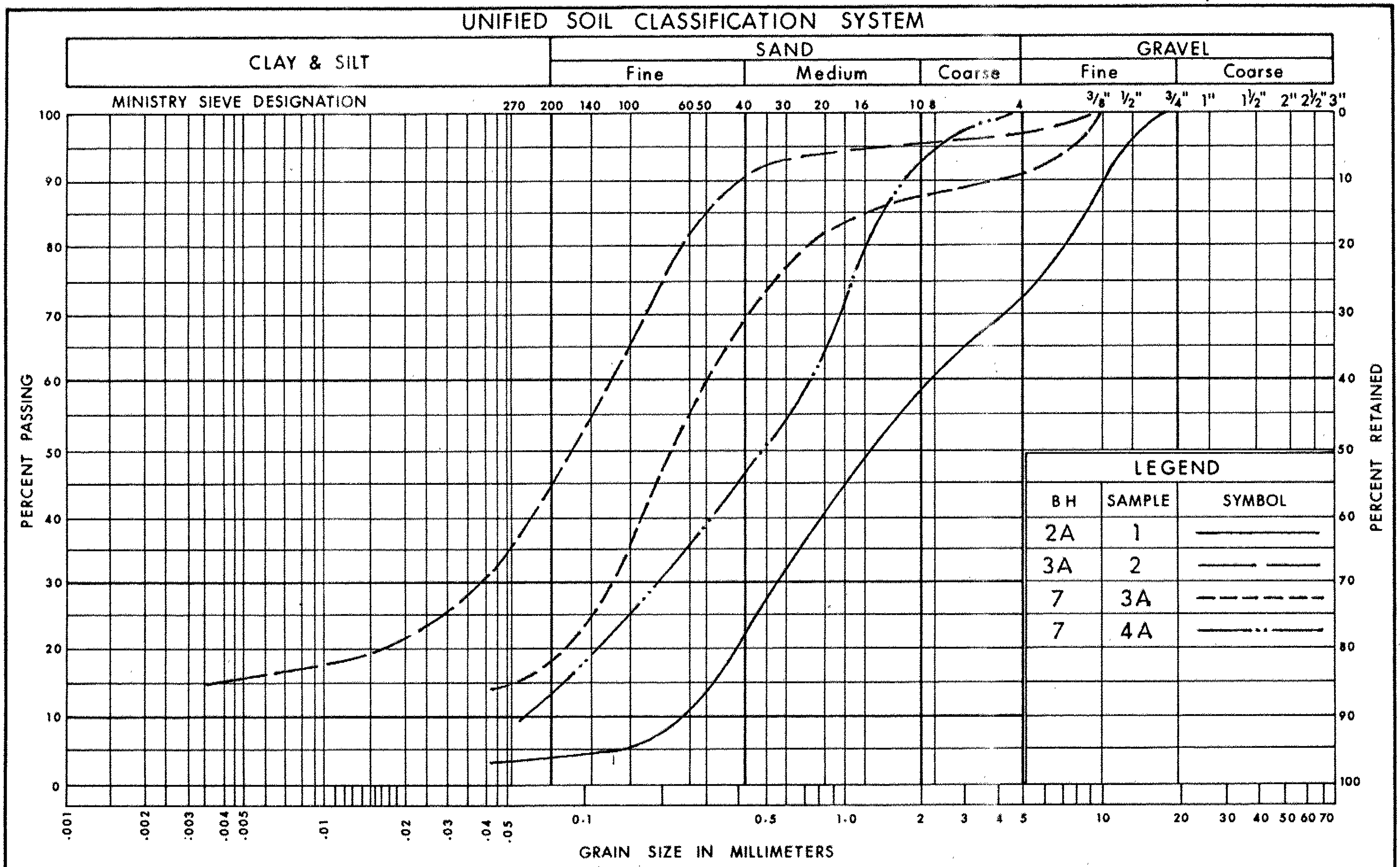
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT W_p NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L
WATER CONTENT (%) 10 20 30
UNIT WEIGHT γ

$+^3$, $\times^5$: Numbers refer to Sensitivity

15 ⌖ 5 (%) STRAIN AT FAILURE (20, 10)

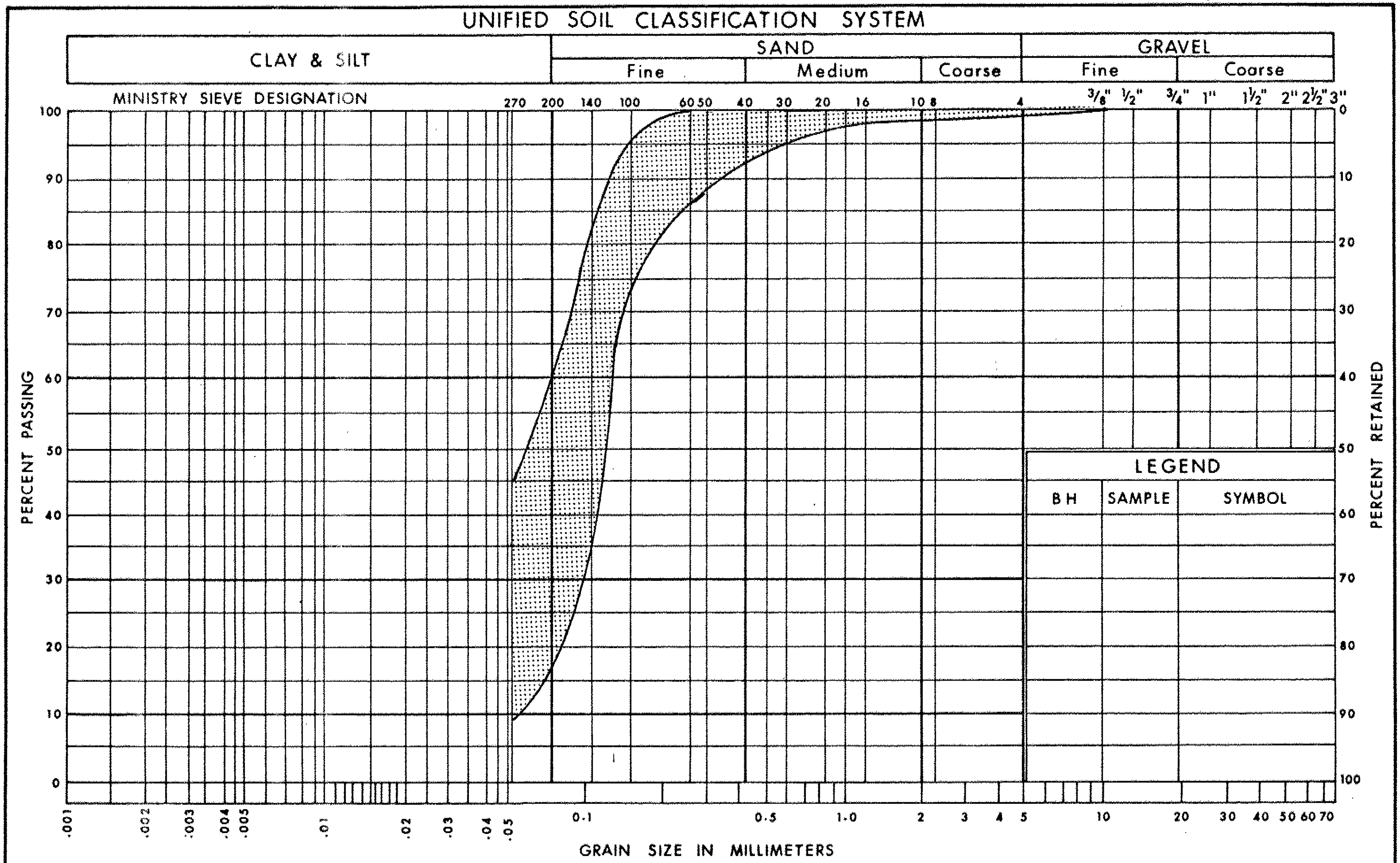
OFFICE REPORT ON SOIL EXPLORATION

Oct 75, FF-S-22



Ministry of Transportation and Communications Ontario ENGINEERING SERVICES BRANCH	GRAIN SIZE DISTRIBUTION SAND	FIG No 1 W P 25-69-00

Oct 75, FF-5-22



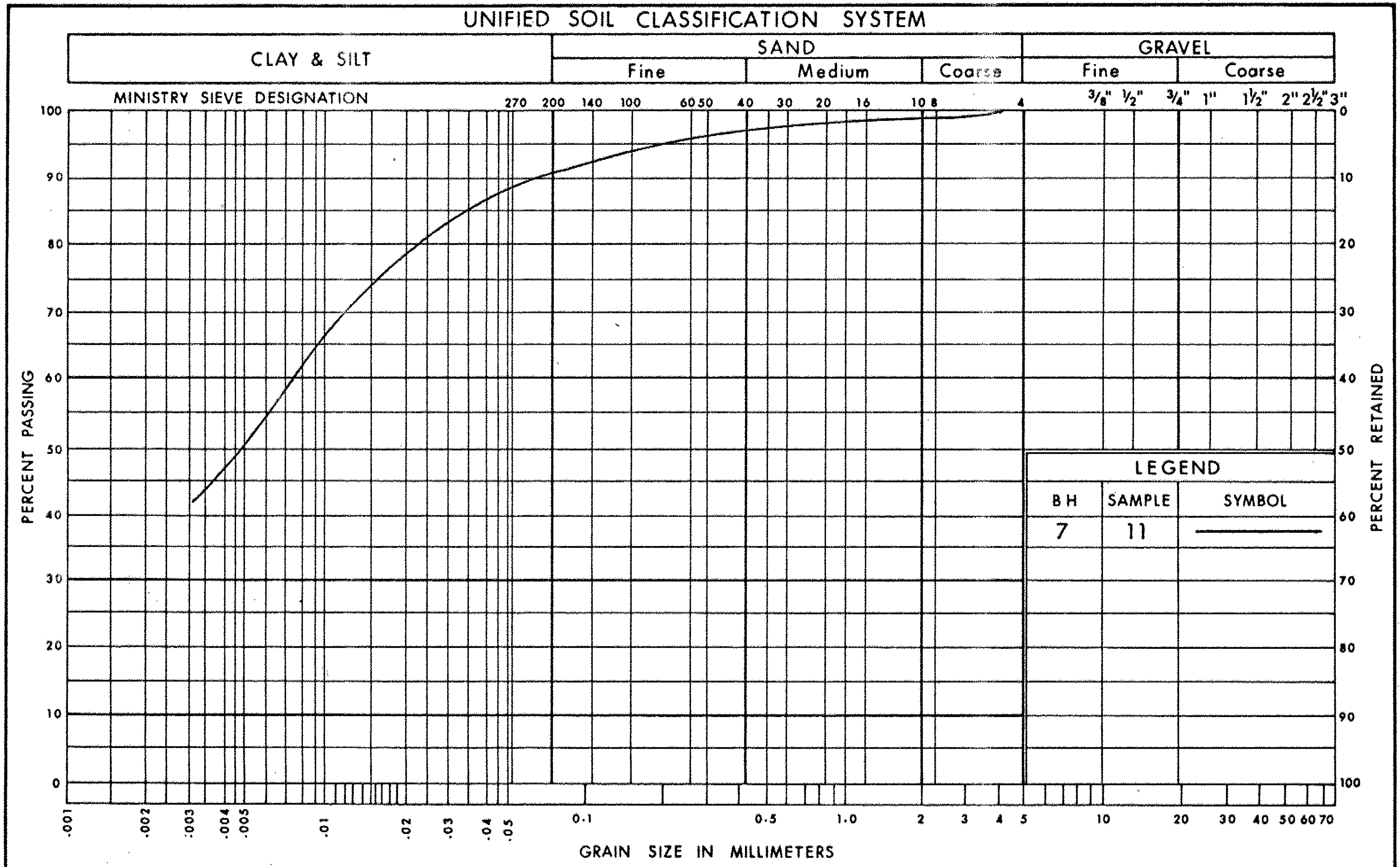
Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
SILTY FINE SAND

FIG No 2

W P 25-69-00

Oct 75, FF-S-22



Ministry of Transportation and Communications

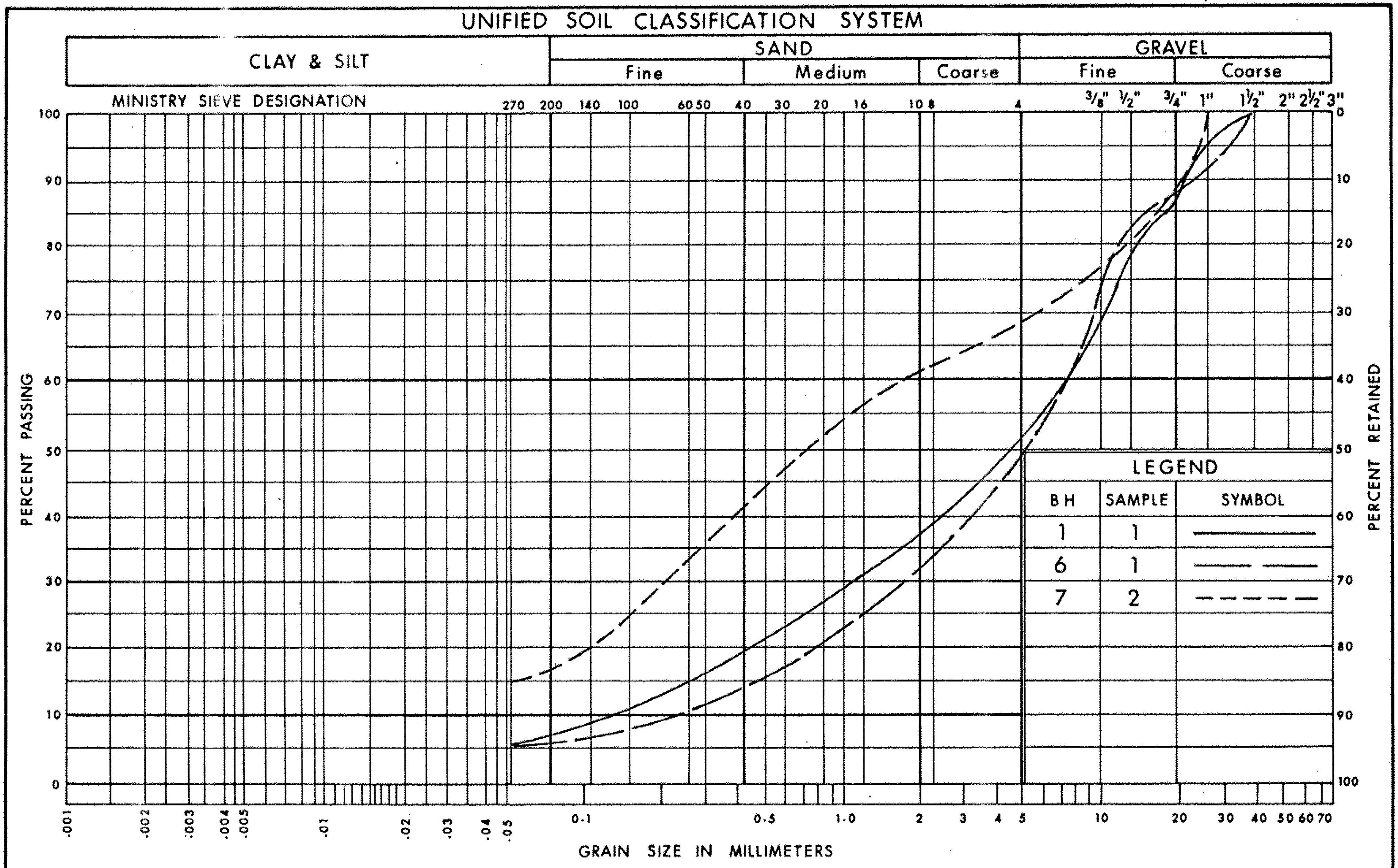
Ontario

ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
CLAYEY SILT

FIG No	3
W P	25-69-00

Oct 75, FF-S-22



Ministry of Transportation and Communications

Ontario

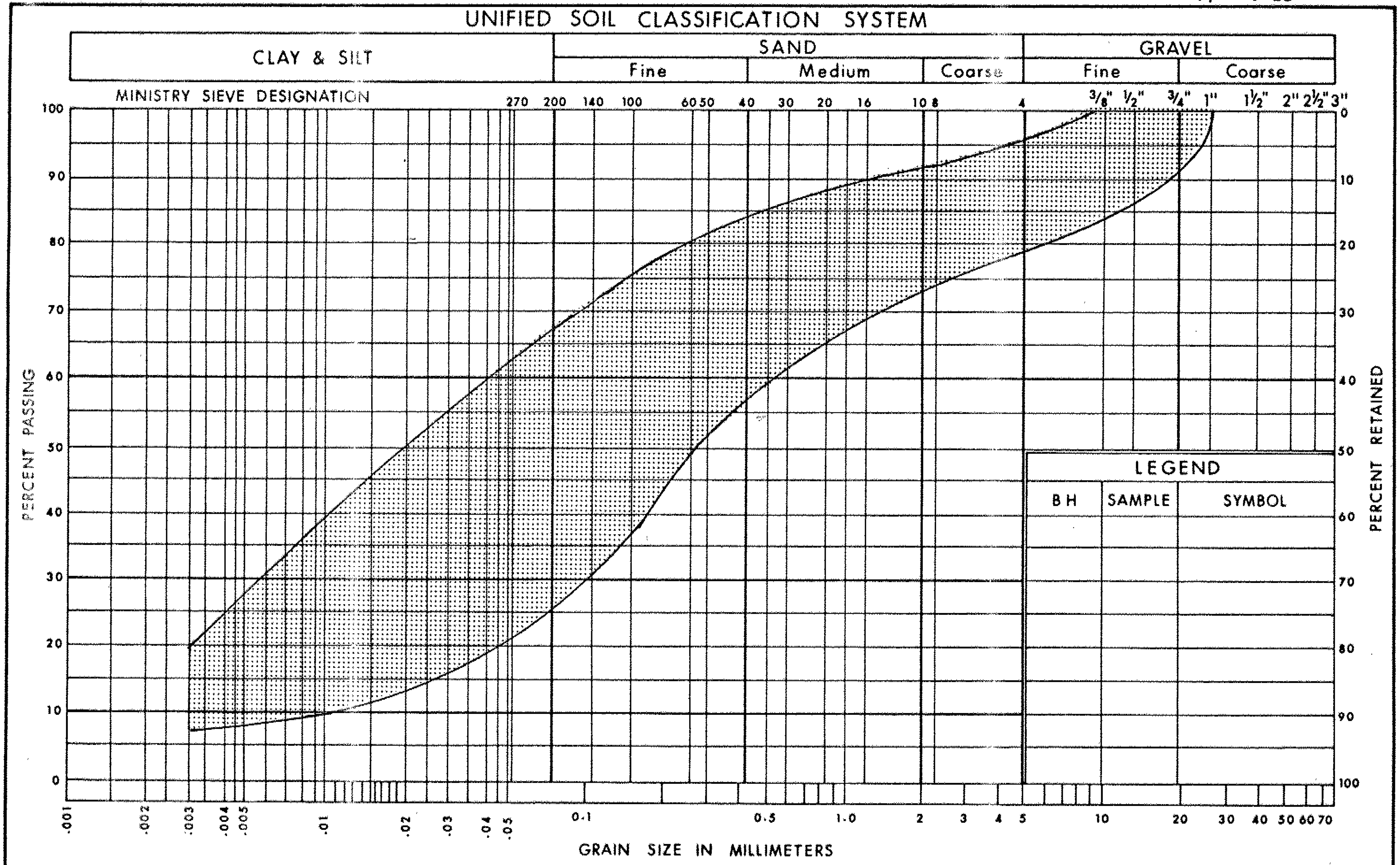
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
SAND & GRAVEL

FIG No 4

WP 25-69-00

Oct 75, FF-S-22



Ministry of Transportation and Communications

Ontario

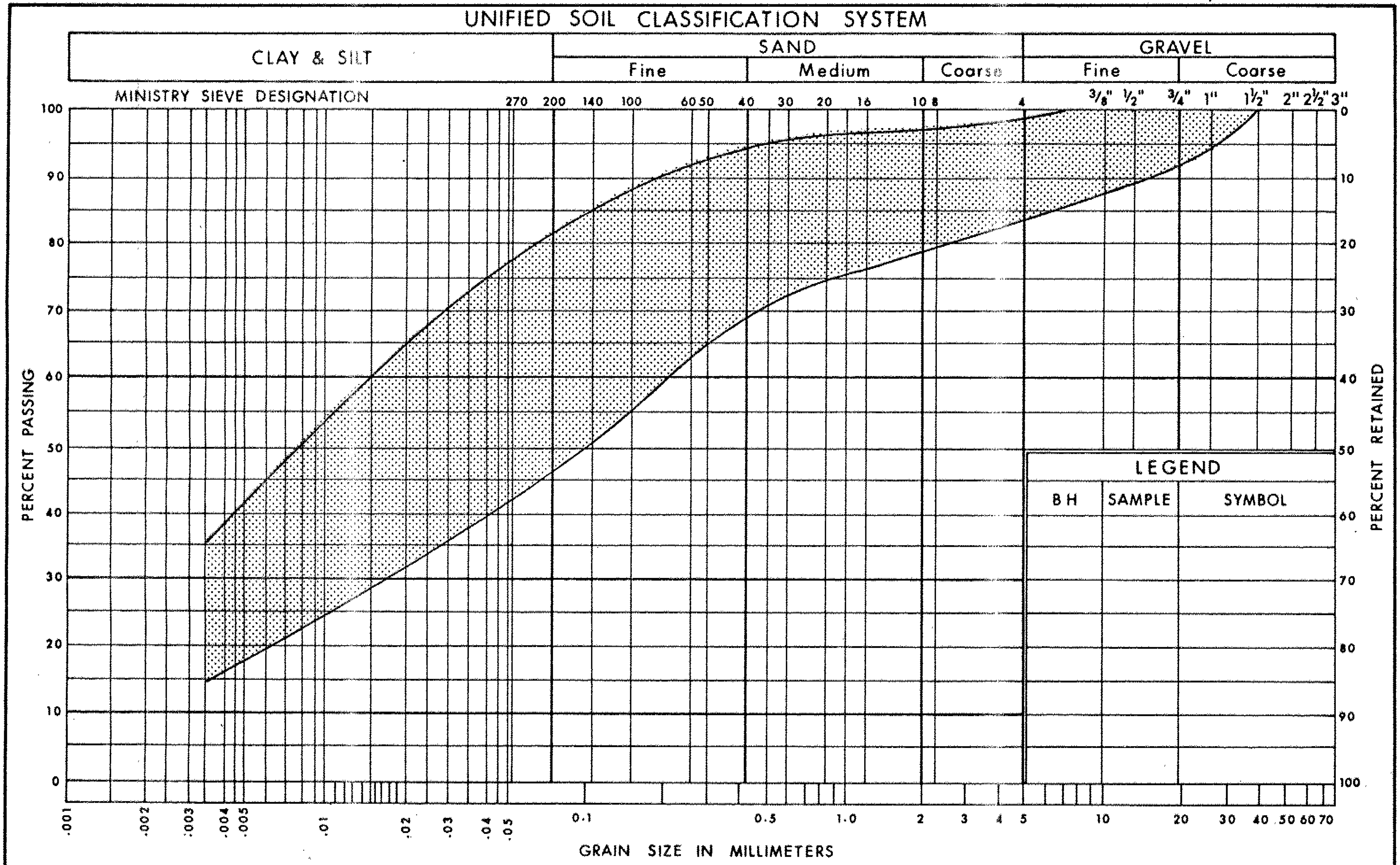
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIXTURE OF SAND SILT CLAY & GRAVEL

FIG No 5

W P 25-69-00

Oct 75, FF-S-22

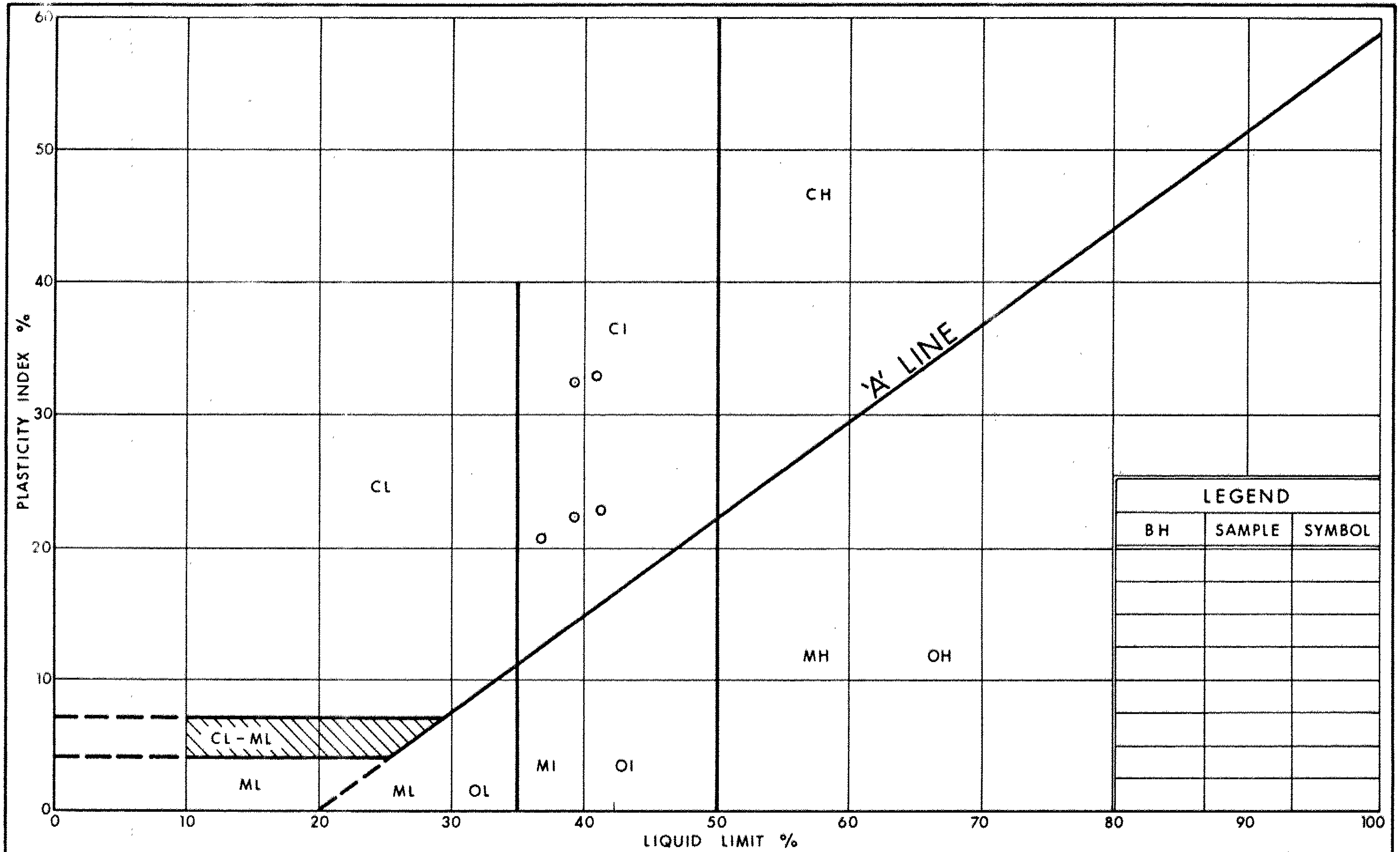


Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 6

W P 25-69-00

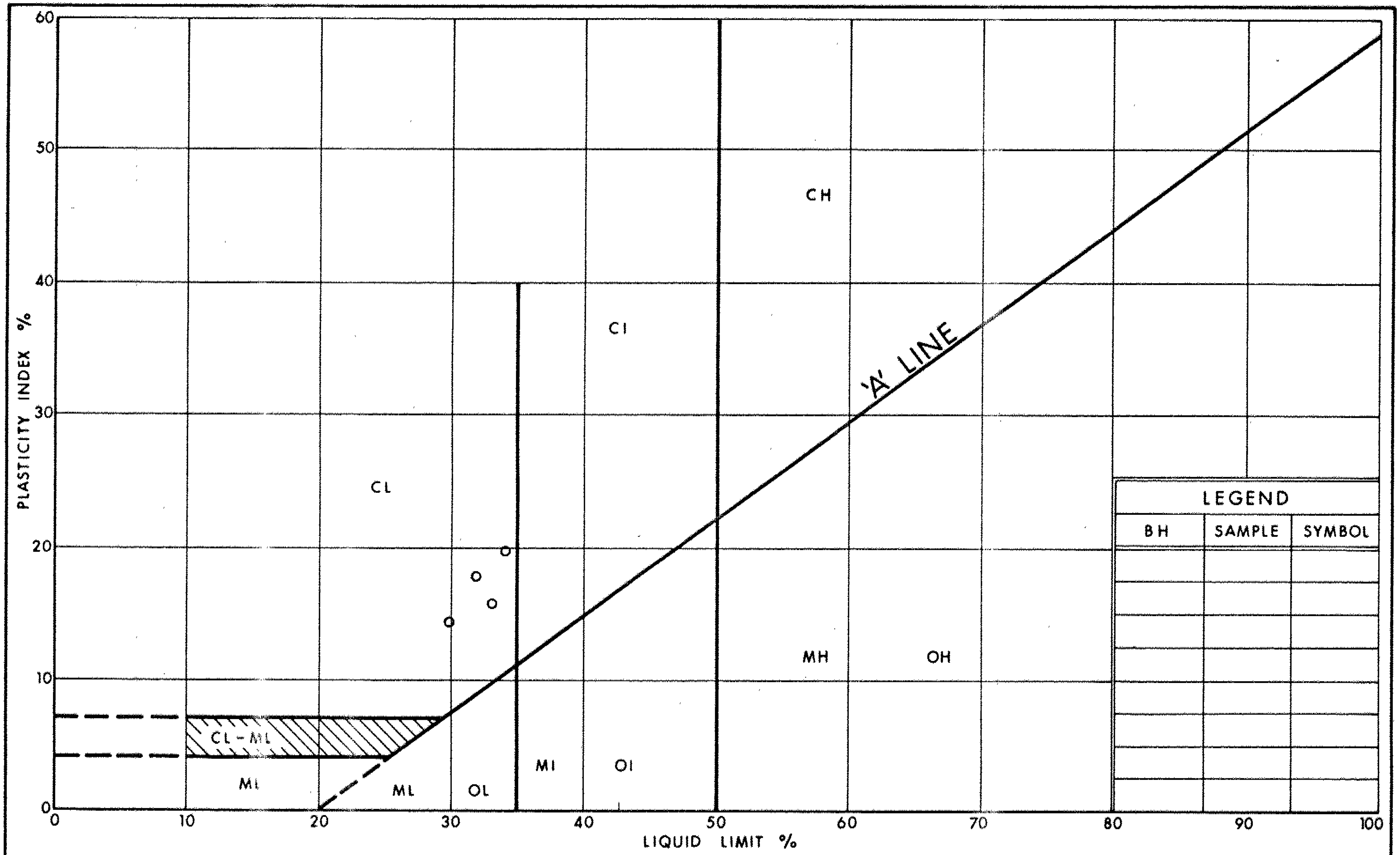


Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

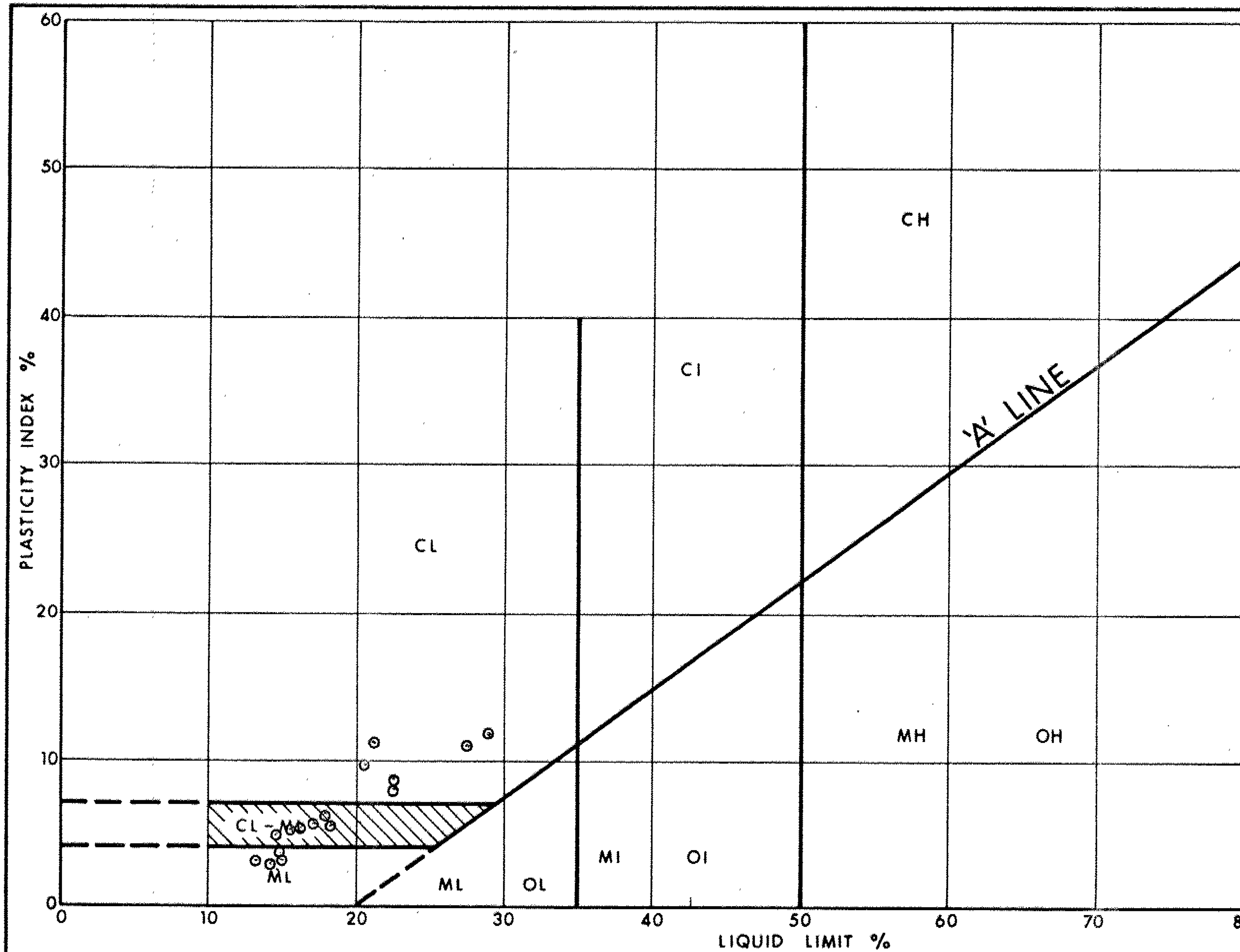
PLASTICITY CHART
SILTY CLAY
TRACE OF GRAVEL

FIG No 7
W P 25-69-00

Oct 75, FF-S-21



Ministry of Transportation and Communications Ontario ENGINEERING SERVICES BRANCH	PLASTICITY CHART CLEYEY SILT	FIG No 8 W P 25-69-00



LEGEND		
BH	SAMPLE	SYMBOL

Ministry of Transportation and Communications
Ontario
ENGINEERING SERVICES BRANCH

PLASTICITY CHART
CLACIAL TILL
HETEROGENEOUS MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 9
W P 25-69-00

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS $\overline{N}$.

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH AS FOLLOWS:

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF SPT 'N' VALUES AS FOLLOWS:

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCK QUALITY: ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER
THEY ARE CONSOLIDATED (C) OR NOT (U)
ISOTROPICALLY (I) OR NOT (A)
AND SHEARED DRAINED (D) OR UNDRAINED (U)
WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS)
EG. $\overline{CIU}$ = CONSOLIDATED ISOTROPIC UNDRAINED
TRIAXIAL WITH PORE PRESSURE MEASUREMENT
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS
ARE IN COMPRESSION

FIELD SAMPLING

S S	SPLIT SPOON
W S	WASH SAMPLE
S T	SLOTTED TUBE SAMPLE
B S	BLOCK SAMPLE
C S	CHUNK SAMPLE
T W	THINWALL OPEN
T P	THINWALL PISTON
O S	OSTERBERG SAMPLE
F S	FOIL SAMPLE
R C	ROCK CORE
P H	T.W. ADVANCED HYDRAULICALLY
P M	T.W. ADVANCED MANUALLY

EARTH PRESSURE TERMS

μ	COEFFICIENT OF FRICTION
δ	ANGLE OF WALL FRICTION
k_o	COEFFICIENT OF EARTH PRESSURE AT REST
k_A	COEFFICIENT OF ACTIVE EARTH PRESSURE
k_p	COEFFICIENT OF PASSIVE EARTH PRESSURE
i	ANGLE OF INCLINATION OF SURCHARGE i
ω	SLOPE ANGLE-BACKFACE OF WALL ω
β	ANGLE OF SLOPE β
N_γ, N_q, N_c	BEARING CAPACITY FACTORS
D_f	DEPTH OF FOOTING
B,L	FOOTING DIMENSIONS

INDEX PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G_s	SPECIFIC GRAVITY OF SOLIDS
e	VOIDS RATIO
e_o	INITIAL VOIDS RATIO
e_{max}	e IN LOOSEST STATE
e_{min}	e IN DENSEST STATE
[illegible]	[illegible] = $\frac{e_{max} - e}{[illegible]}$
n	POROSITY
w	WATER CONTENT
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
w_s	SHRINKAGE LIMIT
I_p	PLASTICITY INDEX = $w_L - w_p$
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\% < 2\mu m \text{ Soil Fraction}}$
Om	ORGANIC MATTER CONTENT
r	[illegible]
S	SENSITIVITY = $\frac{S_u\,(\text{undisturbed})}{S_u\,(\text{remoulded})}$

STRENGTH PARAMETERS

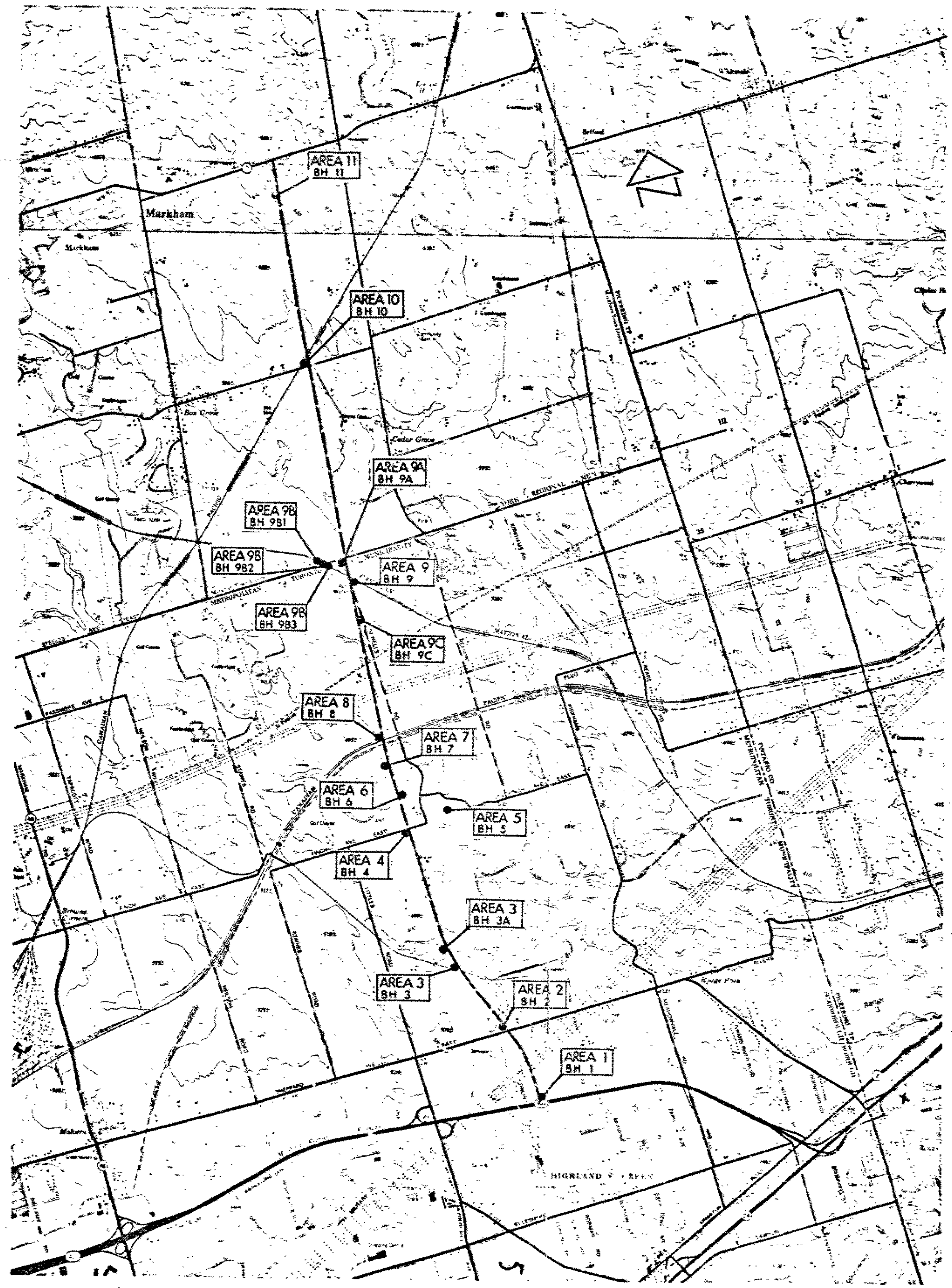
ϕ	ANGLE OF SHEARING RESISTANCE
τ_f	PEAK SHEAR STRENGTH
τ_R	RESIDUAL SHEAR STRENGTH
c	COHESION INTERCEPT
$\sigma_1, \sigma_2, \sigma_3$	NORMAL PRINCIPAL STRESSES
u	PORE WATER PRESSURE
u_e	EXCESS u
r_u	PORE PRESSURE RATIO
q_u	UNCONFINED COMPRESSIVE STRENGTH
s_u	[illegible]
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO
E	MODULUS OF ELASTICITY
G	MODULUS OF SHEAR DEFORMATION
k_s	MODULUS OF SUBGRADE REACTION
m,n	STABILITY COEFFICIENTS
A,B	PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, [illegible]

[illegible]
σ' = EFFECTIVE NORMAL STRESS

HYDRAULIC TERMS

h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
j	SEEPAGE FORCE PER UNIT VOLUME
[illegible]	[illegible]
k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
k_h	k IN HORIZONTAL DIRECTION
k_v	k IN VERTICAL DIRECTION
m_v	COEFFICIENT OF VOLUME CHANGE
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX
C_r	RECOMPRESSION INDEX
d	DRAINAGE PATH DISTANCE
T_v	TIME FACTOR
U	DEGREE OF CONSOLIDATION



PROPOSED STRUCTURE AREAS

1	Hwy 401 & Proposed E M F
2	C P R Spur (South Crossing) & E M F
3	C P R Spur (North Crossing) & E M F
3A	Tributary of Rouge River & E M F
4	Finch Ave E & E M F
5	Relocated Finch Ave Crossing of Rouge River
6	Crossing Rouge River & E M F
7	Crossing of a Relocated Finch Ave & E M F
8	Subway at C P R & E M F
9	C N R at E M F
9A	Crossing of Steeles Ave & E M F
9B	Existing Steeles Ave Subway at C N R
9C	Tributary to Little Rouge River & E M F
10	Overhead at C P R & E M F
11	Hwy 407 Interchange & E M F

CONT No
WP No 25-69-00

EAST METRO FREEWAY
FROM HWY 401 TO HWY 7
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

KEY PLAN

LEGEND

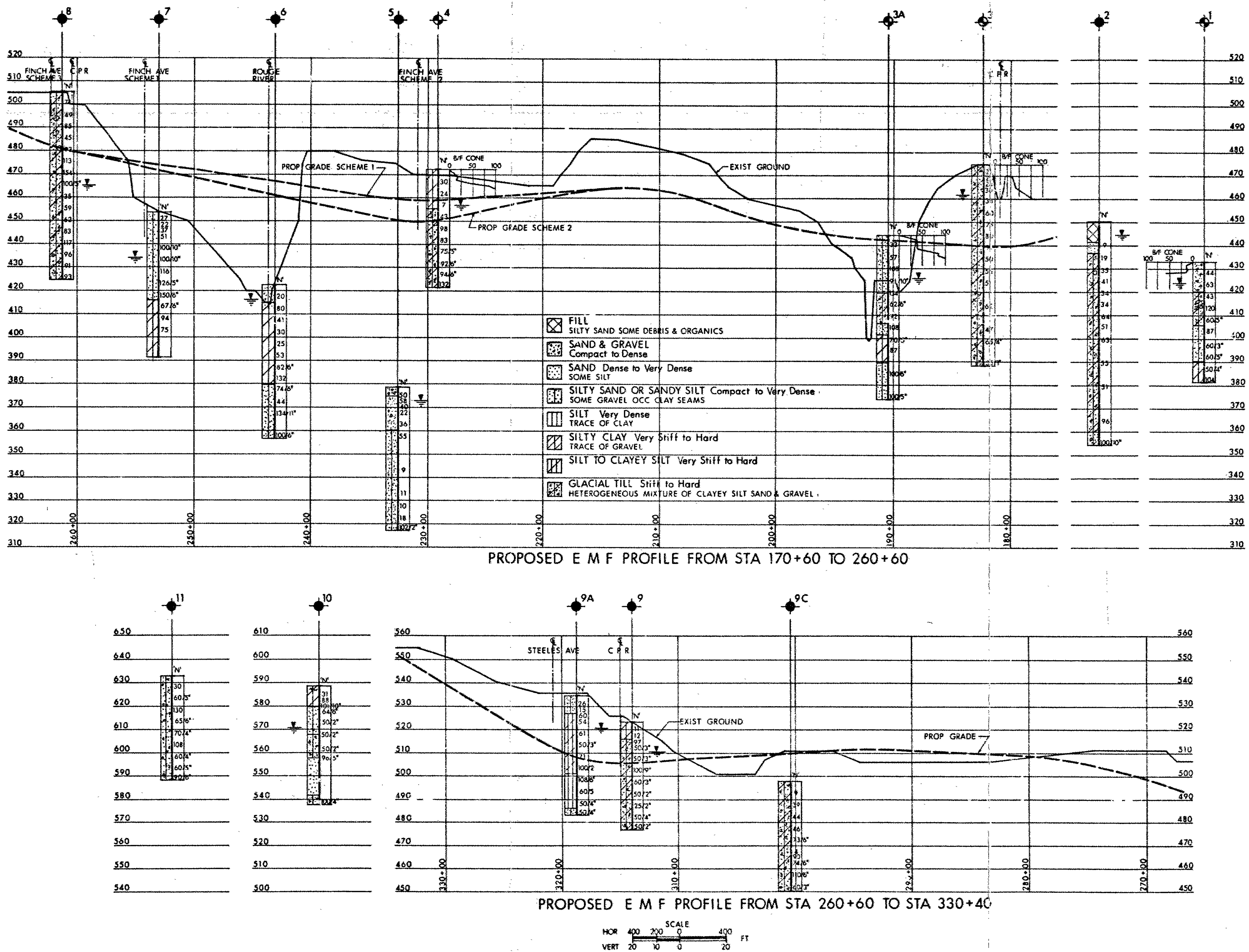
- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation
  NO WL established BH No
  9C 9B1 9B2 9B3 & 11

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	433·1	15 914 615	1 083 280
2	450·8	15 916 870	1 081 950
3	474·8	15 918 770	1 080 510
3A	444·3	15 919 380	1 080 130
4	472·2	15 923 190	1 078 860
5	378·6	15 923 760	1 080 100
6	422·5	15 924 420	1 078 760
7	452·5	15 925 280	1 078 200
8	505·5	15 926 140	1 077 940
9	522·7	15 931 210	1 076 930
9A	533·9	15 931 880	1 076 670
9B1	506·4	15 931 850	1 075 920
9B2	509·0	15 931 800	1 076 010
9B3	506·0	15 931 760	1 076 110
9C	496·9	15 930 100	1 077 260
10	588·9	15 938 160	1 075 270
11	633·0	15 943 790	1 074 350

-NOTE-
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS		
DATE	BY	DESCRIPTION

HWY No E M F — DIST 6
SUBM'D B L — CHECKED — DATE 78 11 01 — SITE
DRAWN C L J — CHECKED — APPROVED — DWG 256930-A



CONT No
WP No 25-69-00

EAST METRO FREEWAY
STA 170+60 TO 330+40

BORE HOLE LOCATIONS & SOIL STRATA

SHEET

KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation

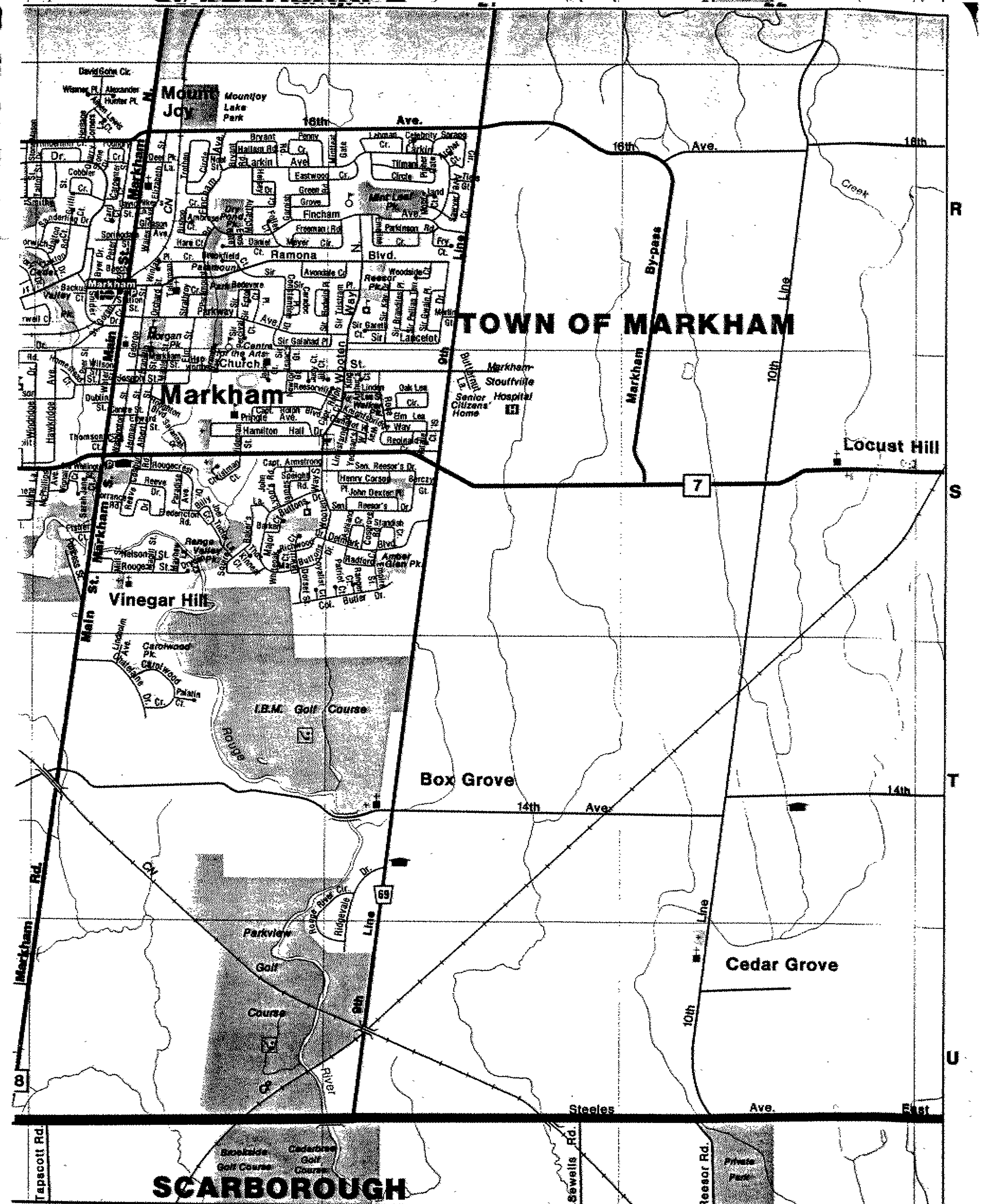
No	ELEVATION

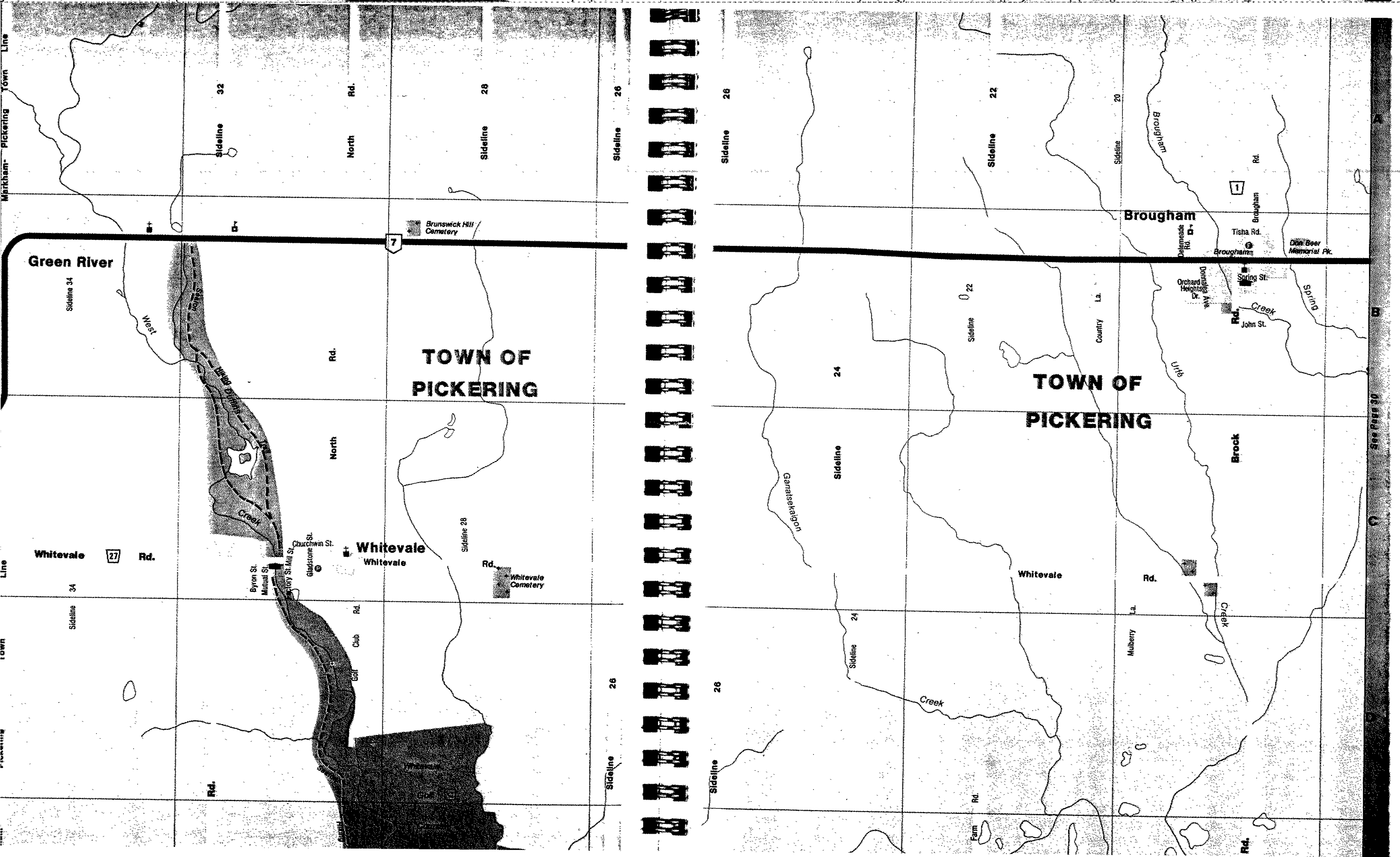
-NOTE-

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

HWY No E M F | DIST 6
SUBM'D B L | CHECKED | DATE 73 12 19 | SITE
DRAWN OL J | CHECKED | APPROVED | DWG 256900-8


Quantztown
16th Ave.
Unionville
Raymerville
Monarch
Markham Centennial Park
Markville Shopping Centre
Milne Park
TOWN OF MARKHAM
Crestheaven Golf Course
14th Ave.
Milliken
Kennedy Rd.
McCowan Rd.
Markham Rd.
CITY OF
See Page 11
7
3
67
48
17
18
19

Mount Joy
Mountjoy Lake Park
16th Ave.
TOWN OF MARKHAM
Markham
Markham-Stouffville Hospital
Locust Hill
Markham By-pass
9th Line
10th Line
Vinegar Hill
I.B.M. Golf Course
Box Grove
14th Ave.
Parkview Golf Course
Cedar Grove
Steeles Ave. East
Tapscott Rd.
Sewells Rd.
Reesor Rd.
SCARBOROUGH
7
8
69
R
S
T
U



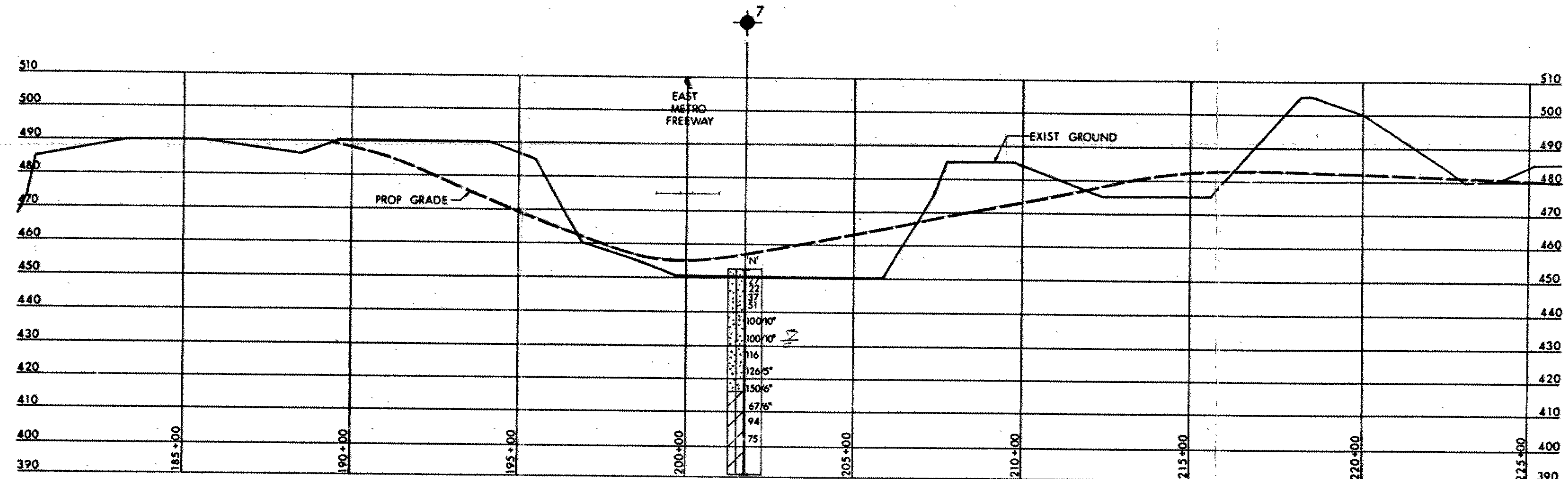
Markham- Pickering Town Line
Sideline 32
North Rd.
Sideline 28
Sideline 26
Brunswick Hill Cemetery
7
Green River
Sideline 34
West
Creek
TOWN OF PICKERING
Whitevale
27
Rd.
Churchwin St.
Gladstone St.
Byron St.
Mutual St.
Mill St.
Whitevale
Whitevale Cemetery
Club Rd.
Golf
Sideline 26
Sideline 22
Sideline 20
Brougham
Rd.
1
Brougham
Tisha Rd.
Don Beer Memorial Pk.
Delemeade Rd.
Orchard Heights Dr.
Donnalea Ave.
Spring St.
Creek
Spring
John St.
Country La.
Urfe
TOWN OF PICKERING
Sideline 24
Ganatsekaigon
Brock Rd.
Whitevale Rd.
Creek
Mulberry La.
Farm Rd.
See Page 30
A
B
C

CONT No
WP No 25-69-00

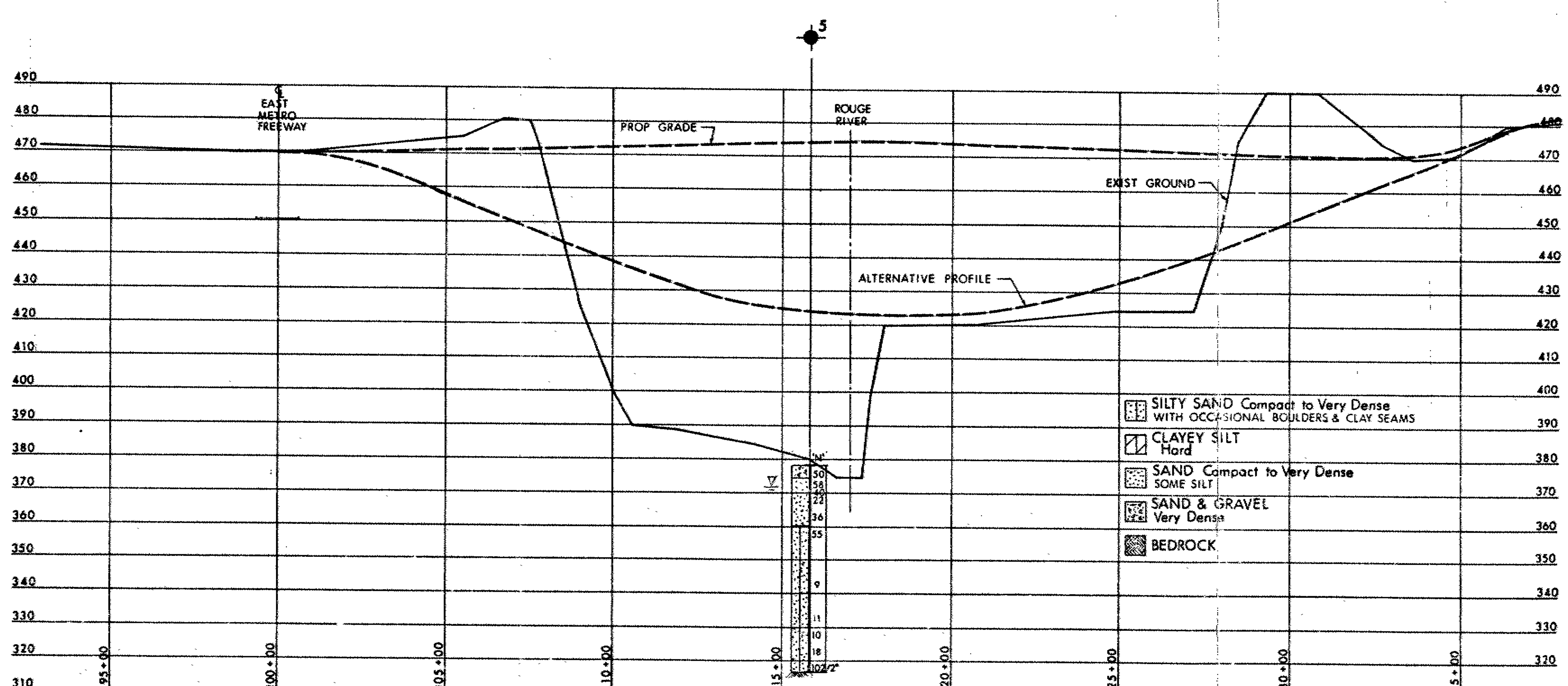
FINCH AVE

BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PROFILE OF FINCH AVE SCHEME 1



PROFILE OF FINCH AVE SCHEME 2

SCALE
HOR 200 100 0 200 FT
VERT 20 10 0 20

KEY PLAN

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- WL at time of investigation

No	ELEVATION		

-NOTE-
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS DATE	BY	DESCRIPTION

HWY No E M F			DIST 6
SUBM'D B L	CHECKED	DATE 75 12 19	SITE
DRAWN OL J	CHECKED	APPROVED	DWG 256900-C

FILE COPY

Ministry of Transportation

Ontario

FOUNDATION DESIGN SECTION

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP	326-88-01	DIST	6
HWY	407	STR SITE	-

Feasibility Study for Hwy 407
From Whitby/Oshawa Boundary to Hwy 35/115

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP	326-88-01	DIST	6
HWY	407	STR SITE	-

Feasibility Study for Hwy 407
From Whitby/Oshawa Boundary to Hwy 35/115

DISTRIBUTION

V.F. Boehnke (3)
D. Billings
B. Shaw (5)
M. Holowka
J. Robinson
E.A. Joseph
F. Bacchus (Cover Only)
File

GEOCRES 30M15-85

DATE OCT 0 3 1994

FOUNDATION INVESTIGATION REPORT
For
Feasibility Study For Hwy 407
From Whitby/Oshawa Boundary to Hwy 35/115
W.P. 326-88-01, Central Region

INTRODUCTION

This report summarizes the results of a foundation investigation for the preliminary design study of the proposed Hwy 407 from Whitby/Oshawa boundary easterly to Hwy 35/115 in the City of Oshawa and Newcastle, Region of Durham. The investigation was carried out at the request of Central Region Structural Section.

Several routes were proposed for Hwy 407 between Whitby/Oshawa boundary and Hwy 35/115. All proposed routes were within the City of Oshawa and Town of Newcastle, except for one northerly route which extended into the Township of Manvers. However, the technically preferred route, where this foundation investigation took place, was the most southerly one, within the City of Oshawa and Town of Newcastle in the Region of Durham. The proposed technically preferred route originates at the intersection of Winchester Road and Whitby/Oshawa boundary. From that point it runs in a southeast direction, intersects Conlin Road just east of Oshawa and Newcastle boundary and then runs more or less parallel to Concession Road 6 in a zigzag manner towards the east, until it intersects Regional Road No. 42. The proposed route then runs in a northeast direction and connects to Hwy 35/115 intersection. The details of the proposed technically preferred route and structures are illustrated on Drawing No. 3268801-A.

This Foundation investigation was intended for initial assessment of the feasibility of the proposed alignment from a foundation point of view, with a general coverage of the area by limited number of boreholes.

Before initiating the Foundation investigation, a Preliminary Geotechnical Conditions report by Geocon Inc., dated July 10, 1990 was reviewed by this office (Geocon Report T11547/53425, Highway 407 Route Planning and Environmental Assessment Study, Hwy 48 to Hwy 35-115).

SITE DESCRIPTION

The site for the proposed Hwy 407 from Whitby/Oshawa boundary to Hwy 35/115 is located within the City of Oshawa and Town of Newcastle in the Region of Durham. Residential properties are primarily located along the major streets which the proposed highway would cross.

The existing ground elevation varies from 166.3m (BH P23) to 345.0m (east of BH P41, near Hwy 35/115 intersection). The proposed route is about 30.5 kilometre long (from station 9+500 to station 40+000). Between stations 31+000 and 40+000 the ground slopes down sharply from east to west at about 2.4 per cent slope (elevation drops from 345.0m to 163m). Further west of station 31+000 the ground surface is undulating, the slope ranges from 0.3 per cent to 2 per cent and the ground elevation varies from 155m and 225m.

Physiographically, the area is located in a region referred to as the "South Slope and Iroquois Plain" (Reference: Chapman and Putnam 'The Physiography of Southern Ontario; 3rd Edition, 1984). This is the low land bordering Lake Ontario which was inundated in the Pleistocene time by Lake Iroquois. Subsoils in these areas generally are characterized by a mosaic of till plains, drumlins and areas of Glaciolacustrine deposits of silt, sand and clayey silt.

INVESTIGATION PROCEDURES

The field work for the investigation was carried out between 94 05 25 and 94 05 30. The investigation consisted of twenty one (21) sampled boreholes (BH P21 through P41). In general, at least one borehole was put down at each proposed major interchange. The boreholes were advanced to depths of 9.3 (BH P29) to 16.9 (BH P26).

The boreholes were advanced with three track mounted machines equipped with continuous flight augers. Conventional solid and hollow stem augers were used. The sampling program consisted of split spoon samples collected in the overburden. Soil samples were retrieved by split spoon sampler in accordance with Standard Penetration Test (ASTM D1586).

Standard Penetration 'N' values were recorded for assessment of the strength of the materials encountered. All subsoil samples were identified in the field and returned to the laboratory for further visual examination and testing. Groundwater levels were measured in each borehole and all boreholes were backfilled upon completion of the field work.

Surveying required to ascertain borehole locations and elevations was carried out by the Central Region Surveys and Plans Section.

SUBSURFACE CONDITIONS

The record of Borehole sheets in the Appendix illustrate the subsurface conditions at the borehole locations. The location and elevation of the boreholes are shown on Drawing No. 3268801-A.

Since the investigation was spread over a large area of 30.5 kilometre (station 9+500 to 40+000), individual borehole logs should be referred to for information on soil conditions at any structure location. However, the predominant soil strata encountered at the site consisted of glacial till (made up primarily of silty clay to clayey silt and silt to silty sand). The surficial deposit at the site was generally a glacial till.

The Standard Penetration test in cohesive glacial till recorded 'N' values from 8 blows to more than 100 blows. Based on the 'N' values, the cohesive glacial till has a stiff to hard consistency. In non-cohesive glacial till the 'N' value ranged from 9 to more than 100 blows indicating the material to be loose to very dense.

GROUNDWATER CONDITIONS

Individual boreholes should be referred to for groundwater elevation at any proposed structure locations. Groundwater level was recorded in all boreholes except for Boreholes P27, P28, P39, and P41 where either the boreholes remained dry or water level couldn't be measured due to borehole collapse. The groundwater table stabilized at depths ranging from 0.7m (BH P24) to 9.1m (BH P34) below ground surface. The groundwater elevation ranged from 157.7m (BH P23) to 252.6m (BH P40). Groundwater levels are subject to seasonal fluctuations and may vary from the values provided in this report.

DISCUSSION AND RECOMMENDATIONS

General

This report contains recommendations pertaining to the structure foundations, approach embankments, cuts and hydrogeological aspects for various structures for the proposed Hwy 407 from Whitby/Oshawa boundary easterly to Hwy 35/115 in the City of Oshawa and Newcastle, Region of Durham. The recommendations given in the report are tentative based on the limited information available and should definitely be reviewed based on supplementary investigations. The site location is shown on Drawing No. 3268801-A.

Total 66 bridge structures (Structure 3 through 68) are proposed along the proposed Hwy 407 from Whitby/Oshawa boundary easterly to Hwy 35/115 in the City of Oshawa and Newcastle, Region of Durham. This includes 22 watercourse structure sites (W), 28 grade separated structure sites (GS) and 16 interchange structure sites (I).

In general, the geotechnical conditions within the proposed route corridors are favourable. There are no foundation concerns that would require realignment of the proposed Hwy 407 route from Whitby/Oshawa boundary easterly to Hwy 35/115. Subsurface conditions over the site are uniform and competent for structure foundation and embankment loadings. The glacial till is expected to provide adequate bearing for most structures and may be able to sustain low to medium loads on shallow spread footings. However, deep foundations such as caissons and piles may be required to transfer heavier loads to greater depths and to more competent bearing material. Our comments from the feasibility, design and construction of the various structures are given on the Foundation Data Sheets included in the Appendix. Twenty one data sheets (Area 21 through 41) are provided for the 66 structures; the area locations are also shown on Drawing No. 3268801-A. An explanation of information provided on the data sheet is outlined below:

1. The structure number (i.e. 03, 04, 05 etc.) are the numbers assigned to the structures for the purpose of the feasibility study. The area number such as 21, 22, 23, etc is based on the borehole numbers P21, P22, P23, etc drilled in those areas. The actual location is shown on Drawing No. 3268801-A

2. The original ground elevation is based on the survey results of the borehole locations along the proposed Hwy 407 from Whitby/Oshawa boundary easterly to Hwy 35/115 in the City of Oshawa and Newcastle, Region of Durham.

3. The grades of roadway given is based on the proposed grades of proposed Hwy 407 at the respective sites, obtained from a profile of the Technically Preferred Route supplied to us (no reference no).

4. Subsurface conditions are described very briefly and are based on generally one borehole per area.

5. <u>Structure Foundations</u>

The recommendations are for pier and abutment foundations. The options for structure foundations are given in preferential order based on geotechnical/economical considerations. Further elaboration of structure recommendations made on the data sheets are given below:

Compacted Granular 'A' Core (Engineered Fill) - This option is generally for abutments where subsurface conditions are competent. The minimum requirements of a compacted granular 'A' core are shown on Figure No. 1 (attached). Furthermore, the footing for this scheme could be designed using the following parameters:

Factored Bearing Capacity at U.L.S. = 900 kPa
Bearing Capacity at S.L.S. Type II = 350 kPa

<u>Spread Footings:</u> This option is given for abutments and piers where subsurface conditions are competent. The highest elevation and corresponding maximum design load is given. It is to be noted the spread footing should be provided with a minimum of 1.2m of earth cover for frost protection purposes. In addition, where the spread footing is to be founded on a cohesive deposit, subject to softening upon exposure to construction or weather conditions, it would be necessary to protect the base of the footing excavation from softening by placing a working slab of lean concrete immediately upon completion of the footing excavation. Also, where the footing is located in a non cohesive deposit and the water table is at or above the footing founding level, it will be necessary to prevent the base of the footing from "boiling" due to an unbalanced excess hydrostatic head. In this case a dewatering scheme would be required.

If the structure is to be designed as a rigid frame then the coefficient of earth pressure at rest (Ko) will be used.

All foundation elements should have a minimum of 1.2m earth cover for frost protection. The concrete for the footings should be placed 'in the dry'. Consequently a dewatering scheme will be required if the concrete is poured below the prevailing water level

8. Remarks

In this column comments are made about any construction difficulties, dewatering and hydrogeological concerns at any given site.

MISCELLANEOUS

The tentative foundation recommendations outlined in this report are for feasibility study or preliminary planning purposes only as they are based on very limited subsurface information. It will be necessary to carry out a detailed foundation investigation at each of the structure sites when the design details and geometries are finalized and approved. In some areas, groundwater studies and special in-situ field testing may be warranted.

The field work for this investigation was carried out under the supervision of Todd Barlow, Lori O'Malley and Tanya Cross Engineering students, using equipment owned and operated by Master Soil Investigation and Atcost Soil Drilling.

The report was prepared by K.S.Q. Ahmad, P. Eng. Foundation Engineer and reviewed and approved by D. Dundas, P. Eng. Acting Chief Foundation Engineer.

LICENSED PROFESSIONAL ENGINEER
S. Q. AHMAD
94 08 17
PROVINCE OF ONTARIO

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

D. Dundas

D.H. Dundas, P. Eng.
Chief Foundation Engineer (Acting)

REGISTERED PROFESSIONAL ENGINEER
D. H. DUNDAS
94 08 17
PROVINCE OF ONTARIO

APPENDIX

FOUNDATION DATA SHEETS

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 21 STRUCTURE Nos. 03, 04, 05, 06 LOCATION Oshawa Creek Bridges, Thornton Road Overpasses

ORIGINAL GROUND ELEV. 172.0 m PROPOSED HWY 407 GRADE ELEV. 173.0 m , 177.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 21 0.0 - 9.4 m Clayey Silt Hard (Glacial Till) Groundwater Elevation 169.2 m	1.) For pier and abutments, spread footings placed within hard glacial till below elevation 171.0 m and below a frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 500 kPa - Bearing Capacity at S.L.S. Type II = 300 kPa 2.) For foundations at higher elevations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) Higher Bearing Capacities can be utilized at a lower depth below elevation 166.0 m.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 22 STRUCTURE Nos. 07 LOCATION Simcoe Road Underpass

ORIGINAL GROUND ELEV. 184.9 m PROPOSED HWY 407 GRADE ELEV. 182.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS: STRUCTURE	RECOMMENDATIONS: APPROACHES	REMARKS
REFERENCE BOREHOLE P 22 0.0 - 5.5 m Clayey Silt Hard (Glacial Till) 5.5 - 12.6 m Silty Sand to Sandy Silt Dense to V. Dense (Glacial Till) Groundwater Elevation 181.8 m	1.) For abutments and piers, spread footings placed within hard glacial till below elevation 182.0 m and below a frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 600 kPa - Bearing Capacity at S.L.S. Type II = 400 kPa 2.) Higher Bearing Capacities can be utilized at a lower depth below elevation 176.0 m.	Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 23 STRUCTURE Nos. 08, 09, 10,11 LOCATION Oshawa Creek Bridges, Ritson Road Overpasses

ORIGINAL GROUND ELEV. 166.3 m PROPOSED HWY 407 GRADE ELEV. 177.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 23 0.0 - 5.5 m Silty Clay to Clayey Silt V. Stiff to Hard (Glacial Till) 5.5 - 9.6 m Silty Sand to Sandy Silt Dense to V. Dense (Glacial Till) Groundwater Elevation 157.7 m	1.) For pier and abutment foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 2.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 24 STRUCTURE Nos. 12, 13, 14 LOCATION Wilson Road, Harmony Road, Grandview Road Underpasses

ORIGINAL GROUND ELEV. 203.2 m PROPOSED HWY 407 GRADE ELEV. 183.0 m, 200.0 m, 196.0 m Respectively
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 24 0.0 - 9.6 m Clayey Silt Hard (Glacial Till) Groundwater Elevation 202.5 m	1.) For pier and abutment foundations, spread footings placed within hard glacial till below elevation 200.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 800 kPa - Bearing Capacity at S.L.S. Type II = Not Governed	Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 25 STRUCTURE Nos. 15 LOCATION West Townline Road Underpass

ORIGINAL GROUND ELEV. 212.3 m PROPOSED HWY 407 GRADE ELEV. 202.0 m
Reference:

<table>
<tr><th rowspan="2">SUBSURFACE CONDITIONS</th><th colspan="2">RECOMMENDATIONS</th><th rowspan="2">REMARKS</th></tr>
<tr><th>STRUCTURE</th><th>APPROACHES</th></tr>
<tr><td>REFERENCE BOREHOLE

P 25

0.0 - 13.8 m Sandy Silt to Silt V. Dense (Glacial Till)

Groundwater Elevation

211.9 m</td><td>1.) For abutment and pier foundations, spread footings placed within V. Dense glacial till below elevation 202.0 m and below frost depth of 1.2 m may be designed for:

- Factored Bearing Capacity at U.L.S. = 1000 kPa
- Bearing Capacity at S.L.S. Type II = Not Governed</td><td>Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.</td><td>1.) No serious foundation problems are anticipated.

2.) Dewatering will be required for excavation below water table. Dewatering may be limited to oversize excavation.

3.) This is not a suitable site for an infiltration pond. Due to possible high water table after construction.</td></tr>
</table>

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 26 STRUCTURE Nos. 16, 17 LOCATION Conlin Road, Langmaid Road Underpasses

ORIGINAL GROUND ELEV. 210.6 m PROPOSED HWY 407 GRADE ELEV. 198.0 m, 202.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 26 0.0 - 9.8 m Silty Sand to Sandy Silt V. Dense (Glacial Till) 9.8 - 16.9 m Clayey Silt Hard (Glacial Till) Groundwater Elevation 203.6 m	1.) For abutment and pier foundations, spread footings placed within V. Dense or Hard glacial till below elevation 202.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 1000 kPa - Bearing Capacity at S.L.S. Type II = Not Governed	Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 27 STRUCTURE Nos. 18, 19 LOCATION Regional Road 34 Overpasses

ORIGINAL GROUND ELEV. 205.4 m PROPOSED HWY 407 GRADE ELEV. 213.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 27 0.0 - 9.6 m Silty Sand to Sandy Silt Dense to V. Dense (Glacial Till) Groundwater Elevation Dry	1.) For pier foundations, spread footings placed within Dense to V. Dense glacial till below elevation 204.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 500 kPa - Bearing Capacity at S.L.S. Type II = 300 kPa 2.) For abutment foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) Higher bearing capacities can be utilized at a lower depth below elevation 202.0 m. 4.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This may be a potential site for an infiltration pond, but should be verified by further investigation.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 28 STRUCTURE Nos. 20, 21 LOCATION Farewell Creek Bridge, Solina Road Underpass

ORIGINAL GROUND ELEV. 211.1 m PROPOSED HWY 407 GRADE ELEV. 190.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 28 0.0 - 12.4 m Silty Sand to Sandy Silt V. Dense (Glacial Till) Groundwater Elevation Hole Collapsed	1.) For pier and abutment, spread footings placed within V. Dense glacial till below elevation 190.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 1000 kPa - Bearing Capacity at S.L.S. Type II = Not Governed	Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 29 STRUCTURE Nos. 22, 23, 24 LOCATION Solina Road Underpass, Rundle Road Overpasses

ORIGINAL GROUND ELEV. 188.5 m PROPOSED HWY 407 GRADE ELEV. 187.0 m , 184.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 29 0.0 - 4.9 m Silty Sand V. Dense 4.9 - 9.3 m Clayey Silt Hard (Glacial Till) Groundwater Elevation 184.9 m	1.) For Abutment and pier, spread footings placed within V. Dense Silty Sand or Hard glacial till below elevation 187.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 1000 kPa - Bearing Capacity at S.L.S. Type II = Not Applicable 2.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill. Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 30 STRUCTURE Nos. 25 LOCATION Holt Road Underpass

ORIGINAL GROUND ELEV. 192.6 m PROPOSED HWY 407 GRADE ELEV. 182.0 m

Reference:

<table>
<tr><th rowspan="2">SUBSURFACE CONDITIONS</th><th colspan="2">RECOMMENDATIONS</th><th rowspan="2">REMARKS</th></tr>
<tr><th>STRUCTURE</th><th>APPROACHES</th></tr>
<tr>
<td>REFERENCE BOREHOLE

P 30

0.0 - 12.3 m Silty Sand to Sandy Silt
V. Dense
(Glacial Till)

Groundwater Elevation

186.5 m</td>
<td>1.) For abutment and pier, spread footings placed within V. Dense glacial till below elevation 182.0 m and below frost depth of 1.2 m may be designed for:

- Factored Bearing Capacity at U.L.S. = 1000 kPa
- Bearing Capacity at S.L.S. Type II = Not Governed</td>
<td>Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.</td>
<td>1.) No serious foundation problems are anticipated.

2.) No major dewatering problems are anticipated.

3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.</td>
</tr>
</table>

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 31 STRUCTURE Nos. 26, 27, 28, 29 LOCATION Bowmanville Creek Bridges, Old Scugog Road Overpass

ORIGINAL GROUND ELEV. 174.4 m PROPOSED HWY 407 GRADE ELEV. 180.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 31 0.0 - 9.8 m Silty Clay to Clayey Silt V. Stiff to Hard (Glacial Till) Groundwater Elevation 173.9 m	1.) For abutment and pier foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 2.) Higher bearing capacities can be utilized at a lower depth below elevation 170.0 m. 3.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 32 STRUCTURE Nos. 30, 31, 32, 33, 34, 35, 36, 37 LOCATION Regional Road 57, Cedar Park Road and Creek Structures

ORIGINAL GROUND ELEV. 172.9 m PROPOSED HWY 407 GRADE ELEV. 182.0 m, 184.0 m, 187.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS: STRUCTURE	RECOMMENDATIONS: APPROACHES	REMARKS
REFERENCE BOREHOLE P 32 0.0 - 9.6 m Silty Clay Firm to Hard Groundwater Elevation 168.5 m	1.) For abutment and pier foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) For higher bearing capacities this structure can be supported on deep foundations. If deep foundations are considered, further investigation will be required.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 33 STRUCTURE Nos. 38, 39, 40, 41 LOCATION Middle Road and Creek East of Middle Road Structures

ORIGINAL GROUND ELEV. 178.2 m PROPOSED HWY 407 GRADE ELEV. 187.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 33 0.0 - 2.4 m Silty Sand Loose 2.4 - 9.8 m Silty Clay to Clayey Silt V. Stiff to Hard (Glacial Till) Groundwater Elevation 177.9 m	1.) For abutment and pier foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 2.) For higher bearing capacity, piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability and the water table is high.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 34 STRUCTURE Nos. 42 LOCATION Regional Road 14 Underpass

ORIGINAL GROUND ELEV. 188.4 m PROPOSED HWY 407 GRADE ELEV. 186.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 34 0.0 - 4.0 m Clayey Silt V. Stiff to Hard (Glacial Till) 4.0 - 7.0 m Silty Sand to Sandy Silt V. Dense (Glacial Till) 7.0 - 12.6 m Silty Clay to Clayey Silt V. Stiff to Hard (Glacial Till) Groundwater Elevation 179.3 m	1.) For pier foundations, spread footings placed within V. Stiff to Hard glacial till below elevation 186.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 650 kPa . - Bearing Capacity at S.L.S. Type II = 400 kPa 2.) For abutment foundation, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 35 STRUCTURE Nos. 43, 44, 45, 46, 47, 48 LOCATION Clemens Road, Mackie Creek and Bethesda Road Structures

ORIGINAL GROUND ELEV. 184.4 m PROPOSED HWY 407 GRADE ELEV. 185.0 m, 189.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 35 0.0 - 9.8 m Silty Sand to Sandy Silt V. Dense (Glacial Till) Groundwater Elevation 182.0 m	1.) For pier foundations, spread footings placed within V. Dense glacial till below elevation 183.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 750 kPa - Bearing Capacity at S.L.S. Type II = 500 kPa 2.) For abutment foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) For higher bearing capacities, piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 36 STRUCTURE Nos. 49, 50, 51, 52, 53 LOCATION Acres Road, Cole Road and Soper Creek Structures

ORIGINAL GROUND ELEV. 171.9 m PROPOSED HWY 407 GRADE ELEV. 188.0 m, 180.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 36 0.0 - 9.6 m Silty Sand Compact to V. Dense (Glacial Till) Groundwater Elevation 166.2 m	1.) For abutment and pier foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 2.) Piles and caissons are also feasible, but should be selected on a cost comparison basis. If this option is selected, further investigation would be required.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This may be a potential site for an infiltration pond. Further investigation will be required to prove this site to be suitable for an infiltration pond.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 37 STRUCTURE Nos. 54, 55 LOCATION Darlington Town Line Road and Brown Road Structures

ORIGINAL GROUND ELEV. 191.0 m PROPOSED HWY 407 GRADE ELEV. 187.0 m, 197.0 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 37 0.0 - 7.0 m Silty Sand to Sandy Silt V. Dense 7.0 - 10.8 m Clayey Silt Hard (Glacial Till) Groundwater Elevation 184.0 m	1.) For pier and abutment foundations, spread footings placed within V. Dense glacial till below elevation 187.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 1000 kPa - Bearing Capacity at S.L.S. Type II = 500 kPa 2.) For pier and abutment foundations at higher elevations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) For Higher bearing capacities, piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill. Cuts up to 6 m deep will be stable at 2 H : 1 V side slope. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This may be a potential site for an infiltration pond. The permeability of the soil is low to medium. Further study will be required to determine if the site is suitable for an infiltration pond.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 38 STRUCTURE Nos. 56, 57, 58, 59, 60, 61 LOCATION Mosport Road, Wilmot Creek and Leskard Road Structures

ORIGINAL GROUND ELEV. 202.3 m PROPOSED HWY 407 GRADE ELEV. 204.0 m, 209.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
REFERENCE BOREHOLE P 38 0.0 - 9.5 m Silty Sand Compact to V. Dense (Glacial Till) Groundwater Elevation 195.1 m	1.) For pier foundations, spread footings placed within Compact to V. Dense glacial till below elevation 201.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 500 kPa - Bearing Capacity at S.L.S. Type II = 300 kPa 2.) For pier and abutment foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 3.) For higher bearing capacities, piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This may be a potential site for an infiltration pond. Further investigation would be required to confirm this.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 39 STRUCTURE Nos. 62 LOCATION Best Road Structures

ORIGINAL GROUND ELEV. 244.4 m PROPOSED HWY 407 GRADE ELEV. 238.5 m
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 39 0.0 - 12.3 m Silty Sand to Sandy Silt Compact to V. Dense (Glacial Till) Groundwater Elevation Not Established	1.) For pier and abutment foundations, spread footings placed within Dense to V. Dense glacial till below elevation 238.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 650 kPa - Bearing Capacity at S.L.S. Type II = 400 kPa 2.) Higher bearing capacities can be utilized at a lower depth below elevation 237.0 m. 3.) Piles and caissons are also feasible, but should be selected on a cost comparison basis.	Cuts up to 6 m deep will be stable at 2 H : 1 V side slopes. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) May be a candidate site for an infiltration pond. Further investigation will be required to prove this.

FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 40 STRUCTURE Nos. 63, 64, 65, 66 LOCATION A Creek East of Best Road and Concession Road 8 Structures

ORIGINAL GROUND ELEV. 255.9 m PROPOSED HWY 407 GRADE ELEV. 250.0 m, 259.0 m

Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS — STRUCTURE	RECOMMENDATIONS — APPROACHES	REMARKS
REFERENCE BOREHOLE P 40 0.0 - 4.0 m Clayey Silt Stiff (Glacial Till) 4.0 - 9.6 m Silt to Silty Sand V. Dense Groundwater Elevation 252.6 m	1.) For pier foundations, spread footings placed within V. Dense Silt to Silty Sand below elevation 250.0 m and below frost depth of 1.2 m may be designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 300 kPa 2.) For pier and abutment foundations at higher elevations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill. Cuts up to 6 m deep will be stable at 2 H : 1 V side slopes. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) Dewatering will be required for excavation below water table in non cohesive material 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability and the water table is likely to remain high after construction.

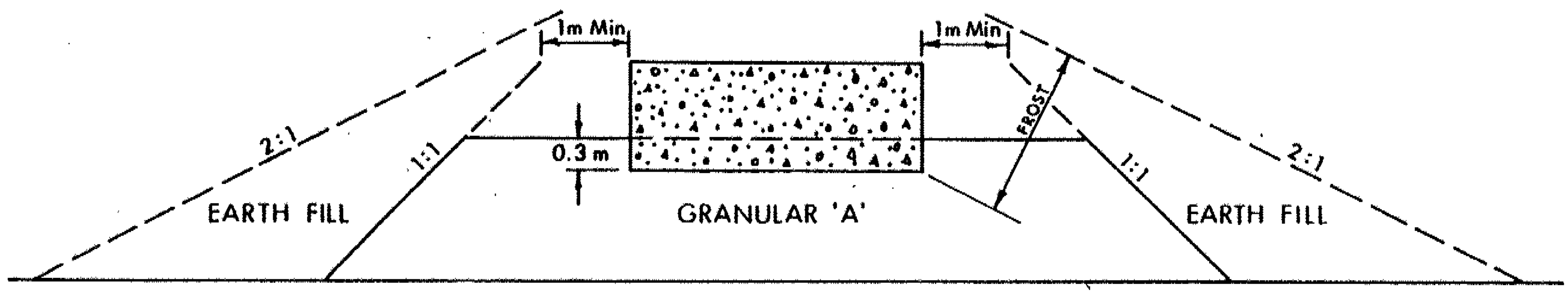
FOUNDATION DATA SHEET

W.P. 326 - 88 - 01 AREA 41 STRUCTURE Nos. 67, 68 LOCATION Skelding Road Structure, Hwy 35/115 Underpass

ORIGINAL GROUND ELEV. 319.0 m PROPOSED HWY 407 GRADE ELEV. 310.0 m, 337.0 m

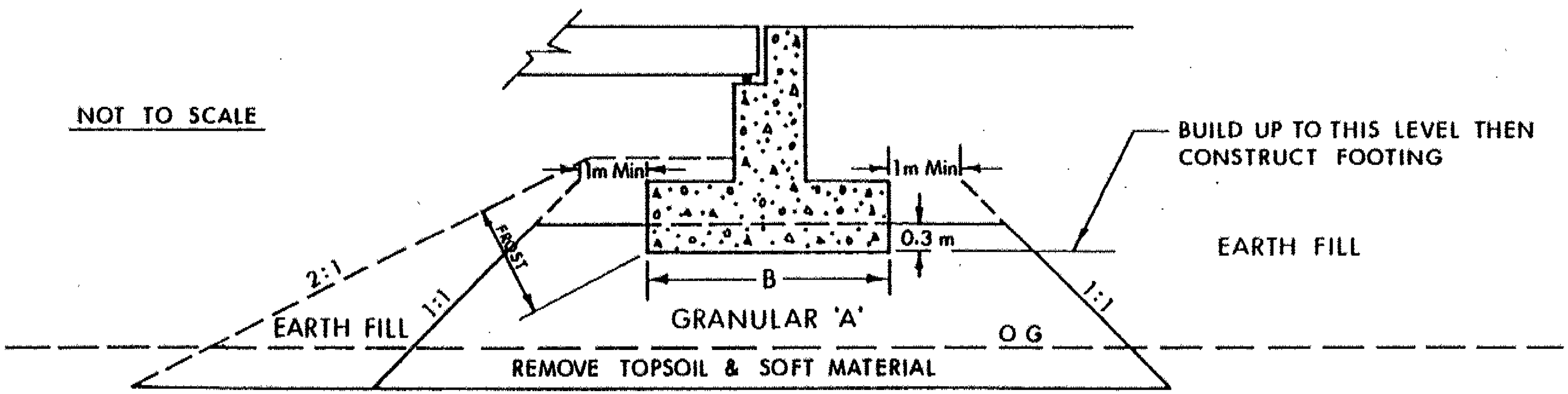
Reference:

SUBSURFACE CONDITIONS	RECOMMENDATIONS		REMARKS
	STRUCTURE	APPROACHES	
REFERENCE BOREHOLE P 41 0.0 - 5.5 m Silty Clay to Clayey Silt V. Stiff to Hard 5.5 - 9.8 m Silt to Silty Sand V. Dense Groundwater Elevation Not Established	1.) For abutment and pier foundations, spread footings can be placed on a well compacted granular 'A' pad designed for: - Factored Bearing Capacity at U.L.S. = 900 kPa - Bearing Capacity at S.L.S. Type II = 350 kPa 2.) For higher bearing capacities, piles and caissons are also feasible, but should be selected on a cost comparison basis.	Fill up to 8 m high can be constructed at 2 H : 1 V side slopes. A mid height berm would be required for higher fill. Cuts up to 6 m deep will be stable at 2 H : 1 V side slopes. A berm would be required for deeper cuts.	1.) No serious foundation problems are anticipated. 2.) No major dewatering problems are anticipated. 3.) This is not a suitable site for an infiltration pond. The soil is of low permeability.



X SECTION

NOT TO SCALE



LONGITUDINAL SECTION

NOTES:

1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A' & EARTH FILL.

2 - PLACE GRANULAR 'A' & EARTH FILL TO BOTTOM OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M T O STANDARDS.

3 - CONSTRUCT CONCRETE FOOTING.

4 - PLACE REMAINDER OF GRANULAR 'A' & EARTH FILL AS REQUIRED.

Ministry of Transportation Ontario	ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE	FIG No 1 W P 326 - 88 - 01

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P21

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 868 931.8, E 351 038.5 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem / Hollow Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 30 CHECKED BY KA

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
172.0	Ground Surface					
0.0	Clayey Silt, Some Sand, Trace Gravel, Hard (Glacial Till)					
		1	SS	31		170
	Sandy Silt	2	SS	31	▽	
		3	SS	41		168
		4	SS	57		166
		5	SS	104		164
162.5		6	SS	120		
9.4	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

15 ◇ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P22

1 OF 1 METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 896.0, E 352 482.8 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem / Hollow Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
184.9	Ground Surface				
0.0	Clayey Silt Some Sand, Trace Gravel Hard (Glacial Till)	1	SS	74	▼ (approx. El. 182)
		2	SS	100	
179.4 5.5	Silty Sand to Sandy Silt Trace of Clay, Trace of Gravel Dense to V. Dense (Glacial Till)	3	SS	39	
		4	SS	41	
		5	SS	108	
		6	SS	100	
172.3		7	SS	101	
12.6	End of Borehole				

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; ELEVATION SCALE (184, 182, 180, 178, 176, 174); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P23

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 724.6, E 354 258.5 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 27 CHECKED BY KA

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
166.3	Ground Surface				
0.0	Silty Clay to Clayey Silt Some Sand, Trace Gravel V. Stiff to Hard (Glacial Till)	1	SS	16	
		2	SS	52	
		3	SS	27	
160.8 / 5.5	Silty Sand to Sandy Silt Trace of Clay, Trace of Gravel Dense to V. Dense (Glacial Till)	4	SS	76	
		5	SS	48	
156.7		6	SS	53	▼ (water level at approx. elev. 157.8)
9.6	End of Borehole				

Column headings: SOIL PROFILE; SAMPLES; STRAT PLOT; ELEVATION SCALE (166, 164, 162, 160, 158); DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P24

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 574.1, E 356 028.6 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 27 CHECKED BY KA

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE
203.2	Ground Surface				
0.0	Clayey Silt Some Sand, Trace Gravel Hard (Glacial Till)				202
		1	SS	44	
		2	SS	78	200
		3	SS	120	198
		4	SS	85	196
		5	SS	104	194
193.6		6	SS	105	
9.8	End of Borehole				

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15-○-5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P25

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 427.6, 357 821.1 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 25 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
213.2	Ground Surface					
0.0	Sandy Silt to Silt Trace Clay, Trace Gravel V. Dense (Glacial Till)				▼	212
		1	SS	58		210
						208
		2	SS	150 /8cm		206
	Clayey Silt	3	SS	150 /8cm		204
		4	SS	150 /18cm		202
		5	SS	111		200
199.3		6	SS	150 /10cm		
13.8	End of Borehole					

Column headings: SOIL PROFILE (ELEV/DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, 'N' VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+³, ×⁵ : Numbers refer to Sensitivity

20 15◇5 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P26

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 399.7, E 359 124.9 ORIGINATED BY LO

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 25 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
210.6	Ground Surface				
0.0	Silty Sand to Sandy Silt, Trace of Clay, Trace of Gravel, V. Dense (Glacial Till)	1	SS	135	
		2	SS	150	
					▽ (approx. El. 203.8)
		3	SS	138	
		4	SS	150 /15cm	
200.8 / 9.8	Clayey Silt, Some Sand, Some Gravel, Hard (Glacial Till)	5	SS	150 /18cm	
		6	SS	150 /18cm	
		7	SS	138	
		8	SS	150 /15cm	
193.6		9	SS	150 /15cm	
16.9	End of Borehole				

Column headings: SOIL PROFILE (ELEV DEPTH, DESCRIPTION, STRAT PLOT); SAMPLES (NUMBER, TYPE, 'N' VALUES); GROUND WATER CONDITIONS; ELEVATION SCALE (210, 208, 206, 204, 202, 200, 198, 196, 194); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20, 40, 60, 80, 100); PLASTIC LIMIT W_P, NATURAL MOISTURE CONTENT W, LIQUID LIMIT W_L; WATER CONTENT (%) (10, 20, 30); UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P27

METRIC

W.P. 326-88-01
LOCATION Coords.: N 4 869 259.2, E 360 032.5
ORIGINATED BY LO

DIST 6 HWY 407
BOREHOLE TYPE Solid Stem / Hollow Stem
COMPILED BY LO

DATUM Geodetic
DATE 1994 05 30
CHECKED BY KA

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.4	Ground Surface										
0.0	Silty Sand to Sandy Silt, Trace of Clay, Trace of Gravel, Dense to V. Dense (Glacial Till)					DRY					
							204				
			1	SS	33						
			2	SS	105		202				
			3	SS	150	/27cm					
							200				
			4	SS	89						
							198				
			5	SS	70						
195.8			6	SS	116		196				
9.6	End of Borehole										

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100. SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100. PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30.

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P28

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 551.5, E 361 241.7 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 25 CHECKED BY KA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
211.1	Ground Surface										
0.0	Silty Sand to Sandy Silt, Trace of Clay, Trace of Gravel, V. Dense (Glacial Till)					*	210				
			1	SS	107		208				
							206				
			2	SS	98	/15cm	204				
			3	SS	150	/20cm	202				
			4	SS	120		200				
198.7			5	SS	130	/18cm					
12.4	End of Borehole										
	* Unable to Measure Ground Water Due to the Hole Collapsing										

Plot legend: ○ UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE. Plastic limit w_P, natural moisture content w, liquid limit w_L. Scales: 20 40 60 80 100; 10 20 30.

$+^3, \times^5$: Numbers refer to Sensitivity $15\overset{20}{\underset{10}{\diamond}}5$ (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P29

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 869 697.3, E 362 491.2 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
188.5	Ground Surface				
0.0	Silty Sand, Trace of Clay, Trace of Gravel, V. Dense	1	SS	185	▼
183.6 / 4.9	Clayey Silt, Some Sand, Trace Gravel, Hard (Glacial Till)	2	SS	189	
		3	SS	140	
179.2 / 9.3	End of Borehole	4	SS	128	

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE (188, 186, 184, 182, 180); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20, 40, 60, 80, 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20, 40, 60, 80, 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) (10, 20, 30); UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3$, $\times^5$: Numbers refer to Sensitivity $15 \diamond 5$ (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P30

 METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 870 650.8, E 363 911.5 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
192.8	Ground Surface					
0.0	Silty Sand to Sandy Silt, Trace of Clay, Trace of Gravel, Pockets of Gravelly Sand, V. Dense (Glacial Till)					192
		1	SS	120	/15cm	190
		2	SS	120	▼	188, 186
		3	SS	90	/15cm	184
		4	SS	160	/15cm	182
180.3		5	SS	157	/15cm	
12.3	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

15-○-5 (20 above, 10 below) (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P31

 METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 871 079.4, E 364 649.2 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 27 CHECKED BY KA

ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
174.4	Ground Surface										
0.0	Silty Clay to Clayey Silt Some Sand, Trace Gravel V. Stiff to Hard (Glacial Till)					▼	174				
			1	SS	25						
							172				
			2	SS	42						
							170				
			3	SS	55						
			4	SS	55		168				
	Lacustrine										
			5	SS	128						
							166				
164.8			6	SS	122						
9.6	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P32

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 871 347.3, E 365 431.0 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 30 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
172.9	Ground Surface										
0.0	Silty Clay, Trace of Sand, Trace of Gravel						172				
			1	SS	19						
							170				
			2	SS	43						
						▼					
	Stiff to Hard		3	SS	13		168				
	Firm		4	SS	6						
							166				
			5	SS	5						
							164				
163.3			6	SS	8						
9.6	End of Borehole										

Legend: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; DCPT scale 20 40 60 80 100; shear strength 20 40 60 80 100; water content 10 20 30; w_P (plastic limit), w (natural moisture content), w_L (liquid limit)

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P33

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 871 673.1, E 367 022.7 ORIGINATED BY TC & VB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 27 CHECKED BY KA

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	ELEVATION SCALE
178.2	Ground Surface				
0.0	Silty Sand, Trace of Clay, With Some Gravel (Glacial Till)				178
		1	SS	9	
175.8 / 2.4	Silty Clay to Clayey Silt, Some Sand, Trace Gravel, V. Stiff to Hard (Glacial Till)				176
		2	SS	47	
					174
		3	SS	37	
		4	SS	23	172
		5	SS	36	
					170
168.6		6	SS	21	
9.6	End of Borehole				

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_p, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P34

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 871 786.0, E 367 844.0 ORIGINATED BY TC

DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 30 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
188.4	Ground Surface					
0.0	Clayey Silt Some Sand, Trace of Gravel V. Stiff to Hard (Glacial Till)	1	SS	19		188
		2	SS	41		186
184.4 4.0	Silty Sand to Sandy Silt Trace of Clay, Trace of Gravel V. Dense (Glacial Till)	3	SS	55		184
		4	SS	90		182
181.4 7.0	Silty Clay to Clayey Silt Some Sand, Trace of Gravel V. Stiff to Hard (Glacial Till)	5	SS	38		180
		6	SS	29	▼	
		7	SS	42		178
175.8		8	SS	164	/25cm	176
12.6	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100

PLASTIC LIMIT w_p, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%): GR SA SI CL

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15-◇-5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P35

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 872 244.1, E 369 422.3 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 25 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
184.4	Ground Surface										
0.0	Silty Sand to Sandy Silt Trace of Clay, Trace of Gravel V. Dense (Glacial Till)		1	SS	66	▽	184				
			2	SS	77		182				
			3	SS	81		180				
			4	SS	83		178				
			5	SS	152		176				
174.8			6	SS	125						
9.6	End of Borehole										

Plot legend: Dynamic cone penetration resistance plot 20 40 60 80 100; Shear strength kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE; 20 40 60 80 100. Plastic limit w_P, Natural moisture content w, Liquid limit w_L; Water content (%) 10 20 30.

$+^3$, $\times^5$: Numbers refer to Sensitivity   20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P36

METRIC

W.P. 326-88-01

LOCATION Coords.: N 4 873 130.2, E 370 875.9

ORIGINATED BY TB

DIST 6 HWY 407

BOREHOLE TYPE Solid Stem

COMPILED BY LO

DATUM Geodetic

DATE 1994 05 25

CHECKED BY KA

ELEV DEPTH	DESCRIPTION (SOIL PROFILE)	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
171.9	Ground Surface					
0.0	Silty Sand Trace of Clay, Trace of Gravel Compact to V. Dense (Glacial Till)					
		1	SS	18		170
		2	SS	48		168
		3	SS	63		
		4	SS	63	▼	166
		5	SS	28		164
162.3		6	SS	20		
9.6	End of Borehole					

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED; + FIELD VANE; ● QUICK TRIAXIAL; × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P; NATURAL MOISTURE CONTENT w; LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P37

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 873 565.4, E 371 610.1 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
191.0	Ground Surface					
0.0	Silty Sand to Sandy Silt, Trace of Clay, Trace of Gravel, V. Dense					190
		1	SS	195		188
						186
		2	SS	54		
184.0 / 7.0	Clayey Silt, Some Sand, Trace of Gravel, Hard (Glacial Till)				▼	184
		3	SS	185	/28cm	
		4	SS	120	/13cm	182
180.2 / 10.8	End of Borehole	5	SS	117	/15cm	

Column headings also printed: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P38

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 874 706.1, E 373 460.3 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

ELEV DEPTH	SOIL PROFILE DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
202.3	Ground Surface					
0.0	Silty Sand Trace of Clay, Trace of Gravel Occasional Pockets of Gravel Compact to V. Dense (Glacial Till)					202
		1	SS	30		200
		2	SS	28		198
		3	SS	35		196
		4	SS	46	▼	194
		5	SS	33		
192.8		6	SS	92	/18cm	
9.5	End of Borehole					

Column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; GROUND WATER CONDITIONS; ELEVATION SCALE; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity

20 15◇5 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P39

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 875 662.9, E 374 279.7 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 30 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
244.4	Ground Surface					
0.0	Silty Sand to Sandy Silt Trace of Clay, Trace of Gravel Occasional Layers of Gravelly Sand Compact to V. Dense (Glacial Till)				*	
		1	SS	18		
		2	SS	37		
		3	SS	120		
	Sandy Gravel	4	SS	99		
		5	SS	120	/12cm	
232.0 12.3	End of Borehole	6	SS	123	/15cm	

* Ground Water Not Established

Elevation scale: 244, 242, 240, 238, 236, 234

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³

$+^3, \times^5$: Numbers refer to Sensitivity   15-○-5 (20 above, 10 below) (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P40

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 876 521.2, E 374 481.4 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 26 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L / WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
255.9	Ground Surface										
0.0	Clayey Silt Some Sand, Traces of Gravel Stiff (Glacial Till)		1	SS	11		254				
			2	SS	8	▼					
252.0 4.0	Silt to Silty Sand V. Dense		3	SS	49		252				
			4	SS	94		250				
			5	SS	25		248				
246.3			6	SS	57						
9.6	End of Borehole										

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P41

METRIC

W.P. 326-88-01 LOCATION Coords.: N 4 878 682.4, E 374 562.7 ORIGINATED BY TB

DIST 6 HWY 407 BOREHOLE TYPE Solid Stem COMPILED BY LO

DATUM Geodetic DATE 1994 05 30 CHECKED BY KA

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
319.0	Ground Surface						
0.0	Silty Clay to Clayey Silt Some Sand, Traces of Gravel V. Stiff to Hard				*	318	
		1	SS	26			
	Silty Sand	2	SS	17		316	
		3	SS	24		314	
313.6 / 5.5	Silt to Silty Sand V. Dense	4	SS	49			
						312	
		5	SS	48			
309.4		6	SS	144		310	
9.8	End of Borehole						
	* Ground Water Not Established						

Column headings also include: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m^3

$+^3$, x^5: Numbers refer to Sensitivity   20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3 m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

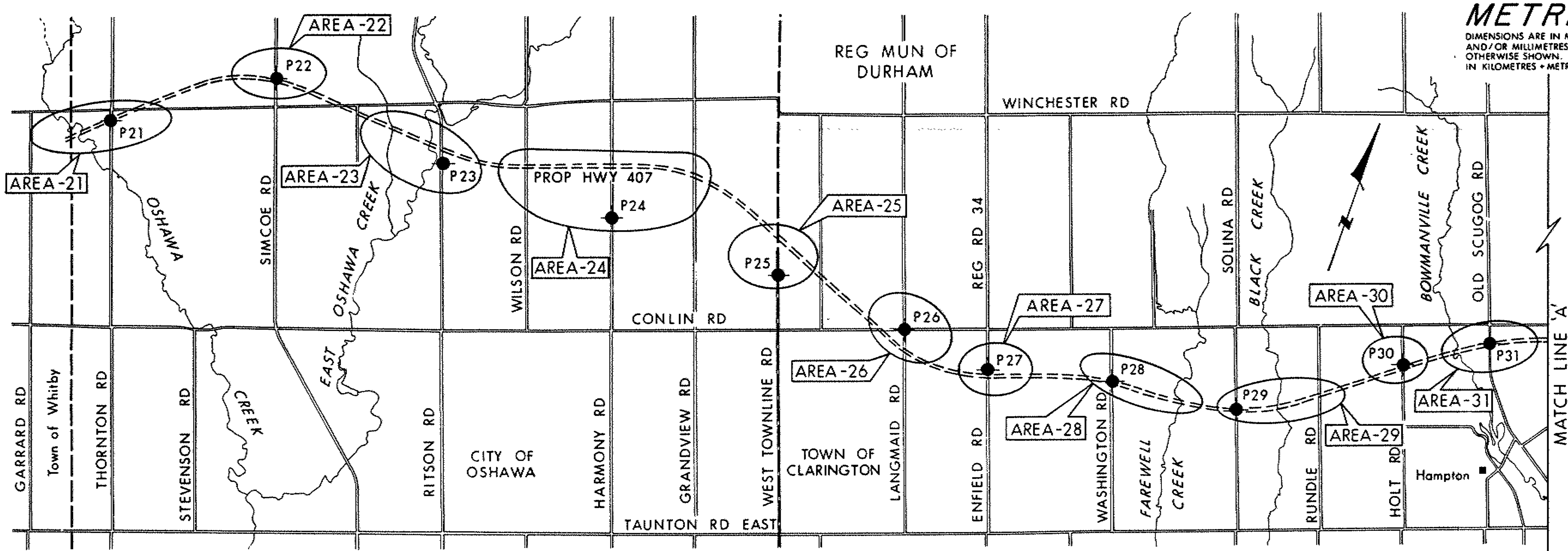
m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY $= \frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL

e	1,%	VOID RATIO
n	1,%	POROSITY
w	1,%	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_p	%	PLASTIC LIMIT
w_s	%	SHRINKAGE LIMIT
I_p	%	PLASTICITY INDEX $= w_L - w_p$
I_L	1	LIQUIDITY INDEX $= \frac{w - w_p}{I_p}$
I_C	1	CONSISTENCY INDEX $= \frac{w_L - w}{I_p}$
e_{max}	1,%	VOID RATIO IN LOOSEST STATE

e_{min}	1,%	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE



METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No

WP No 326-88-01

FEASIBILITY STUDY FOR HWY 407
FROM WHITBY/OSHAWA BOUNDARY
TO HWY 35/115
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

PLAN
SCALE
500m 0 500m

KEY PLAN
SCALE

NOTE
For Soil Details Refer to Record of Borehole Sheets

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation 1994 05

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
P21	172.0	4 868 931.8	351 038.5
P22	184.9	4 869 896.0	352 482.8
P23	166.3	4 869 724.6	354 258.5
P24	203.2	4 869 574.1	356 028.6
P25	213.2	4 869 427.6	357 821.1
P26	210.6	4 869 399.7	359 124.9
P27	205.4	4 869 259.2	360 032.5
P28	211.1	4 869 551.5	361 241.7
P29	188.5	4 869 697.3	362 491.2
P30	192.6	4 870 650.8	363 911.5
P31	174.4	4 871 079.4	364 649.2

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
21	P21	3	OSHAWA CREEK BRIDGE WBL (W)
		4	OSHAWA CREEK BRIDGE EBL (W)
		5	THORNTON RD OVERPASS WBL (I)
		6	THORNTON RD OVERPASS EBL (I)
22	P22	7	SIMCOE RD UNDERPASS (I)
23	P23	8	EAST OSHAWA CREEK BRIDGE WBL (W)
		9	EAST OSHAWA CREEK BRIDGE EBL (W)
		10	RITSON RD OVERPASS-ALT A (GS)
		11	RITSON RD OVERPASS-ALT A (GS)
24	P24	12	WILSON RD UNDERPASS-ALT A (GS)
		13	HARMONY RD UNDERPASS-ALT A (I)
		14	GRANDVIEW RD UNDERPASS-ALT A (GS)
25	P25	15	WEST TOWNLINE RD UNDERPASS-ALT A (I)
26	P26	16	CONLIN RD UNDERPASS-ALT A (GS)
		17	LANGMAID RD UNDERPASS-ALT A (GS)

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
27	P27	18	REGIONAL RD 34 OVERPASS WBL-ALT A (I)
		19	REGIONAL RD 34 OVERPASS EBL-ALT A (I)
28	P28	20	FAREWELL CREEK BRIDGE WBL (W)
		21	FAREWELL CREEK BRIDGE EBL (W)
29	P29	22	SOLINA RD UNDERPASS (GS)
		23	RUNDLE RD OVERPASS WBL (I)
		24	RUNDLE RD OVERPASS EBL (I)
30	P30	25	HOLT RD UNDERPASS (GS)
31	P31	26	BOWMANVILLE CREEK BRIDGE WBL (W)
		27	BOWMANVILLE CREEK BRIDGE EBL (W)
		28	OLD SCUGOG RD OVERPASS WBL (GS)
		29	OLD SCUGOG RD OVERPASS EBL (GS)

LEGEND

W - WATERCOURSE STRUCTURE SITES
GS - GRADE SEPARATED STRUCTURE SITES
I - INTERCHANGE STRUCTURE SITES

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen Cond

REV.	DATE	BY	DESCRIPTION

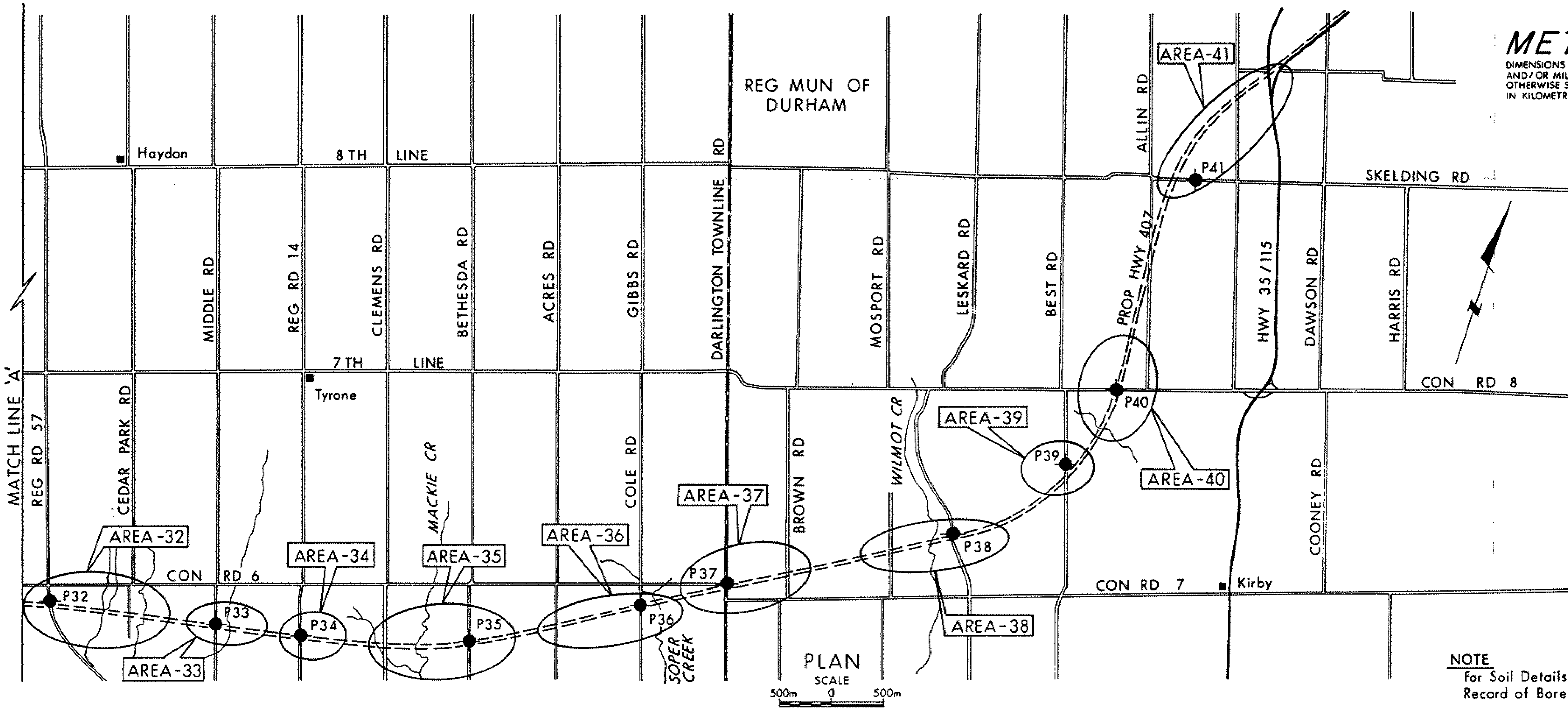
Geocres No 30M15-85

HWY No 407			DIST 6
SUBM'D KA	CHECKED	DATE 1994 08 08	SITE

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-207 88-10

CONT No	
WP No 326-88-01	
FEASIBILITY STUDY FOR HWY 407 FROM WHITBY/OSHAWA BOUNDARY TO HWY 35/115 BORE HOLE LOCATIONS & SOIL STRATA	SHEET

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.



NOTE
For Soil Details Refer to Record of Borehole Sheets

KEY PLAN
SCALE

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
32	P32	30	REGIONAL RD 57 OVERPASS WBL (I)
		31	REGIONAL RD 57 OVERPASS EBL (I)
		32	CREEK EAST OF REG RD 57 BRIDGE WBL (W)
		33	CREEK EAST OF REG RD 57 BRIDGE EBL (W)
		34	CEDAR PARK RD OVERPASS WBL (GS)
		35	CEDAR PARK RD OVERPASS EBL (GS)
		36	CREEK EAST OF CEDAR PARK RD BRIDGE WBL (W)
		37	CREEK EAST OF CEDAR PARK RD BRIDGE EBL (W)
33	P33	38	MIDDLE RD OVERPASS WBL (GS)
		39	MIDDLE RD OVERPASS EBL (GS)
		40	CREEK EAST OF MIDDLE RD BRIDGE WBL (W)
		41	CREEK EAST OF MIDDLE RD BRIDGE EBL (W)
34	P34	42	REGIONAL RD 14 UNDERPASS (I)
35	P35	43	CLEMENS RD OVERPASS WBL (GS)
		44	CLEMENS RD OVERPASS EBL (GS)
		45	MACKIE CREEK BRIDGE WBL (W)
		46	MACKIE CREEK BRIDGE EBL (W)
		47	BETHESDA RD OVERPASS WBL (I)
		48	BETHESDA RD OVERPASS EBL (I)

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
36	P36	49	ACRES RD UNDERPASS (GS)
		50	COLE RD OVERPASS WBL (GS)
		51	COLE RD OVERPASS EBL (GS)
		52	SOPER CREEK BRIDGE WBL (W)
		53	SOPER CREEK BRIDGE EBL (W)
37	P37	54	DARLINGTON TOWNLINE RD U'PASS (I)
		55	BROWN RD UNDERPASS (GS)
38	P38	56	MOSPORT RD OVERPASS WBL (GS)
		57	MOSPORT RD OVERPASS EBL (GS)
		58	WILMOT CREEK BRIDGE WBL (W)
		59	WILMOT CREEK BRIDGE EBL (W)
		60	LESKARD RD OVERPASS WBL (GS)
		61	LESKARD RD OVERPASS EBL (GS)
39	P39	62	BEST RD UNDERPASS (GS)
40	P40	63	CREEK EAST OF BEST RD BRIDGE WBL (W)
		64	CREEK EAST OF BEST RD BRIDGE EBL (W)
		65	CON RD 8 OVERPASS WBL (GS)
		66	CON RD 8 OVERPASS EBL (GS)
41	P41	67	SKELDING RD UNDERPASS (GS)
		68	HWY 35/115 UNDERPASS (I)

LEGEND

W - WATERCOURSE STRUCTURE SITES
GS - GRADE SEPARATED STRUCTURE SITES
I - INTERCHANGE STRUCTURE SITES

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation 1994 05

No	ELEVATION	CO-ORDINATES NORTH	EAST
P32	172.9	4 871 347.3	365 431.0
P33	178.2	4 871 673.1	367 022.7
P34	188.4	4 871 786.0	367 844.0
P35	184.4	4 872 244.1	369 422.3
P36	171.9	4 873 130.2	370 875.9
P37	191.0	4 873 565.4	371 610.1
P38	202.3	4 874 706.1	373 460.3
P39	244.4	4 875 662.9	374 279.7
P40	255.9	4 876 521.2	374 481.4
P41	319.0	4 878 682.4	374 562.7

NOTE
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen Cond

REV.	DATE	BY	DESCRIPTION

Geocres No 30M15-85

HWY No 407			DIST 6
SUBM'D KA	CHECKED	DATE 1994 08 08	SITE
DRAWN DT	CHECKED	APPROVED	DWG 3268801-B

REF No NTS Maps 30M/15b & 30M/15g

FILE COPY

Ministry of Transportation
Ontario

FOUNDATION DESIGN SECTION

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 282-86-01 DIST 6

HWY 407 STR SITE

Preliminary Design Study for Proposed Hwy. 407
From Hwy. 48 to Whitby/Oshawa Boundary

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 282-86-01 DIST 6

HWY 407 STR SITE

Preliminary Design Study for Proposed Hwy. 407
From Hwy. 48 to Whitby/Oshawa Boundary

DISTRIBUTION

V.F. Boehnke (3)
D. Billings
W. Peck (2)
B. Peltier (3)
M. Holowka
J. Robinson
E.A. Joseph
F. Bacchus (Cover Only
File

GEOCRES 30M14-227 DATE AUG 04 1994

FOUNDATION INVESTIGATION REPORT
For
Preliminary Design Study For
Proposed Hwy 407
From Hwy 48 to Whitby/Oshawa Boundary
W.P. 282-86-01, District 6, Toronto

INTRODUCTION

This report summarizes the results of our foundation investigation carried out for the preliminary design study of the proposed Hwy 407 at the above location. This investigation is intended for initial assessment of the feasibility of the proposed alignment from a foundation point of view, with a general coverage of the area by limited number of boreholes. The recommendations given in the report are tentative based on the limited information available and should definitely be reviewed based on supplementary investigations.

Fieldwork was carried out during the period of 93 12 06 to 94 01 12 and is consisted of a total of fifteen (15) sampled boreholes advanced to depths ranging from 10.8 to 27.9 m below ground surface. A desk study carried out before the commencement of the fieldwork has revealed borehole information from existing reports that are relevant to the current design alignment. This information has been extracted and incorporated in this report.

SITE DESCRIPTION

The area investigated extends from the east end of the Town of Markham through the Town of Pickering to the east boundary of the Town of Whitby. The alignment of the proposed Hwy 407 in this area runs more or less in an east-west direction in the vicinity of Hwy 7. It is located within one km south of the existing Hwy 7 from Hwy 48 to around Sideline 16 in Pickering where it cuts across Hwy 7. From there on, it is located within one km approximately north of Hwy 7. It then runs south and intersects Hwy 7 again just east of Cochrane St. in Whitby. From this point on, it stays within one km south of Hwy 7/Winchester Road through the east end of Whitby. The proposed route is illustrated in Drawing Nos. 2828601-A & B.

The existing ground elevation varies from 180 ± m at Hwy 48 to 225 ± m just east of Sideline 24 and dips from there to 140 ± m at Duffins Creek. The grade elevation then goes up easterly to 200 ± m just east of Kinsale Road and smooths off gently to 170 ± m at the east end of Whitby. The topography of the terrain is generally flat to undulating, except at major river or creek locations where relatively deep valleys can be found.

Most of the land along the proposed highway alignment has been cleared and cultivated. Other land use such as residential and commercial developments may be found in towns and along major roads.

Physiographically, the area is located in two regions known as the Peel Plain and South Slope (after Chapman & Putnam, 1984). These regions generally comprise glacial till deposits containing shale and limestone, with lacustrine clay and silt probably reworked by the glacier.

INVESTIGATION PROCEDURES

Soil data and inherent properties were obtained by in-situ and laboratory testing. The procedures employed are discussed below.

Field

The field work for the investigation was carried out between 93 12 06 and 94 01 12 and consisted of fifteen (15) sampled boreholes with dynamic cone penetration tests. The boreholes were advanced to depths of 10.8 - 27.9 m.

The boreholes were advanced with a truck mounted machine equipped with continuous flight augers. Conventional hollow stem or solid stem augers were used supplemented by washboring with BW size casings in some boreholes. The sampling program consisted of split spoon samples collected in the overburden. Disturbed subsoil samples were retrieved by split spoon sampler in accordance with Standard Penetration Test (ASTM D1586). Standard Penetration ('N') values were recorded for assessment of the strength of the materials encountered. All subsoil samples were identified in the field and returned to the laboratory for further examination and appropriate testing. Dynamic Cone Penetration tests were carried out adjacent to each borehole. Groundwater levels were measured in each borehole and all boreholes were backfilled upon completion of the field work.

Surveying required to ascertain borehole locations and elevations was carried out by the Central Region Surveys and Plans Section.

Laboratory

The laboratory testing on selected soil samples consisted of the following:

- Atterberg Limit Test
- Grain Size Distribution
- Natural Moisture Content Determination

Laboratory test results are illustrated on Record of Borehole sheets included in the Appendix.

SUBSURFACE CONDITIONS

Reference should be made to the Record of Borehole sheets contained in the Appendix for subsurface conditions at a particular location. The locations and elevations of the borings are shown on Dwg. Nos. 2828601-A & B.

The predominant soil strata encountered in the boreholes consisted of glacial till with occasional sand layers and silt zones. Silty clay was contacted at two of the boreholes (BH P7 and P8) in the valley with the lowest ground elevations of the area investigated. A surficial layer of granular fill was generally found in all the boreholes as the holes were advanced from existing roads. Bedrock was not encountered at the termination depth of the boreholes.

The glacial till encountered is a heterogeneous mixture of clayey silt, sand and gravel for cohesive tills and a heterogeneous mixture of silt, sand and gravel for non-cohesive tills. Based on the 'N' values of the Standard Penetration test, the glacial till has a hard consistency in the case of a cohesive matrix and a very dense relative density in the case of a non-cohesive matrix. The sand layers or silt zones encountered are also competent with dense to very dense relative density according to the 'N' values obtained. The consistency of silty clay varies widely from hard in BH P8 to soft to stiff in BH P7.

Groundwater level was measured in the open boreholes during the investigation and is given in the Record of Borehole sheet for each borehole. Groundwater levels are subject to seasonal fluctuations and may vary from the values provided in this report.

DISCUSSION AND RECOMMENDATIONS

This report covers the proposed Hwy 407 alignment from Hwy 48 to the Whitby/Oshawa boundary over a distance of about 25 km. The current investigation is intended to collect minimum subsoil information to allow an initial assessment of the feasibility of the proposed route from a foundation point of view. Additional data collected from existing reports are also incorporated.

The subsurface conditions at the various structure sites and the corresponding tentative foundation recommendations are summarized in tabular form on the following pages.

It should be noted that the tentative foundation recommendations provided are for feasibility study or preliminary planning purposes only as they are based on very limited subsurface information. It will be necessary to carry out a detailed investigation at each structure site location when a structure scheme and a profile grade have been decided on.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of D. Kwok, Project Foundation Engineer. The equipment was owned and operated by Master Soils Investigation Ltd.

The project was carried out by D. Kwok under the supervision of B. Iyer, Senior Foundation Engineer. This report was prepared by D. Kwok, reviewed by P. Payer, Senior Foundation Engineer and approved by D. Dundas, Acting Chief Foundation Engineer.

LICENSED PROFESSIONAL ENGINEER
W. D. KWOK
94 07 26
PROVINCE OF ONTARIO

D. Kwok, P. Eng.
Project Foundation Engineer

D. Dundas

D. Dundas, P. Eng.
Acting Chief Foundation Engineer

REGISTERED PROFESSIONAL ENGINEER
D. H. DUNDAS
PROVINCE OF ONTARIO

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 1 Struct. No. 01 : Markham Rd Underpass

Ground Elevation : 180.8 m Proposed Hwy 407 Grade Elevation : 175 ± m
at BH Location

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Boreholes</u> (W.P. 90-78-00) BH C12 - 0-1.8m Roadway Fill 1.8-15.7 m V. Stiff glacial till Groundwater - 173 ± m	1. Spread footings placed within the very stiff glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=500kPa Bearing Capacity at SLS Type II=300kPa 2. Alternatively, spread footings can be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cuts up to 8 m can be constructed with side slopes of 2H:1V 4. Major subsoil deposit is of low permeability and ground water table is close to proposed Hwy 407 grade. It is not a feasible site for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01   Area : 2   Struct. No. 02 : Rouge River Bridge WBL
No. 03 : Rouge River Bridge EBL

Ground Elevation at BH Location : C13 178.7m, C14 178.6m   Proposed Hwy 407 Grade Elevation : 178 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Boreholes (W.P.90-78-00) BH C13 (WBL) 0-0.3m Topsoil 0.3-22.9m V. stiff glacial till 22.9-27.6m V. dense glacial till BH C13B (EBL) 0-15.7m Stiff to V. stiff glacial till Groundwater - BH C13 168 m BH C13B not established	1. Spread footings placed within the very stiff glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=500kPa Bearing Capacity at SLS Type II=300kPa 2. Alternatively, spread footings can be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. End bearing piles to an elevation of 153±m 4. Fills up to 8 m can be constructed with side slopes of 2H:1V 5. Base groundwater table at 10 ±m below proposed Hwy 407 grade. Subsoil is of low permeability at this depth. The site is not ideal for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 3 Structure No. 4 : 9th Line Underpass

Ground Elevation : 182.4 m at BH Location Proposed Hwy 407 Grade Elevation : 183.6 $\pm$ m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref Borehole</u> (W.P.90-78-00) BH C14 0-1.5 m Roadway Fill 1.5-15.7 m Hard glacial till Groundwater - Not established	1. Spread footings placed within the hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not control 2. Fills up to 8 m can be constructed with side slopes of 2H:1V 3. Subsoil is generally of low permeability. It is not an ideal site for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 4 Structure No. 5 : N-S Arterial Road Underpass

Ground Elevation : 192.9 m at BH Location Proposed Hwy 407 Grade Elevation : 195.6 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P. 25-69-00) BH 11 0-13.9 m Hard glacial till Groundwater - Not established	1. Spread footings placed within the hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not control 2. Fills up to 8 m can be constructed with side slopes of 2H:1V 3. Subsoil is generally of low permeability. It is not an ideal site for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 5 Struct Nos. 06/07 : 10th Line Overpass
08/09 : CPR Overhead
10/11 : Little Rouge River Bridge

Ground Elevation : 193.4 m Proposed Hwy 407 Grade Elevation : 196.2 ± m
at BH Location 200.8 ± m
199.6 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P.282-86-01) BH P1 0-0.6 m Granular Fill 0.6-10.8 m Hard glacial till Groundwater - 186.6 m	1. Spread footings placed within the hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=700 kPa Bearing Capacity at SLS Type II does not govern. 2. Abutment footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Fills up to 12 m can be constructed at 2H:1V with a 2 m wide mid-height berm 4. Major subsoil deposit is of low permeability and the sites are not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 6 Struct. No.20 : Regional Road #30 Underpass

Ground Elevation : 205.3 m Proposed Hwy 407 Grade Elevation : 212 ± m
at BH Location

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P. 282-86-01) BH P2 0-0.8m Granular Fill 0.8-12.4m V. Stiff to Hard glacial till Groundwater - 195.4 m	1. Spread footings placed within the hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=700 kPa Bearing Capacity at SLS Type II does not govern 2. Abutment footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Fills up to 8 m can be constructed at side slopes of 2H:1V. 4. Subsoil is generally of low permeability. It is not an ideal site for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 7 Struct. Nos. 21/22 : West Duffin Creek Bridge

Ground Elevation : 176.2 m at BH Location Proposed Hwy 407 Grade Elevation : 186 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P. 69-65-02) BH 3 0-1m Firm Clayey Silt	1. Spread footings placed within dense to very dense sand and gravel material below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=700kPa Bearing Capacity at SLS Type II does not govern.	Prior dewatering is required for footing construction on sand and gravel
1-11.1m Dense to V.Dense Sand and Gravel	2. Alternatively, footings can be placed on a well compacted Granular 'A' pad built on the sand and gravel stratum and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Fills up to 12 m can be constructed at 2H:1V with a 2 m wide mid-height berm. 4. High groundwater table with local artesian conditions. The site is not recommended for infiltration ponds.	Artesian conditions were found in boreholes south of West Duffin Creek @170 m. Water came up to 300 mm above ground level
Groundwater - 175.4 m		

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 9 Struct. No. 24 : Sideline 24 Underpass

Ground Elevation : 215.6 m Proposed Hwy 407 Grade Elevation : 216 $\pm$ m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P. 282-86-01) BH P4 0-1.5m Fill 1.5-10.8m Hard glacial till Groundwater - dry	1. Spread footings placed within the hard glacial till stratum below El. 216 m and the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not govern. 2. Abutment footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Subsoil is generally of low permeability. The site is not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01

Area : 10 Struct. No. 25 : Brock Road Underpass
No. 26 : Sideline 16 Underpass
No. 27&28 : Hwy 7 Overpass WBL/EBL

Ground Elevation : 192.4 m
at BH Location

Proposed Hwy 407 Grade Elevation : 189 ± m
179 ± m
174 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P. 282-86-01) BH P5 0-0.9m Granular Fill 0.9-5.3 m Stiff to Hard Till 5.3-9.9m V. Dense Sand/Silt 9.9-10.8m Hard glacial till Groundwater - 186.1 m	1. Spread footings placed within the hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=700kPa Bearing Capacity at SLS Type II does not govern. 2. Alternatively, footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II =350kPa 3. Cuts/Fills up to 10 m may be constructed at 2H:1V with a 2 m wide mid-height berm for fill heights or cut depths over 8 m. 4. Groundwater table generally close to proposed Hwy 407 grade. The site is not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 11 Structure No. 31 : Sideline 14 Underpass
Nos.40&41 : Structures @ Sideline 14 I/C

Ground Elevation : 167.1 m at BH Location Proposed Hwy 407 Grade Elevation : 164 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P.282-86-01) BH P6 0-3.4 m Fill 3.4-6.9 m V. Stiff to Hard Till 6.9-15.7m Compact to Dense Silty Sand Groundwater - 165.3 m	1. Spread footings placed within the glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=600kPa Bearing Capacity at SLS Type II=350kPa 2. Abutment footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut slopes may be formed at 2H:1V with a 2 m berm every 8 m up to a maximum height of 25 m. 4. Groundwater table close to proposed Hwy 407 grade. The site is not recommended for infiltration ponds.	Cuts up to 25±m high may be required west of the structure

FOUNDATION DATA SHEET

W.P. 282-86-01 | Area : 12 | Struct. No.32 : Paddock Road Underpass
Nos.33&34 : East Duffin Creek Bridge
No.35 : Westney Road Underpass

Ground Elevation : 145.4 m at BH Location | Proposed Hwy 407 Grade Elevation : 154 ± m
157 ± m
153 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P.282-86-01) BH P7 0-2.3m Granular Fill 2.3-3.5m Peat 3.5-5.3m Dense Alluvial Sand 5.3-11.4m Soft to Stiff Silty Clay 11.4-15.2m Compact Silty Sand 15.2-17.5m V. Stiff Silty Clay 17.5-18.7m Compact Silty Sand Groundwater - 147.6 m	1. Footings elements can be supported by piles driven to an end bearing stratum below El. 131 m, to be determined by additional investigation. 2. All organic material has to be removed prior to placement of fill 3. Stability and geometry of fill embankment has to be determined by additional investigation at structure locations. 4. Permeable sand layers are intercepted by clay strata of low permeability. The sites are not recommended for infiltration ponds.	Additional investigation is required to determine the pile founding stratum and stability of embankment

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 13 Structure 36 : Salem Road Underpass

Ground Elevation : 170.7 m Proposed Hwy 407 Grade Elevation : 166 ± m
at BH Location

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P.282-86-01) BH P8 0-0.5m Granular Fill 0.5-7.6m V. Stiff to Hard Till 7.6-10.7m Dense to V. dense Sand 10.7-19.1m Dense to V. dense Silt 19.1-27.9m Hard Silty Clay Groundwater - 168.8 m	1. Spread footings placed within the hard glacial till below the frost depth (1.2m) can be designed with Factored Bearing Capacity at ULS=700kPa Bearing Capacity at SLS Type II does not govern. 2. Alternatively, footings may be placed on a well compacted Granular 'A' pad and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut slopes may be formed at 2H:1V up to a maximum depth of 8 m. 4. Groundwater table close to proposed Hwy 407 grade. Not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 14 Struct. No.37 : Side Road #4 Underpass
No.38 : Kinsale Road Underpass

Ground Elevation : 181.1 m at BH Location Proposed Hwy 407 Grade Elevation : 177 ± m
192 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref Borehole (W.P. 282-86-01) BH P9 0-0.5m Granular Fill 0.5-1.5m Clayey Silt Fill 1.5-23.3m V. Stiff to Hard Till Groundwater - 177.7 m	1. Spread footings placed within hard glacial till below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not govern 2. Abutment footings may be placed on a well compacted Granular 'A' pad and designed with Factored Bearing Capacity at ULS =900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut slopes may be formed at 2H:1V up to 10 m deep with a 2m wide mid-height berm for cuts deeper than 8 m. 4. Subsoil generally of low permeability. Not an ideal site for infiltration ponds.	Cuts up to 10 m deep may be required between the two structures

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 15 Struct No. 39 : Regional Road 23 Underpass
No. 50 : Halls Road Underpass

Ground Elevation : 191.4 m at BH Location Proposed Hwy 407 Grade Elevation : 194 ± m
186 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P. 282-86-01) BH P10 0-0.8 m Granular Fill 0.8-7.0m Hard glacial till 7.0-9.1m Very Dense Silty Sand 9.1-12.2m Very Dense glacial till 12.2-15.4m Hard glacial till Groundwater - 192 m	1. Spread footings placed within hard glacial till below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not govern 2. Cut/fill slopes may be formed at 2H:1V up to 8 m maximum. 3. Groundwater table close to proposed Hwy 407 grade. The site is not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 16 Structure No.51 : Coronation Road Underpass
Nos.52&53 : West Lynde Creek Bridge
No.54 : Country Lane Road Underpass

Ground Elevation : 167.2 m at BH Location

Proposed Hwy 407 Grade Elevation : 168 ± m
161 ± m
157 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P. 282-86-01) BH P11 0-0.3m Granular Fill 0.3-1.5m Fill 1.5-21.8m Stiff to Hard glacial till Groundwater - dry	1. Spread footings placed within hard glacial till below 163 ± m and the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=1000kPa Bearing Capacity at SLS Type II does not govern 2. Alternatively, footings may be placed on a well compacted Granular 'A' pad built over native glacial till material and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut/fill slopes may be formed at 2H:1V to 10 m maximum with a mid-height berm for slopes more than 8 m high. 4. No aquifer encountered during the investigation. Subsoil generally dry and of low permeability. The site is not recommended for infiltration ponds.	Cuts up to 10 ± m may be required in the vicinity of the structures.

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 17

Struct No.55 : Cochrane Street Underpass
No.56 : Hwy 7 Underpass
No.57 : Regional Road #41 Underpass

Ground Elevation : 161.5 m
at BH Location

Proposed Hwy 407 Grade Elevation : 161 ± m
164 ± m
164 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P.282-86-01) BH P12 0-0.8m Granular Fill 0.8-3.8m Very Stiff to hard till 3.8-20.4m Compact to very dense till 20.4-24.8m Hard till Groundwater - 159.3 m	1. Spread footings placed within the upper very stiff to hard glacial till stratum below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=500kPa Bearing Capacity at SLS Type II=300kPa 2. Alternatively, footings may be placed on a well compacted Granular 'A' pad built over native soils and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. End bearing piles may be founded within the lower hard till stratum at 137.5 ± m. 4. Cut/fill slopes may be formed at 2H:1V up to 8 m maximum. 5. Major aquifer in non-cohesive till with sand layers. The sites may be feasible for construction of infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 18 Structure No.58 : Hwy 12 Underpass

Ground Elevation : 158.8 m Proposed Hwy 407 Grade Elevation : 157 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P.282-86-01) BH P13 0-0.5m Granular Fill 0.5-1.4m Fill 1.4-2.1m Very Stiff Till 2.1-6.1m Dense to very dense till 6.1-12.4m Hard till Groundwater - 157.3 m	1. Spread footings placed within dense to very dense till below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=700kPa Bearing Capacity at SLS Type II does not govern 2. Abutment footings may be placed on a well compacted Granular 'A' pad built over native soils and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut/fill slopes may be formed at 2H:1V up to 8m maximum. 4. Groundwater level close to proposed Hwy 407 grade. The site is not recommended for infiltration ponds.	

FOUNDATION DATA SHEET

W.P. 282-86-01   Area : 19   Struct. Nos. 59 & 60 : Lynde Creek Bridge
61 : Anderson Road Underpass

Ground Elevation : 156.8 m   Proposed Hwy 407 Grade Elevation : 156 ± m
156 ± m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
Ref. Borehole (W.P.282-86-01) BH P14 0-0.8m Granular Fill 0.8-1.5m Fill 1.5-11.4m Hard till 11.4-20.6m Very dense silty sand with gravel 20.6-23.0m Hard till Groundwater - 152.6 m	1. Spread footings placed within the hard glacial till below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=500kPa Bearing Capacity at SLS Type II=300kPa 2. Abutment footings may be placed on a well compacted Granular 'A' pad built over native soils and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut/fill slopes may be formed at 2H:1V up to 8 m maximum. 4. Aquifer in silty sand stratum some 10 m below proposed Hwy 407 grade. Site No. 61 may be feasible for the construction of infiltration ponds. Site Nos. 59 & 60 are located next to Main Lynde Creek and are therefore environmentally sensitive.	

FOUNDATION DATA SHEET

W.P. 282-86-01 Area : 20 Struct. No.62 : Thickson Road Underpass
No.63 : Garrard Road Underpass

Ground Elevation : 172.2 m Proposed Hwy 407 Grade Elevation : 164 $\pm$ m
at BH Location 173 $\pm$ m

SUBSURFACE CONDITIONS	RECOMMENDATIONS	REMARKS
<u>Ref. Borehole</u> (W.P.282-86-01) BH P15 0-0.8m Granular Fill 0.8-8.4m Hard Till 8.4-17.0m Very dense till Groundwater - 168.2 m	1. Spread footings placed within hard glacial till below the frost depth (1.2 m) may be designed with Factored Bearing Capacity at ULS=650kPa Bearing Capacity at SLS Type II=400kPa 2. Abutment footings may be placed on a well compacted Granular 'A' pad built over native soils and be designed with Factored Bearing Capacity at ULS=900kPa Bearing Capacity at SLS Type II=350kPa 3. Cut/fill slopes may be formed at 2H:1V up to 8 m maximum. 4. Aquifer in non-cohesive till stratum some 10 m below the proposed Hwy 407 grade at Struct. No. 63. Groundwater level is at about 5 m below Hwy 407 grade. The site may be feasible for the construction of infiltration ponds.	

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS $\overline{N}$

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3 m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R.Q.D.), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S.S.	SPLIT SPOON	T.P.	THINWALL PISTON
W.S.	WASH SAMPLE	O.S.	OSTERBERG SAMPLE
S.T.	SLOTTED TUBE SAMPLE	R.C.	ROCK CORE
B.S.	BLOCK SAMPLE	P.H.	T.W. ADVANCED HYDRAULICALLY
C.S.	CHUNK SAMPLE	P.M.	T.W. ADVANCED MANUALLY
T.W.	THINWALL OPEN	F.S.	FOIL SAMPLE

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	$-°$	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	$-°$	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY $= \frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES
ρ_w	kg/m^3	DENSITY OF WATER
γ_w	kN/m^3	UNIT WEIGHT OF WATER
ρ	kg/m^3	DENSITY OF SOIL
γ	kN/m^3	UNIT WEIGHT OF SOIL
ρ_d	kg/m^3	DENSITY OF DRY SOIL
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL
e	1, %	VOID RATIO
n	1, %	POROSITY
w	1, %	WATER CONTENT
S_r	%	DEGREE OF SATURATION
w_L	%	LIQUID LIMIT
w_P	%	PLASTIC LIMIT
w_S	%	SHRINKAGE LIMIT
I_P	%	PLASTICITY INDEX $= w_L - w_P$
I_L	1	LIQUIDITY INDEX $= \frac{w - w_P}{I_P}$
I_C	1	CONSISTENCY INDEX $= \frac{w_L - w}{I_P}$
e_{max}	1, %	VOID RATIO IN LOOSEST STATE
e_{min}	1, %	VOID RATIO IN DENSEST STATE
I_D	1	DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$
D	mm	GRAIN DIAMETER
D_n	mm	n PERCENT - DIAMETER
C_U	1	UNIFORMITY COEFFICIENT
h	m	HYDRAULIC HEAD OR POTENTIAL
q	m^3/s	RATE OF DISCHARGE
v	m/s	DISCHARGE VELOCITY
i	1	HYDRAULIC GRADIENT
k	m/s	HYDRAULIC CONDUCTIVITY
j	kN/m^3	SEEPAGE FORCE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P1

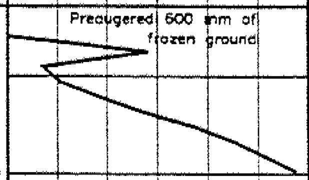
METRIC

W.P. 282-86-01 LOCATION N 4 859623.2 E 328166.1 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE S.S.Auger, Cone Test COMPILED BY DK

DATUM Geodetic DATE 94 01 12 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) 20 40 60 80 100	PLASTIC LIMIT w_p, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
193.4	Ground Surface										
0.0	Granular Fill							Preaugered 600 mm of frozen ground			
0.6	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Sand Layers, Cobbles and Boulders (Glacial Till)										
	Very Stiff		1	SS	28		192				
	Hard		2	SS	80	▼*	190				
			3	SS	100 /25cm						
	Brown / Grey		4	SS	100 /18cm		188				
			5	SS	100 /13cm		186				
			6	SS	100 /13cm		184				
182.6			7	SS	100 /15cm						
10.8	End of Borehole										



* Unstabilized water level measured upon completion of drilling on 94 01 12

$+^3$, $\times^5$: Numbers refer to Sensitivity

15 ◇ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

Foundation Design

RECORD OF BOREHOLE No P2

METRIC

W.P. 282-86-01 LOCATION N 4 860936.6 E 329984.7 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE S.S.Auger, Cone Test COMPILED BY DK

DATUM Geodetic DATE 94 01 11 - 94 01 12 CHECKED BY BI

ELEV DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%) w_P – w – w_L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.3	Ground Surface									
204.5 / 0.0	Granular Fill						Preaugered 600 mm of frozen ground			
0.8	Heterogeneous Mixture of Clayey Silt, Trace Sand, Trace Gravel, Occasional Cobbles and Boulders (Glacial Till) – Very Stiff / Hard; Brown / Grey	1	SS	21		204				
		2	SS	100/26cm		202				
		3	SS	100/28cm		200				
		4	SS	114				o ⊢⊣		6 43 42 9
		5	SS	61		198				
	Silty Sand with Gravel, Very Dense									
		6	SS	108/18cm	▽*	196				
		7	SS	120/5cm		194				
192.9		8	SS	100/18cm						
12.4	End of Borehole									

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100

WATER CONTENT (%): 10 20 30 (PLASTIC LIMIT, NATURAL MOISTURE CONTENT, LIQUID LIMIT)

* Unstabilized water level measured upon completion of drilling on 94 01 12

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P3

METRIC

W.P. 282-86-01 LOCATION N 4 862074.3 E 331845.5 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE S.S. Auger, Cone Test COMPILED BY DK

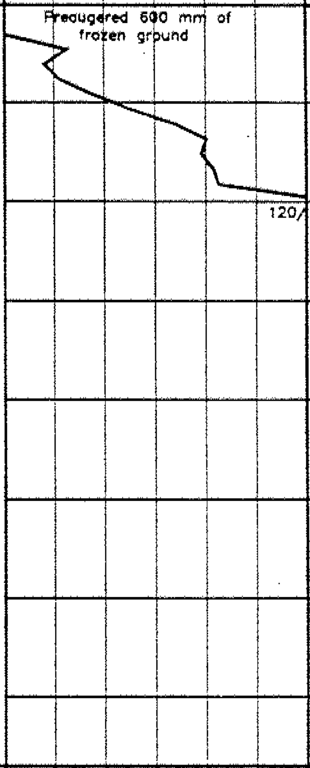
DATUM Geodetic DATE 94 01 10 – 94 01 11 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%) / PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
210.0	Ground Surface								
0.0	50mm Asphalt over Granular Fill				DRY *				
0.5	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel, Hard, Occasional Cobbles and Boulders (Glacial Till)								
		1	SS	27		208			
		2	SS	30					
	Brown / Grey	3	SS	120/8cm		206			
		4	SS	100/10cm		204	o H		2 42 42 14
		5	SS	103/15cm		202			
		6	SS	100/28cm		200			
		7	SS	101					
		8	SS	100/23cm		198			
		9	SS	100/10cm		196			
194.6		10	SS	100/15cm			o I		6 45 38 [illegible]
15.4	End of Borehole								

* Borehole dry upon completion of drilling on 94 01 11

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE: 20 40 60 80 100



$+^3, \times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P4

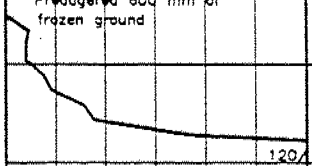
METRIC

W.P. 282-86-01 LOCATION N 4 862825.5 E 334219.0 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE S.S. Auger, Cone Test COMPILED BY DK

DATUM Geodetic DATE 94 01 10 CHECKED BY BI

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
215.6	Ground Surface									
0.0	300mm of Granular Fill over Clayey Silt Fill with Organic Inclusions, Brown (Fill)				DRY *		Preaugered 600 mm of frozen ground			
214.1 / 1.5	Heterogeneous Mixture of Clayey Silt, Trace Gravel Some Sand, Occasional Cobbles and Boulders (Glacial Till) Stiff / Hard; Brown / Grey	1	SS	14		214				
		2	SS	110 /23cm		212	120/10cm	o		14 36 33 17
		3	SS	100 /10cm		210				
		4	SS	120 /8cm						
		5	SS	120 /10cm		208				
		6	SS	120 /18cm		206		o		18 32 32 18
204.8 / 10.8	End of Borehole	7	SS	100 /18cm						



* Borehole dry upon completion of drilling on 94 01 10

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \diamond 5$ (20 above, 10 below) (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P5

METRIC

W.P. 282-86-01 LOCATION N 4 863709.4 E 336527.6 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE S.S. Auger, Cone Test COMPILED BY DK

DATUM Geodetic DATE 94 01 10 CHECKED BY BI

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.4	Ground Surface						
0.0 191.5	Granular Fill					192	
0.9	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Silt Zones, Brown (Glacial Till) Stiff / Hard	1	SS	12			
		2	SS	31		190	
187.1		3	SS	60		188	
5.3	Sandy Silt to Silty Sand Very Dense Brown / Grey	4	SS	66	▼*	186	1 27 68 4
		5	SS	85		184	
182.5		6	SS	53			
9.9 181.6	Heterogeneous Mixture of Clayey Silt, Trace Gravel, Grey, Hard	7	SS	110/18cm		182	
10.8	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

Preaugered 600 mm of frozen ground 186

High blowcounts due to frozen ground

120/28cm

* Unstabilized water level measured upon completion of drilling on 94 01 10

$+^3, \times^5$: Numbers refer to Sensitivity $15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P6

METRIC

W.P. 282-86-01	LOCATION N 4 865235.6 E 337903.4		ORIGINATED BY DK
DIST 6	HWY 407	BOREHOLE TYPE H.S. Auger, Cone Test	COMPILED BY DK
DATUM Geodetic	DATE 94 01 05 – 94 01 07		CHECKED BY BI

SOIL PROFILE

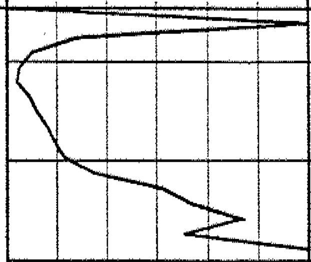
ELEV / DEPTH	DESCRIPTION
167.1	Ground Surface
0.0	Clayey Silt, Trace Gravel, Some Organic Inclusions, Brown and Grey, Firm (Fill)
163.7 / 3.4	Heterogeneous Mixture of Clayey Silt, Trace Gravel, Some Sand layers, Grey, Very Stiff to Hard (Glacial Till)
160.2 / 6.9	Silty Sand, Trace Gravel, Grey, Compact to Dense
151.4 / 15.7	End of Borehole

* Unstabilized water level measured upon completion of drilling on 94 01 07

SAMPLES

NUMBER	TYPE	'N' VALUES	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	6		
2	SS	17		
3	SS	33		
4	SS	30		
5	SS	17		
6	SS	23	o	0 42 52 6
7	SS	34		
8	SS	20		
9	SS	37	o	0 91 5 4
10	SS	68		

Column headings: GROUND WATER CONDITIONS; ELEVATION SCALE (166, 164, 162, 160, 158, 156, 154, 152); DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL



High blowcount due to frozen ground

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No P7

1 OF 1 METRIC

W.P. 282-86-01 LOCATION N 4 865854.8 E 338570.2 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DK

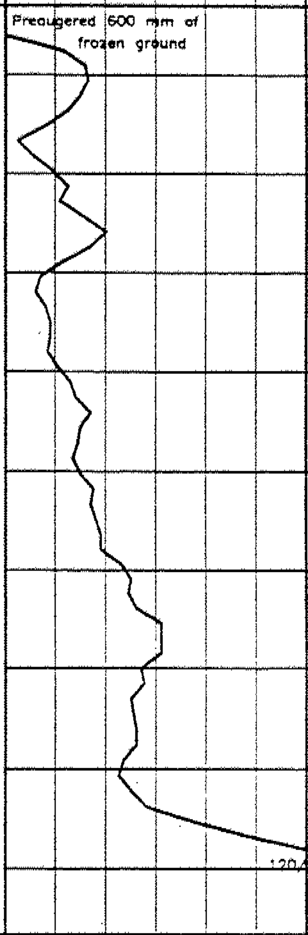
DATUM Geodetic DATE 94 01 05 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
145.4	Ground Surface				
0.0	Silty Sand, Trace Gravel, Brown and Grey, Compact (Fill)	1	SS	27	
143.1 / 2.3	Organics with Wood Fibres, Black, Loose (Peat)	2	SS	8	
141.9 / 3.5	Sand with Gravel, Trace Silt, Grey, Dense (Alluvial Deposit)	3	SS	32	
140.1 / 5.3	Silty Clay, Some silt zones, Grey, Soft to Stiff	4	SS	4	
		5	SS	6	
		6	SS	11	
		7	SS	15	
134.0 / 11.4	Silty Sand, Grey, Compact	8	SS	4**	
		9	SS	3**	
130.2 / 15.2	Silty Clay, Grey, Very Stiff	10	SS	24	
	more silty	11	SS	17	0 2 85 13
127.9 / 17.5	Silty Sand, Grey, Compact, Occasional Silt Zones	12	SS	8**	
126.7 / 18.7	End of Borehole				

Ground water conditions: water level symbol (*) at approx. elev. 143.

Elevation scale: 144, 142, 140, 138, 136, 134, 132, 130, 128

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100



SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE — 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³

* Unstabilized water level taken upon completion of drilling on 94 01 05

** Unrepresentative blowcounts due to possible disturbance caused by unbalanced hydrostatic heads

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P8

METRIC

W.P. 282-86-01 LOCATION N 4 866905.5 E 340849.2 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 21 – 93 12 24 CHECKED BY SI

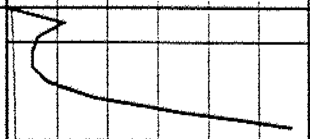
ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
170.7	Ground Surface							
0.0	Granular Fill							
0.5	Heterogeneous Mixture of Clay Silt, Trace Sand Trace Gravel, Occasional Cobbles and Boulders (Glacial Till); Very Stiff / Hard; Brown / Grey; Some Sand Layers	1	SS	17	▼*	170		
		2	SS	31				
		3	SS	51		168		
		4	SS	100/25cm				
		5	SS	45		166		
		6	SS	100/23cm		164		
163.1								
7.6	Silty Sand Dense to Very Dense Brown and Grey	7	SS	33		162		
		8	SS	74				
160.0								
10.7	Silt Trace Clay, Some Sand Grey Dense to Very Dense	9	SS	46		160		0 21 75 4
		10	SS	91		158		
		11	SS	100/18cm		156		
	Silty Sand layer	12	SS	40				
	Becoming more Clayey	13	SS	100/23cm		154		0 3 79 18
		14	SS	100		152		
151.6								
19.1	Silty Clay Grey, Hard (Lacustrine)	15	SS	76		150		
		16	SS	48				
		18	SS	70		148 / 146		
						144		
142.8		19	SS	58				
27.9	End of Borehole * 93 12 24							

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3



AUGER

WASHBORING

$+^3$, $\times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

RECORD OF BOREHOLE No P9

METRIC

W.P. 282-86-01 LOCATION N 4 867137.7 E 341645.3 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 20 – 93 12 21 CHECKED BY BI

ELEV DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
181.1	Ground Surface					
0.0	Granular Fill					
0.5	Clayey Silt, Trace Gravel and Organics, Greenish Grey, Soft (Fill)	1	SS	4		180
179.6 / 1.5	Very Stiff	2	SS	21	▼*	
	Hard	3	SS	68		
		4	SS	100 /20cm		178
		5	SS	79		176
	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Cobbles and Boulders, Grey (Glacial Till)	6	SS	65		174
		7	SS	64		
		8	SS	66		172
		9	SS	43		170
	Occasional Sand Layers	10	SS	61		168
		11	SS	72		166
		12	SS	100 /28cm		
		13	SS	114 /20cm		164
						162
		14	SS	122 /25cm		160
157.8		15	SS	120		158
23.3	End of Borehole					

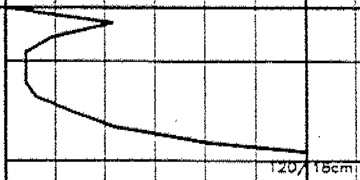
DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL



* Unstabilized water table measured upon completion of drilling on 93 12 21

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No P10

METRIC

W.P. 282-86-01 LOCATION N 4 867555.7 E 343258.4 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger , Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 17 - 93 12 20 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
191.4	Ground Surface						
190.6 / 0.0	Granular Fill						
0.8	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Sand Seams, Cobbles and Boulders, Hard (Glacial Till) Brown / Grey	1	SS	33			
		2	SS	82	190		
		3	SS	110/28cm		H	5 37 45 13
		4	SS	110/23cm	188		
		5	SS	59			
		6	SS	120/13cm	186		
184.4 / 7.0	Silty Sand with Gravel Grey, Very Dense	7	SS	100/25cm	184		
182.3 / 9.1	Heterogeneous Mixture of Silt, Sand and Gravel Occasional Sand Layers Grey, Very Dense (Glacial Till)	8	SS	100/23cm	182		6 56 32 6
		9	SS	100/18cm	180		
179.2 / 12.2	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Sand Layers, Cobbles and Boulders Grey, Hard (Glacial Till)	10	SS	106/18cm			
		11	SS	138/15cm	178		
176.0 / 15.4	End of Borehole	12	SS	120/15cm			

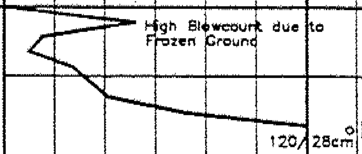
Ground water conditions: ▼ 93 12 20

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³



$+^3$, $\times^5$: Numbers refer to Sensitivity

15-○-5 (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No P11

METRIC

W.P. 282-86-01 LOCATION N 4 867746.0 E 344497.0 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 15 – 93 12 16 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
167.2	Ground Surface					
0.0	Asphalt and Granular Fill				DRY *	
0.3	Clayey Silt with Organic Inclusions, Firm, Brown (Fill)	1	SS	6		
165.7 / 1.5	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel, Occasional Cobbles and Boulders (Glacial Till)					
	Stiff to Very Stiff	2	SS	14		
		3	SS	25		
	Hard	4	SS	52		
	Some Wet Sand Seams	5	SS	100/8cm		
	Brown / Grey	6	SS	100/13cm		
		7	SS	100/10cm		
		8	SS	110/20cm		
		9	SS	110/13cm		
		10	SS	115/15cm		
		11	SS	120/20cm		5 40 34 21
		12	SS	110/20cm		
		13	SS	100/15cm		
145.4		14	SS	115/28cm		
21.8	End of Borehole					

* 93 12 16

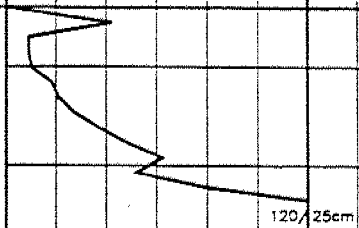
ELEVATION SCALE: 166, 164, 162, 160, 158, 156, 154, 152, 150, 148, 146

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m³



$+^3, \times^5$: Numbers refer to Sensitivity

$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

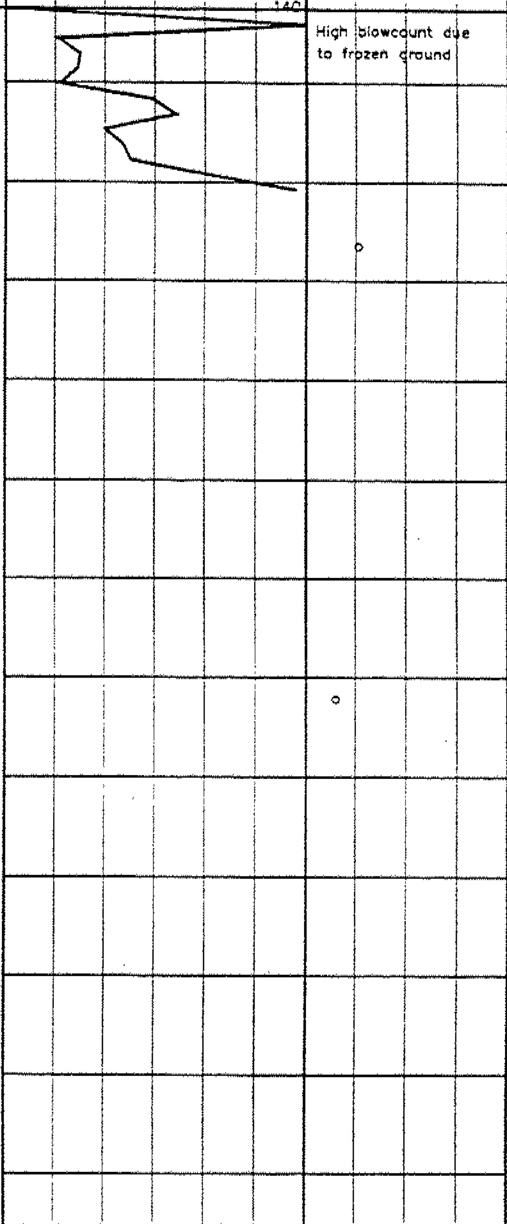
RECORD OF BOREHOLE No P12 1 OF 1 METRIC

W.P. 282-86-01 LOCATION N 4 867570.7 E 346795.7 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 14 – 93 12 15 CHECKED BY BI

ELEV / DEPTH	SOIL PROFILE – DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
161.5	Ground Surface						
0.0 / 160.7	Granular Fill						
0.8	Heterogeneous Mixture of Clayey Silt, Trace Sand and Gravel; Brown / Grey; Very Stiff to Hard (Glacial Till)	1	SS	26			High blowcount due to frozen ground
		2	SS	33	▼*	160	
		3	SS	21			
157.7		4	SS	25		158	
3.8		5	SS	36			6 47 36 11
	Silty Sand, Grey, Loose	6	SS	5**		156	
		7	SS	6**		154	
	Heterogeneous Mixture of Silt, Sand and Gravel, Occasional Cobbles and Boulders, Grey, Compact to Very Dense (Glacial Till)	8	SS	24		152	
		9	SS	120 /23cm		150	
		10	SS	52			
	Trace Clay	11	SS	80		148	29 37 26 8
		12	SS	40		146	
	Trace Clay	13	SS	54		144	
		14	SS	113			
141.1	Some Sand Layers	15	SS	42		142	
20.4	Heterogeneous Mixture of Clayey Silt, Trace Gravel, Occasional Cobbles and Boulders, Grey, Hard (Glacial Till)	16	SS	115 /23cm		140	
136.9		17	SS	120 /20cm		138	
24.8	End of Borehole						



* Unstabilized water level measured upon completion of drilling on 93 12 15

** Unrepresentative blowcounts due to possible disturbance caused by unbalanced hydrostatic heads

$+^3, \times^5$: Numbers refer to Sensitivity

20 15◇5 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P13

METRIC

W.P. 282-86-01 LOCATION N 4 867422.8 E 348100.7 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 13 CHECKED BY BI

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
158.8	Ground Surface
0.0	Granular Fill
0.5 / 157.4	Clayey Silt, Trace Sand, with Organic Inclusions (Fill)
1.4 / 156.7	Heterogeneous Mixture of Clayey Silt, Gravel, Brown, Very Stiff
2.1 … 152.7	Heterogeneous Mixture of Silt, Sand and Gravel, Occasional Cobbles and Boulders (Glacial Till) — Brown, Dense / Grey, Very Dense
6.1 … 146.4	Heterogeneous Mixture of Clayey Silt, Trace Gravel Occasional Sand layers, Cobbles and Boulders, Grey, Hard (Glacial Till)
12.4	End of Borehole

* Unstabilized water level measured upon completion of drilling on 93 12 13

SAMPLES

NUMBER	TYPE	'N' VALUES	WATER CONTENT (%)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	9		
2	SS	20		
3	SS	37	o	3 63 26 8
4	SS	123		
5	SS	120 /18cm		
6	SS	103 /15cm		
7	SS	112 /23cm		
8	SS	120 /20cm		
9	SS	120 /23cm		
10	SS	100 /23cm		

GROUND WATER CONDITIONS ▽*

ELEVATION SCALE: 158, 156, 154, 152, 150, 148

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

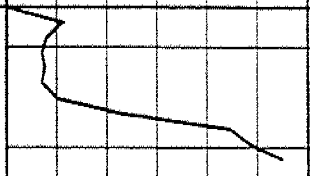
SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_p NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L

WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL



$+^3$, $\times^5$: Numbers refer to Sensitivity

15 $\diamond$ 5 (20 above, 10 below) (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P14

 METRIC

W.P. 282-86-01 | LOCATION N 4 867482.6 E 348937.8 | ORIGINATED BY DK

DIST 6 HWY 407 | BOREHOLE TYPE H.S. Auger, Cone Test, BW Casing | COMPILED BY DT

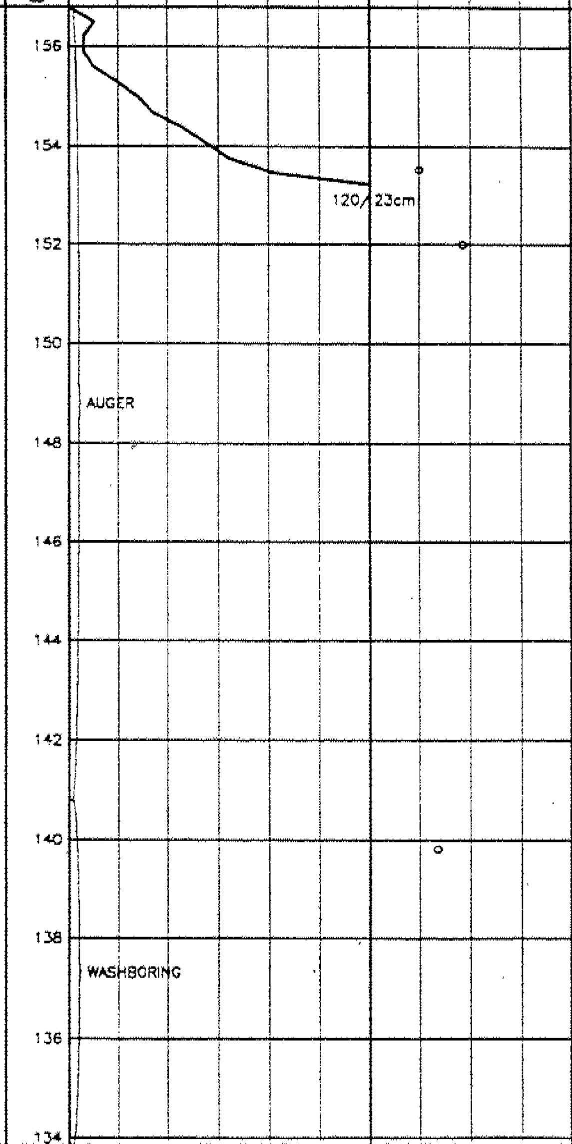
DATUM Geodetic | DATE 93 12 06 - 93 12 10 | CHECKED BY BI

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GR	SA	SI	CL
156.8	Ground Surface							
0.0	Granular Fill							
155.3 0.8	Clayey Silt, Trace Gravel Brown, Firm (Fill)	1	SS	6				
1.5	Heterogeneous Mixture of Clayey Silt Trace Sand and Gravel Occasional Cobbles and Boulders Brown, Hard (Glacial Till)	2	SS	30				
		3	SS	33				
	Silt and Sand Grey, Dense	4	SS	39	8	39	45	8
		5	SS	30	0	53	42	5
	Occasional Sand layers and Silt zones Grey	6	SS	72				
		7	SS	100/23cm				
		8	SS	65				
145.4		9	SS	100/18cm				
11.4	Silty Sand with Gravel Occasional Cobbles and Boulders Grey, Very Dense	10	SS	58				
		11	WS	–				
		12	SS	100/18cm				
		13	SS	113/20cm	17	74	5	3
136.2		14	WS	–				
20.6	Heterogeneous Mixture of Clayey Silt, Trace Sand & Gravel Grey, Hard (Glacial Till)	16	SS	150/15cm				
133.8		17	SS	150/11cm				
23.0	End of Borehole							

GROUND WATER CONDITIONS: water level symbol* at approx. elev. 154.7

* Unstabilized water level measured 1.5 hours after completion of drilling on 93 12 10

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30; UNIT WEIGHT γ kN/m³; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL



$+^3, \times^5$: Numbers refer to Sensitivity   15◇5 (20 above, 10 below) (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No P15 1 OF 1 METRIC

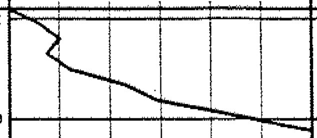
W.P. 282-86-01 LOCATION N 4 868335.2 E 350382.7 ORIGINATED BY DK

DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, Cone Test COMPILED BY DT

DATUM Geodetic DATE 93 12 06 - 93 12 07 CHECKED BY SI

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
172.2	Ground Surface					172		
0.0 / 171.4	Granular Fill							
0.8	Heterogeneous Mixture of Clayey Silt, Trace Sand & Gravel Occasional Sand layers, Cobbles and Boulders, Hard	1	SS	31				
		2	SS	38			o ├─┤	7 37 42 14
		3	SS	37		170		
		4	SS	48	▼*			
	Brown / Grey					168		
		5	SS	40				
		6	SS	89		166		
163.8		7	SS	70		164		
8.4	Heterogeneous Mixture of Silt, Sand and Gravel Occasional Cobbles and Boulders Grey, Very Dense	8	SS	71			o	28 41 25 6
						162		
		9	SS	58				
	Occasional Sandy and Gravelly layers	10	SS	50		160		
		11	SS	100 /13cm		158		
		12	SS	100 /23cm			o	46 42 9 3
155.2						156		
17.0	End of Borehole	13	SS	100 /25cm				

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100



SHEAR STRENGTH kPa: o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

* Unstabilized water level measured 5 hours after completion of drilling on 93 12 07

$+^3, \times^5$: Numbers refer to Sensitivity $\quad 15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No 3

METRIC

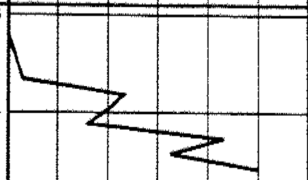
W.P. 69-65-02 LOCATION Sta. 37+87, 16 ft. Lt (Imperial units) ORIGINATED BY VK

DIST 6 HWY 7 BOREHOLE TYPE NX casing and washboring COMPILED BY VK

DATUM Geodetic DATE 68 05 16 CHECKED BY MD

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
176.2	Ground Surface						
0.0	Clayey Silt with Sand and a trace of Organic matter Grey, Firm					176	
175.1 / 1.1	Sandy Gravel to Gravelly Sand with a Trace of Silt and Clay Grey Compact to Very Dense	1	TW	–	▼		3.29% Organic Content
		2	SS	25			27 55 15 3
		3	SS	44		174	51 43 (6)
		4	SS	84			
		5	SS	157		172	
		6	SS	77			22 55 17 6
		7	SS	93		170	
		8	SS	154		168	
		9	SS	100/15cm			
		10	SS	100/13cm		166	
165.1 / 11.1	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100



SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

Foundation Design

RECORD OF BOREHOLE No C 12 — 1 OF 1 — METRIC

W.P. 90-78-00 — LOCATION Coods. N 4 857926.8 E 324307.2 — ORIGINATED BY BL

DIST 6 HWY 407 — BOREHOLE TYPE H.S. Augers — COMPILED BY BL

DATUM Geodetic — DATE 79 02 19 — CHECKED BY OJ

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	WATER CONTENT (%)	GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
180.8	Ground Surface							
0.0	Sandy Roadway Fill Loose					180		
179.0 / 1.8	Heterogeneous Mixture of Clayey Silt, Sand and Some Gravel Very Stiff (Glacial Till)	1	SS	5				
		2	SS	24		178	○	16 36 37 11
		3	SS	74		176		
		4	SS	25			○	18 40 33 9
		5	SS	30	▼	174		
		6	SS	30		172	○	10 41 40 9
		7	SS	17		170		
		8	SS	17		168		
		9	SS	21		166		
165.1		10	SS	11				
15.7	End of Borehole							

Column headings: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100); SHEAR STRENGTH kPa (○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE; 20 40 60 80 100); PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^5$: Numbers refer to Sensitivity — 20 / 15◇5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No C 13

METRIC

W.P. 90-78-00 | LOCATION Coords. N 4 858121.9 E 324633.3 | ORIGINATED BY BL

DIST 6 HWY 407 | BOREHOLE TYPE H.S. Augers | COMPILED BY BL

DATUM Geodetic | DATE 79 02 19 | CHECKED BY GJ

SOIL PROFILE

ELEV / DEPTH	DESCRIPTION
178.7	Ground Surface
0.0	Topsoil
0.3	Heterogeneous Mixture of Clayey Silt, Sand and Gravel, Very Stiff (Glacial Till) — Brown / Grey
155.8 / 22.9	Heterogeneous Mixture of Sand, Silt, Some Clay and Gravel, Very Dense (Glacial Till)
151.1 / 27.6	End of Borehole

SAMPLES

NUMBER	TYPE	'N' VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	24	
2	SS	18	19 38 35 8
3	SS	45	
4	SS	19	12 34 39 15
5	SS	24	
6	SS	30	15 37 37 11
7	SS	26	
8	SS	23	
9	SS	39	
10	SS	32	
11	SS	14	
12	SS	101	
13	SS	60 /10cm	

GROUND WATER CONDITIONS: water level at approx. elev. 168

ELEVATION SCALE: 178, 176, 174, 172, 170, 168, 166, 164, 162, 160, 158, 156, 154, 152

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE: 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m^3

$+^3$, $\times^5$: Numbers refer to Sensitivity

$15 \diamond 5$ (20 above, 10 below) (%) STRAIN AT FAILURE

Ministry of Transportation Ontario

RECORD OF BOREHOLE No C 13B

METRIC

W.P. 90-78-00 LOCATION Coords. N 4 858048.7 E 324727.8 ORIGINATED BY BL

DIST 6 HWY 407 BOREHOLE TYPE H.S. Augers COMPILED BY BL

DATUM Geodetic DATE 79 02 20 CHECKED BY OJ

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
178.6	Ground Surface					
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel Very Stiff (Glacial Till) Brown / Grey (colour change)				*	178
		1	SS	23		176
		2	SS	45		174
		3	SS	31		172
		4	SS	11		170 / 168
		5	SS	13		166 / 164
162.9 15.7	End of Borehole					

* Groundwater level not established

Form column headings: SOIL PROFILE; STRAT PLOT; SAMPLES; DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100; PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3; REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3, \times^3$: Numbers refer to Sensitivity   20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C 14 1 OF 1 METRIC

W.P. 90-78-00 LOCATION Coords. N 4 859210 E 326206.1 ORIGINATED BY BL

DIST 6 HWY 407 BOREHOLE TYPE H.S. Augers COMPILED BY BL

DATUM Geodetic DATE 79 02 22 CHECKED BY OJ

ELEV / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
182.4	Ground Surface						
0.0	Roadway Fill Material				*	182	
180.9 / 1.5	Heterogeneous Mixture of Clayey Silt, Sand and Gravel, Hard (Glacial Till)	1	SS	20			
						180	
	Brown / Grey	2	SS	50/13cm			19 38 32 11
		3	SS	60/13cm		178	11 35 36 18
		4	SS	50/10cm		176	
		5	SS	101		174	6 28 46 20
		6	SS	40			
						172	
		7	SS	48			
		8	SS	60		170	
		9	SS	88		168	
166.7		10	SS	50/13cm			
15.7	End of Borehole						

* Groundwater level not established

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: o UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m³

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11

METRIC

W.P. 25-69-00 LOCATION Coords. N 4 859667.2 E 327461.9 ORIGINATED BY J.J.

DIST 6 HWY EMF BOREHOLE TYPE H.S. Auger COMPILED BY J.J.

DATUM Geodetic DATE 78 08 16 CHECKED BY O.J.

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
192.9	Ground Surface						
0.0	Heterogeneous Mixture of Clayey Silt, Sand and Gravel, Hard (Glacial Till); Brown / Grey				DRY	192	
		1	SS	30			
		2	SS	60 /13cm		190	
		3	SS	130		188	6 25 (69)
		4	SS	65 /15cm		186	
		5	SS	70 /10cm			9 36 (55)
		6	SS	108		184	
		7	SS	60 /10cm		182	
		8	SS	60 /13cm		180	18 37 (45)
179.0 / 13.9	End of Borehole	9	SS	90 /15cm			

Legend: DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100; SHEAR STRENGTH kPa: ○ UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE, 20 40 60 80 100; PLASTIC LIMIT w_P, NATURAL MOISTURE CONTENT w, LIQUID LIMIT w_L; WATER CONTENT (%) 20 40 60; UNIT WEIGHT γ kN/m^3

$+^3, \times^5$: Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

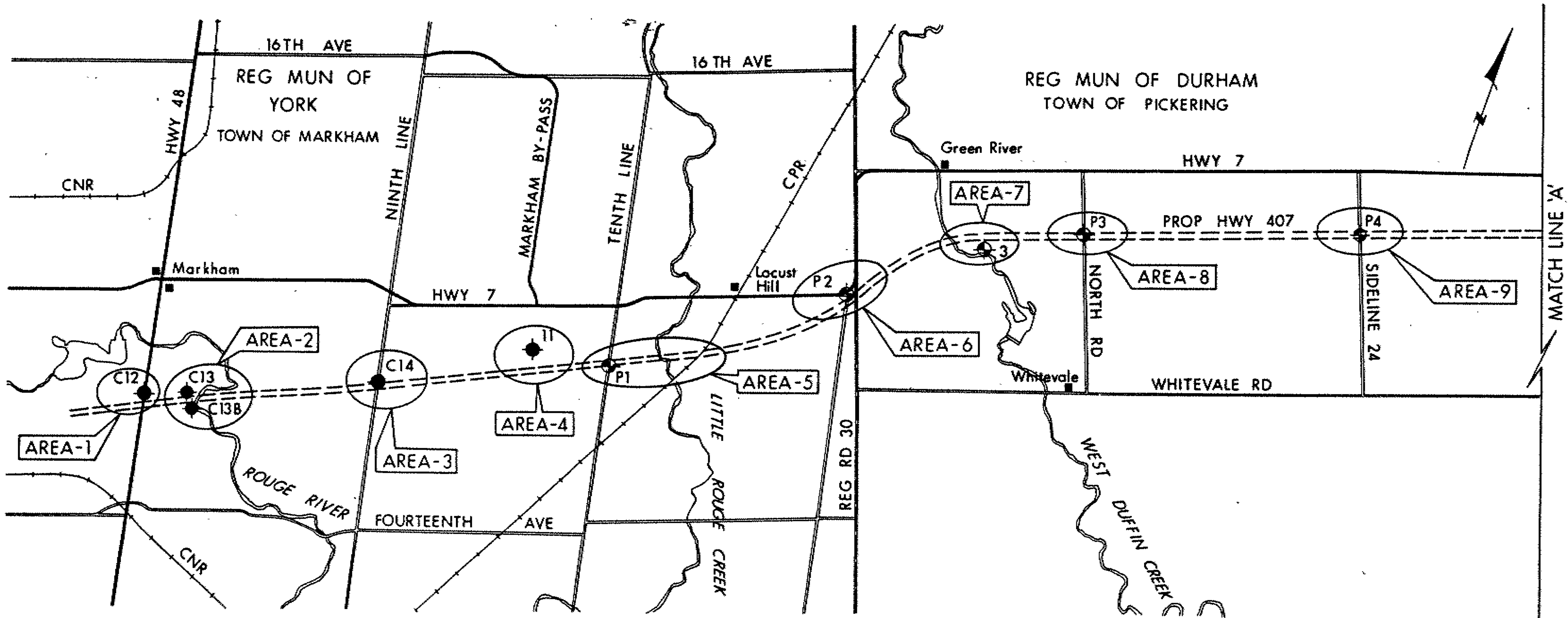
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

CONT No
WP No 282-86-01

PROP HWY 407
From
HWY 48 TO WHITBY OSHAWA BOUNDARY
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLAN
SCALE
500m 0 500m

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
1	C12 (WP 90-78-00)	1	MARKHAM ROAD UNDERPASS
2	C13 C13B (WP 90-78-00)	2 3	ROUGE RIVER BRIDGE WBL ROUGE RIVER BRIDGE EBL
3	C14 (WP 90-78-00)	4	9TH LINE UNDERPASS
4	11 (WP 25-69-00)	5	N-S ARTERIAL ROAD UNDERPASS
5	P1	6 7 8 9 10 11	10TH LINE OVERPASS WBL 10TH LINE OVERPASS EBL CPR OVERHEAD WBL CPR OVERHEAD EBL LITTLE ROUGE RIVER BRIDGE WBL LITTLE ROUGE RIVER BRIDGE EBL
6	P2	20	REGIONAL ROAD 30 UNDERPASS
7	3 (WP 69-65-02)	21 22	WEST DUFFIN CREEK BRIDGE WBL WEST DUFFIN CREEK BRIDGE EBL
8	P3	23	NORTH ROAD UNDERPASS
9	P4	24	SIDELINE 24 UNDERPASS

KEY PLAN
SCALE

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N • Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation 1968 05 1978 08, 1979 02, 1994 01

	No	ELEVATION	CO-ORDINATES NORTH	EAST
	P1	193.4	4 859 623.2	328 166.1
	P2	205.3	4 860 936.6	329 984.7
	P3	210.0	4 862 074.3	331 845.5
	P4	215.6	4 862 825.5	334 219.0
90-78-00	C12	180.8	4 857 926.8	324 307.2
90-78-00	C13	178.7	4 858 121.9	324 633.3
90-78-00	C13B	178.6	4 858 048.7	324 727.8
90-78-00	C14	182.4	4 859 210.0	326 206.1
25-69-00	11	192.9	4 859 667.2	327 461.9
69-65-02	3	176.2		

NOTE
For Soil details refer to Record of Borehole Sheets

=NOTE=
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen Cond.

LICENSED PROFESSIONAL ENGINEER W. D. KWOK PROVINCE OF ONTARIO

REV	DATE	BY	DESCRIPTION

Geocres No 30M14-227

HWY No 407			DIST 6
SUBM'D DK	CHECKED	DATE 1994 02 18	SITE
DRAWN DT	CHECKED RS	APPROVED	DWG 2828601-A

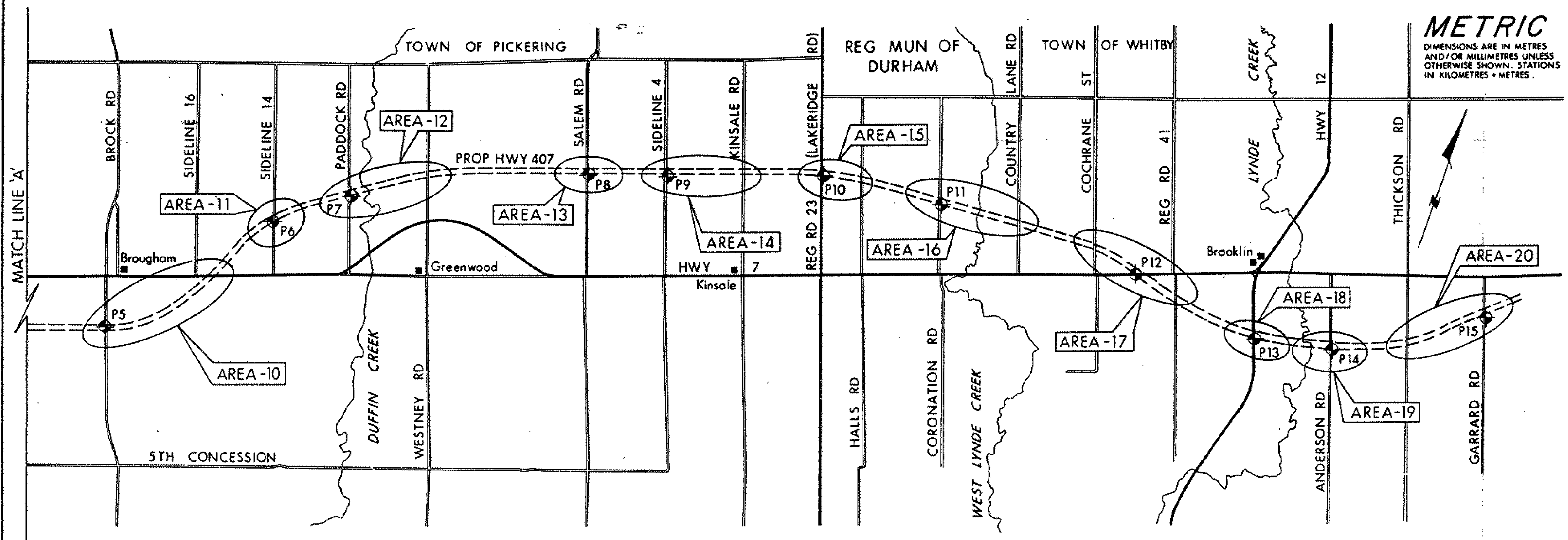
REF No NTS Maps 30M/14b, 30M/14c, 30M14f, 30M14g & 30M14h

CONT No
WP No 282-86-01

SHEET

PROP HWY 407
From
HWY 48 TO WHITBY OSHAWA BOUNDARY
BORE HOLE LOCATIONS & SOIL STRATA

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.



PLAN
SCALE
500m 0 500m

KEY PLAN
SCALE

LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation 1993 12 & 1994 01

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
P5	192·4	4 863 709·4	336 527·6
P6	167·1	4 865 235·6	337 903·4
P7	145·4	4 865 854·8	338 570·2
P8	170·7	4 866 905·5	340 849·2
P9	181·1	4 867 137·7	341 645·3
P10	191·4	4 867 555·7	343 258·4
P11	167·2	4 867 746·0	344 497·0
P12	161·5	4 867 670·7	346 795·7
P13	158·8	4 867 422·8	348 100·7
P14	156·8	4 867 482·6	348 937·8
P15	172·2	4 868 335·2	350 382·7

NOTE
For Soil details refer to Record of Borehole Sheets

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
10	P5	25	BROCK ROAD UNDERPASS
		26	SIDELINE 16 UNDERPASS
		27	HWY 7 OVERPASS WBL
		28	HWY 7 OVERPASS EBL
		29 & 30	HWY 407/HWY 7 INTERCHANGE
11	P6	31	SIDELINE 14 UNDERPASS
		40 & 41	STRUCTURES AT SIDELINE 14 INTERCHANGE
12	P7	32	PADDOCK ROAD UNDERPASS
		33	EAST DUFFIN CREEK BRIDGE WBL
		34	EAST DUFFIN CREEK BRIDGE EBL
		35	WESTNEY ROAD UNDERPASS
13	P8	36	SALEM ROAD UNDERPASS
14	P9	37	SIDELINE 4 UNDERPASS
		38	KINSALE ROAD UNDERPASS
15	P10	39	REGIONAL ROAD 23 UNDERPASS
		50	HALLS ROAD UNDERPASS

AREA	BOREHOLE No	STRUCT REF No	DESCRIPTION
16	P11	51	CORONATION ROAD UNDERPASS
		52	WEST LYNDE CREEK WBL
		53	WEST LYNDE CREEK EBL
		54	COUNTRY LANE ROAD UNDERPASS
17	P12	55	COCHRANE STREET UNDERPASS
		56	HWY 7 UNDERPASS
		57	REGIONAL ROAD 41 UNDERPASS
18	P13	58	HWY 12 UNDERPASS
19	P14	59	LYNDE CREEK BRIDGE WBL
		60	LYNDE CREEK BRIDGE EBL
		61	ANDERSON ROAD UNDERPASS
20	P15	62	THICKSON ROAD UNDERPASS
		63	GARRARD ROAD UNDERPASS

=NOTE=
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section GC 2·01 of OPS Gen Cond.

LICENSED PROFESSIONAL ENGINEER
W. D. KWOK
PROVINCE OF ONTARIO

REV.	DATE	BY	DESCRIPTION

Geocres No 30M14-227

HWY No 407			DIST 6
SUBM'D DK	CHECKED	DATE 1994 02 18	SITE
DRAWN DT	CHECKED KS	APPROVED	DWG 2828601-8

REF No NTS Maps 30M/14g, 30M/14h & 30M/15e

SOILS REPORT - NESBITT BRIDGE (SITE #146)

TABLE OF CONTENTS

SOILS REPORT - NESBITT BRIDGE (SITE #146)

INTRODUCTION

An investigation of foundation soil conditions has been carried out at the Nesbitt Bridge site on Lots 16 and 17, Concession 5 of East Whitby Township. The County of Ontario proposes to construct a new bridge at the site of the existing crossing. It was intended that either a prestressed beam or a rigid frame design would be used for the new structure and that, soil conditions permitting, the abutments would be founded on concrete spread footings.

Authorization to proceed with the investigation was received on September 9th and the field work was subsequently done on September 14, 1970. A truck-mounted, hollow stem auger drill was used to advance 2 boreholes,one in each abutment area as shown on figure 1. Samples were obtained at 2 to 5-ft. intervals with a 2-inch open-end drive sampler while recording standard penetration resistances (N-values). A summary of the borehole data and test results will be found on figures 2 and 3 at the end of this report. An inferred sub-soil stratigraphy as well as the location plan is outlined on figure 1 and an explanation of some of the symbols and terminology used in this report is given in Appendix "A".

SOILS REPORT - NESBITT BRIDGE (SITE #146)

SOIL CONDITIONS

The bridge site is located in the physiographic region known as the "South Slope" of the Oak Ridges inter-lobate kame morraine. The area has been eroded by streams draining toward Lake Ontario, leaving recent alluvial deposits overlying the till soils in the eroded valleys.

The soils profiles obtained in the two boreholes at this site support the geological data for the area, revealing that under the existing approach embankment fill material there are loose fine-grained river deposits (silty sand, sand silt, clayey silt and clay) which in turn overlie relatively compact sandy till soils.

The river-deposited sediment extends approximately from elevation 88 feet down to elevation 78 feet and consists of irregularly stratified sand, silty sand, sandy silt and silty clay. Standard penetration resistances in this soft, loose material varied from 1 to 11 blows/ft.

Below elevation 78 feet, approximately, the subsoils are relatively compact and sandy in texture, consisting mainly of very fine to medium sand. Standard penetration resistances in this underlying sand till zone varied from 16 to over 30 blows/ft., there being a general increase in density with depth.

SOILS REPORT - NESBITT BRIDGE (SITE #146)

FOUNDATION CONSIDERATIONS

If spread footings are considered for supporting the abutments of the structure, the base of the footings will have to be at least as low as elevation 77 feet in order to reach the compact sand zone. At this level, the footings will be about 8 feet below the present creek bottom under 9 to 10 feet of water. The allowable load for such footings is estimated to be 4000 lbs per sq. ft. provided that the soils below the footing are not disturbed.

It should be noted that dewatering the excavation for these spread footings could be troublesome unless the water table is lowered in advance with a well-point system. Conventional pumping of the excavations will result in "piping" at the footing level which will seriously reduce the bearing capacity of these fine sand subsoils.

PILE FOUNDATION CONSIDERATIONS

As an alternative to spread footings, it is recommended that piles be considered for supporting the abutment loads on this project. Adequate pile capacity can be obtained by driving displacement-type piles (wood, steel or concrete) to elevation 60 feet approximately. Timber piles will likely be the most economically feasible for this structure (although concrete or steel-tube piles are not ruled out) and the full allowable capacity, for the timber size selected, can be used.

SOILS REPORT - NESBITT BRIDGE (SITE #146)

EROSION AND SCOUR CONSIDERATIONS

The existing river bed materials are highly erodable, but, if footings are based 8 feet below stream bed level, or if piles are used, there should be adequate protection against scour damage. The toes of the approach embankments will need protection, however, and it is recommended that rip-rap be placed on these slopes up to the design high water level.

SETTLEMENT CONSIDERATIONS

The subsoils below the proposed foundation bearing levels are compact granular materials which are relatively incompressible. Any foundation settlement which does take place will occur during construction and will be well within tolerable limits.

Submitted by:

SITE INVESTIGATION SERVICES LIMITED

REGISTERED PROFESSIONAL ENGINEER
J. A. HAYES
PROVINCE OF ONTARIO

per J A Hayes
J. A. HAYES, P. ENG.

JAH/df

BOREHOLE DATA and TEST SUMMARY

SITE INVESTIGATION SERVICES Ltd. | JOB No: 70-95 | BOREHOLE No: 1 | FIGURE No: 2

Project - NESBITT BRIDGE
Location - LOT 16 & 17, CONC. 5, TWP. OF EAST WHITBY
Hole Location - SEE FIGURE 1

Date - SEPTEMBER 11, 1970
Elevation Datum - ASSUMED 100.0' B.M. ON POST @ STA 10+94 (5.3' LT)
Type of Drill - HOLLOW STEM AUGER

LEGEND

Penetration Tests
2" O.D. Split Spoon —○—○—
2" O.D. Cone —●—●—●—

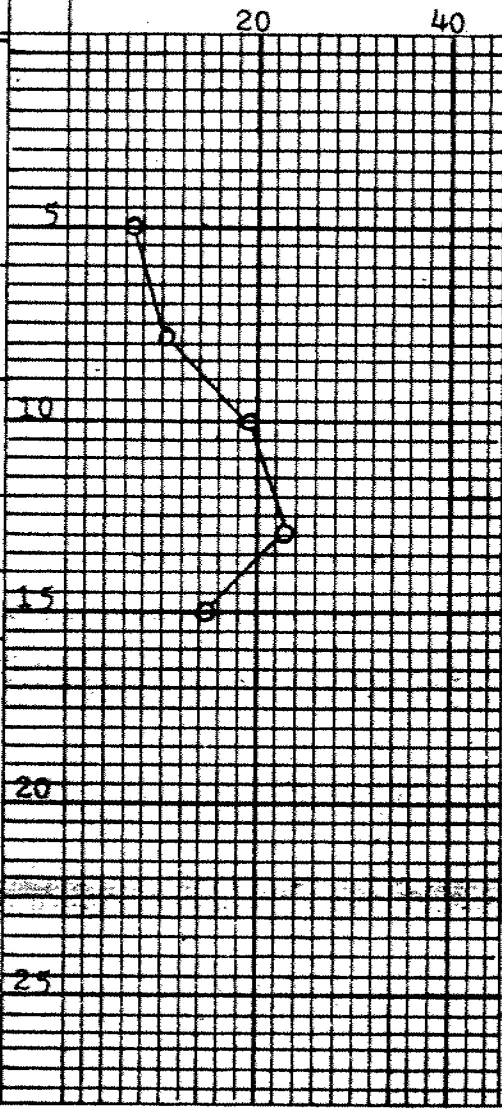
Moisture Contents
In-Situ ○
Liquid Limit ——|
Plastic Limit |——

(See Appendix "A" for Other Symbols)

SOIL DESCRIPTION	ELEVATION IN FEET
	96.0
ASPHALT	
SILTY SAND FILL - Dark brown silty medium to fine sand fill with some stones and pieces of concrete	
FINE SAND - Dark brown fine sand-moist and occasional stones	87.0
SILTY CLAY - Grey silty clay with woody material at 10½' - 11½'	
SILTY CLAYEY SAND - Grey silty clayey sand - saturated and soft	80.2
SILTY SAND - Dark grey brown silty medium to coarse sand	
END OF HOLE	
END OF CONE PENETRATION	

DEPTH IN FEET

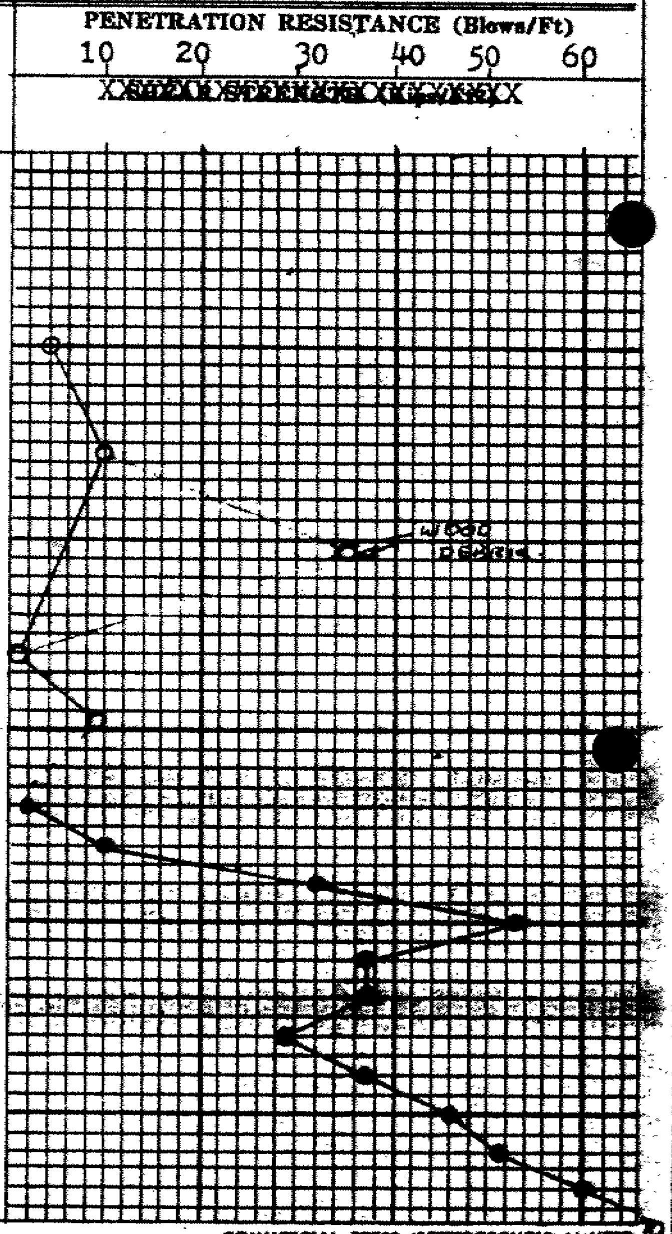
MOISTURE CONTENT and ATTERBERG LIMITS (%)



SAMPLE TYPE AND NUMBER

Sample
DS 1
DS 2
DS 3
DS 4
DS 5

PENETRATION RESISTANCE (Blows/Ft)



BOREHOLE DATA and TEST SUMMARY

SITE INVESTIGATION SERVICES Ltd. | JOB No. 70-95 | BOREHOLE No: 2 | FIGURE No: 3

Project - NESBITT BRIDGE

Location - LOT 16 & 17, CONC. 5, TWP. OF EAST WHITBY

Hole Location - SEE FIGURE 1

Date - SEPTEMBER 14, 1970

Elevation Datum - ASSUMED 100.0' BM @ STA. 10+94 (5'Lt)

Type of Drill - HOLLOW STEM AUGER

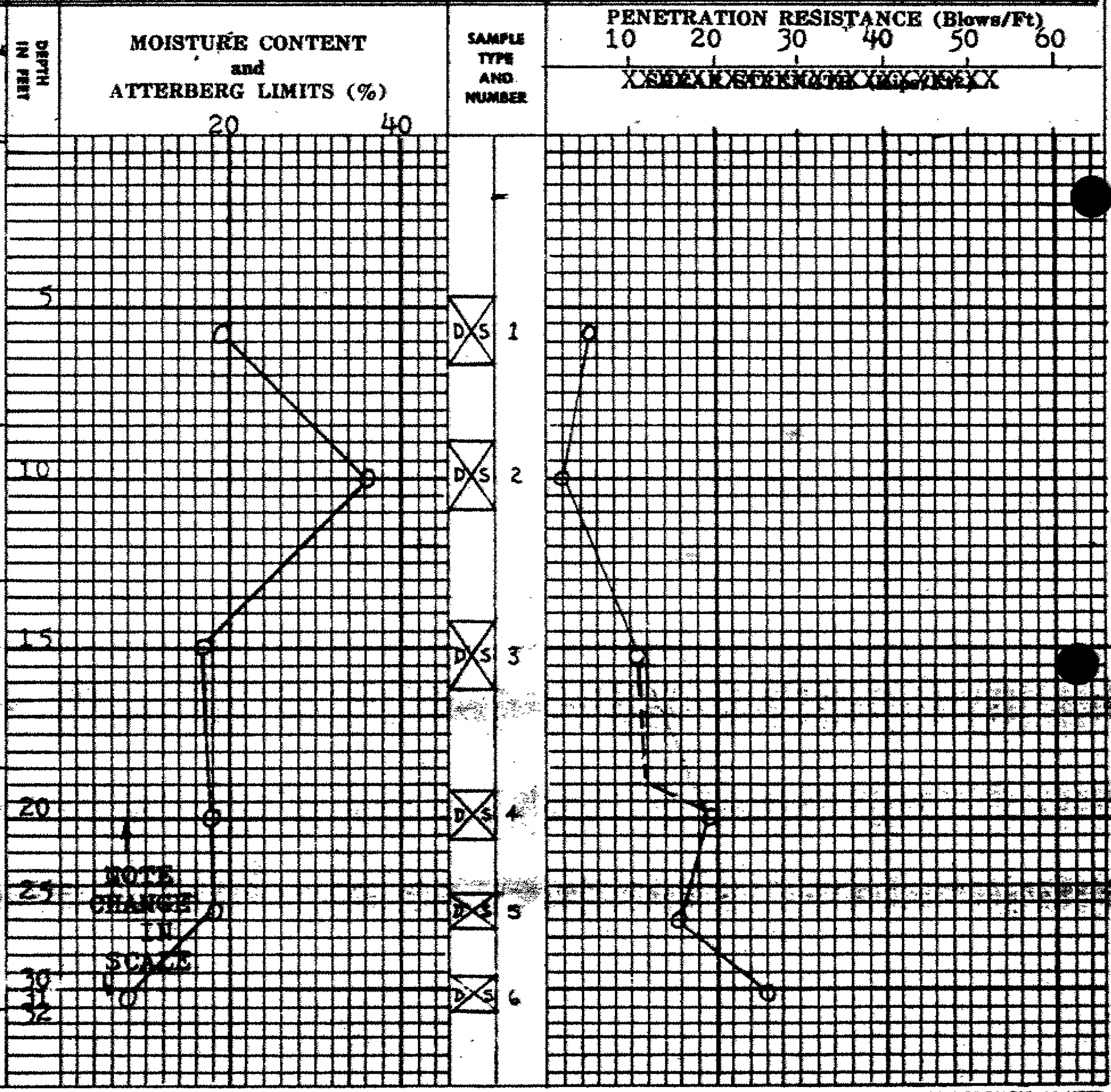
LEGEND

Penetration Tests: 2" O.D. Split Spoon —o—o— ; 2" O.D. Cone —●—●—●—

Moisture Contents: In-Situ o ; Liquid Limit —| ; Plastic Limit |—

(See Appendix "A" for Other Symbols)

SOIL DESCRIPTION	ELEVATION IN FEET
	96.0
ASPHALT	
STONEY SAND SILT FILL - Dark brown stoney, very fine sandy silt fill	87.5
SANDY SILT - Black to dark brown, very fine sandy silt - wet - traces of organics at 10½'	83.0
SILTY SAND - Brown silty fine sand	77.5
SAND - Brown, very fine sand with some silt becoming fine to medium sand at 23' - becoming hard at 27' and coarser	65.0
END OF HOLE	



COMMERCIAL PRESS (PETERBOROUGH) LIMITED

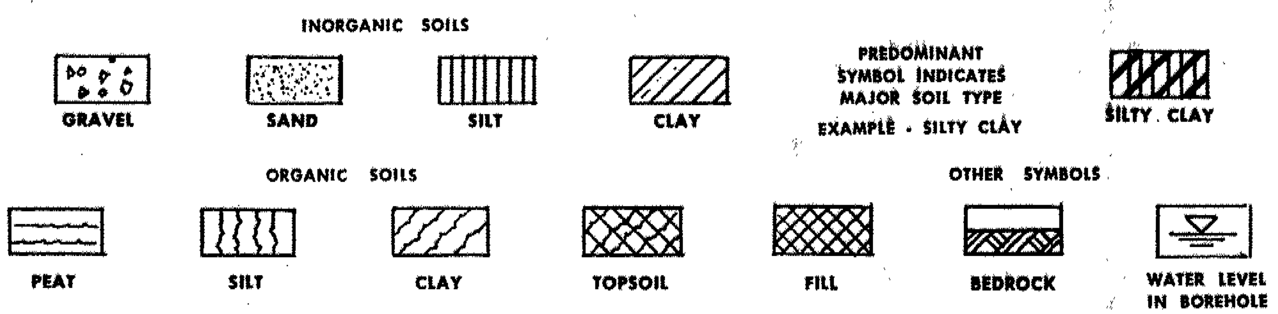
Appendix A

EXPLANATION OF SYMBOLS AND TERMINOLOGY

SOIL DESCRIPTION

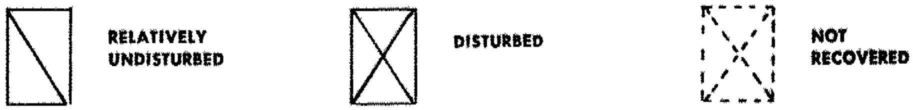
A description of visible characteristics of the soil as determined in the field and altered, if necessary, on the basis of laboratory classification tests. The soil profile applies only to the borehole location and may be different at other locations on the site.

A soil symbol is usually found opposite each soil type as follows:



SAMPLES

Condition:



Type:

D.S. - 1 3/8" ID Drive Sample
A.S. - Auger Sample
U - Thin-walled Tube Sample
J - Small Jar Sample
B - Bag Sample

Penetration Resistance: (N) Indicates number of blows, of a 140-lb. hammer falling 30 inches, required to drive a 2" OD Drive Sampler a distance of 1 foot into the soil. This resistance is used to assess the relative density of cohesionless soils and the relative consistency of cohesive soils.

OTHER TESTS

M - Grain size analysis using seives or hydrometer or both - plotted graphically on a separate sheet.

q_u - unconfined compressive strength.

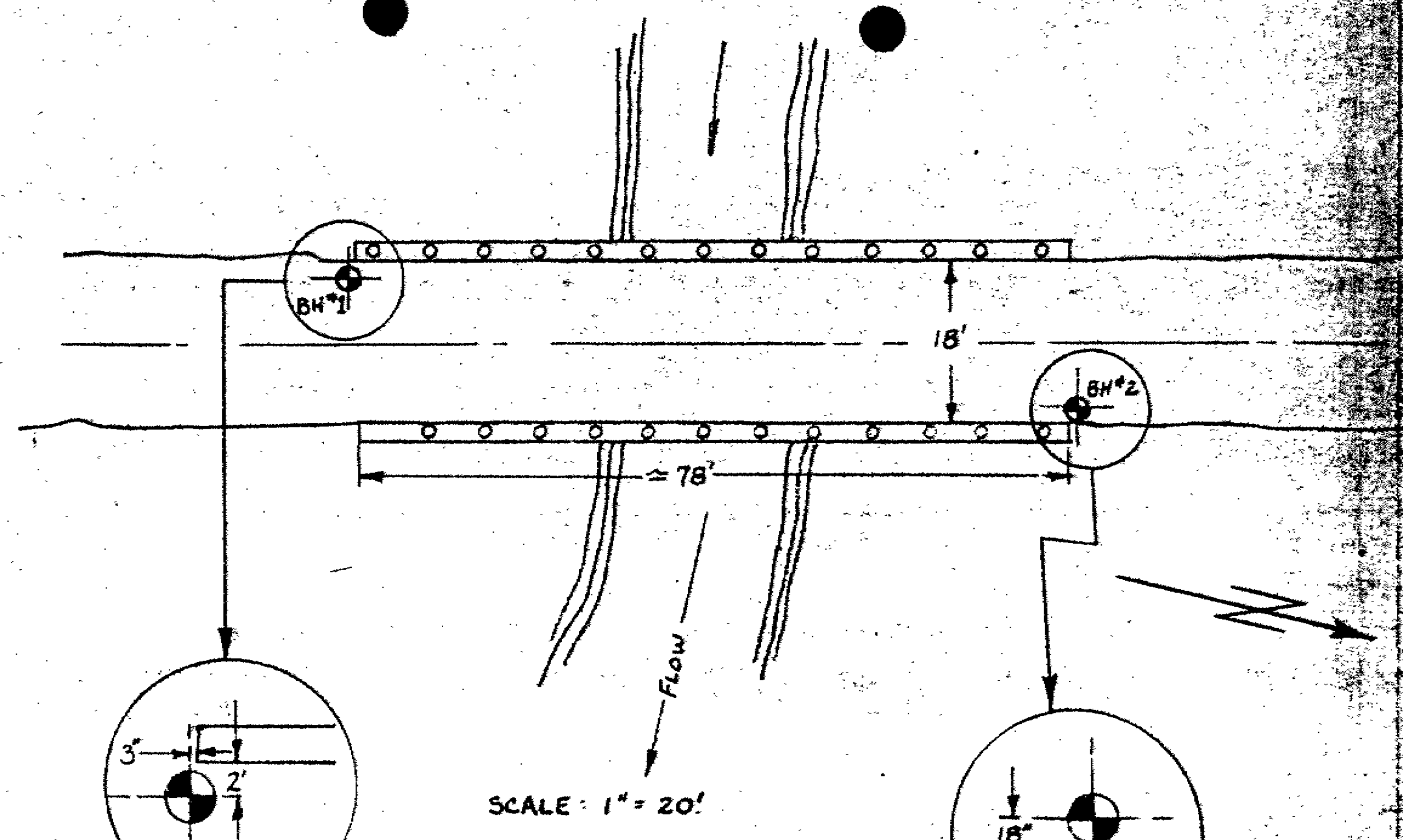
v_f - field vane tests.

v_l - laboratory vane tests.

γ_d - dry unit weight.

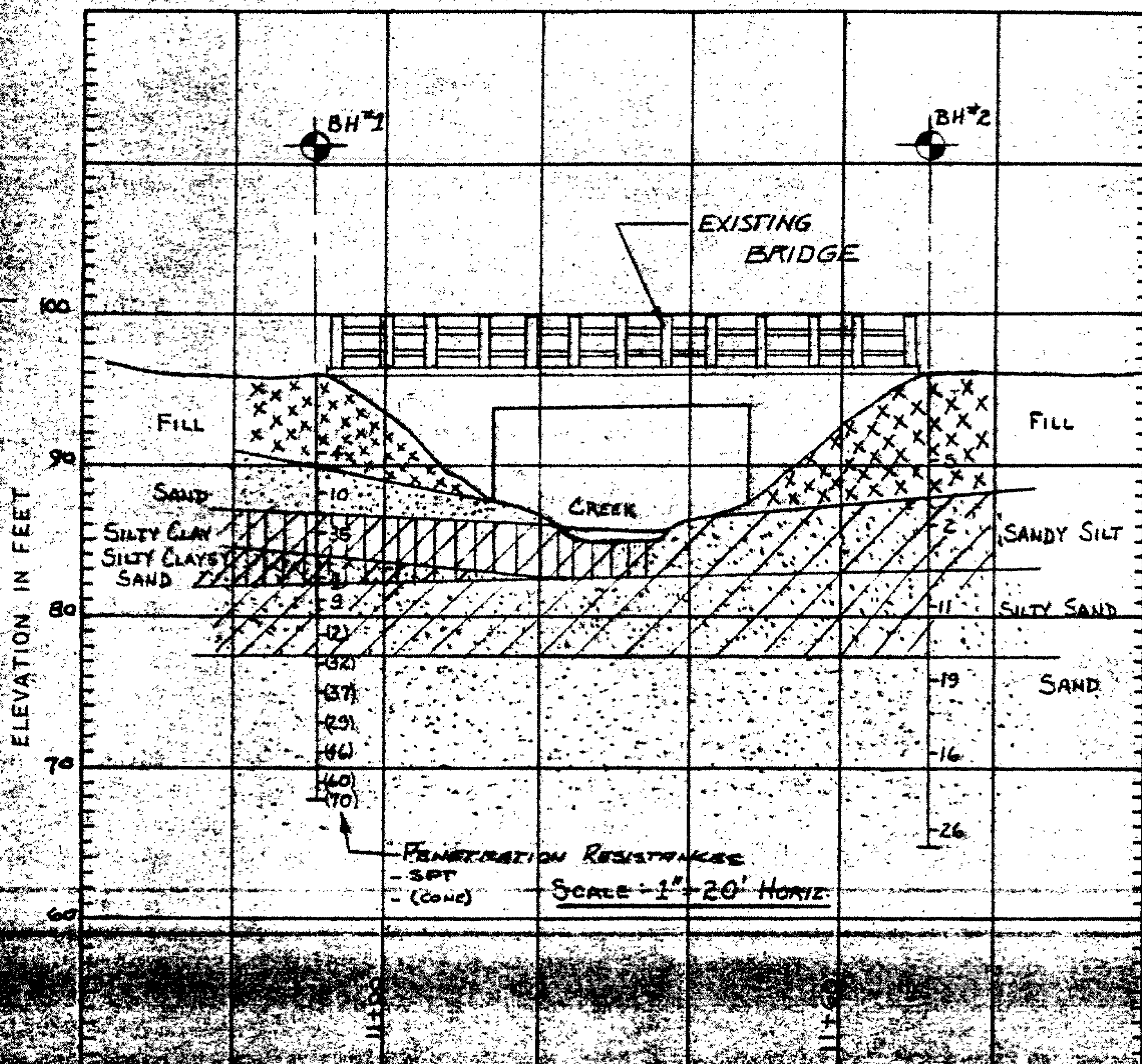
C - consolidation test - results on a separate sheet.

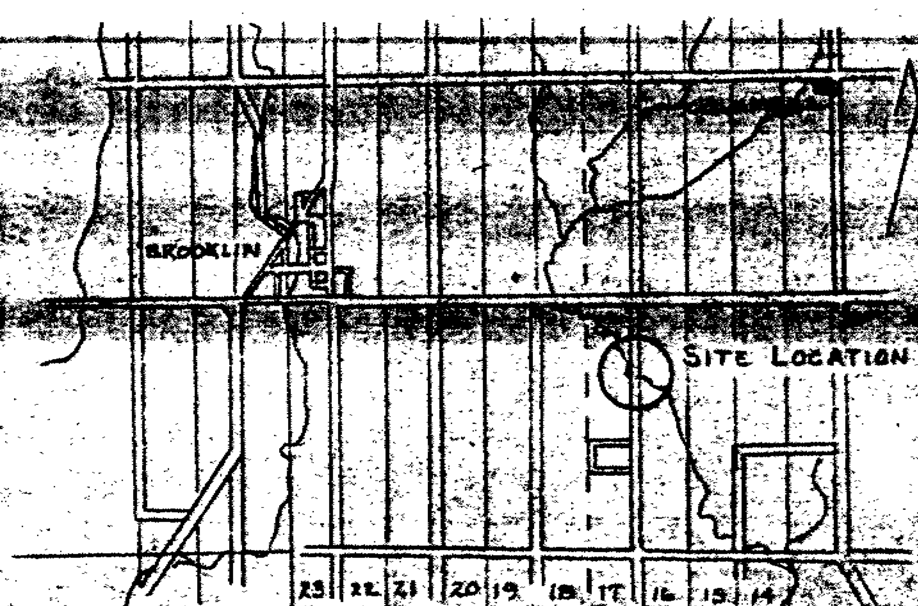
T - triaxial compression test - results on a separate sheet.



SITE PLAN

INFERRED SOIL STRATIGRAPHY





LOCATION PLAN

NOTE - SOILS DATA APPLIES ONLY TO THE ACTUAL BOREHOLE LOCATIONS. CONDITIONS MAY BE DIFFERENT AT OTHER PARTS OF THE SITE.

SITE INVESTIGATION SERVICES LIMITED

NESBITT BRIDGE (SITE No. 146)

COUNTY of ONTARIO

SCALE: AS SHOWN	DWN. BY R.J.E.	DATE: SEPT./70	FIGURE No. 1

OSHAWA SUBURBAN ROAD COMMISSION

605 ROSSLAND ROAD EAST

WHITBY, ONTARIO

REPORT ON FOUNDATION CONDITIONS

~~EAST OSHAWA CREEK BRIDGE~~

OSHAWA SUBURBAN ROAD #3

BRIDGE

TOWNSHIP OF EAST WHITBY

STRUCTURE SITE NO. 22-306

JOB NO. 71-87

OCTOBER 1971

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

TABLE OF CONTENTS

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

INTRODUCTION

As part of the proposed reconstruction of Oshawa Suburban Road #3, it will be necessary to provide a new structure for the East Oshawa creek crossing at station 54+00±. A diversion of the creek is also planned. The proposed bridge site is located in Lot 9, Concession VI of East Whitby Township, as indicated on the Location Plan, Figure 1. At the request of Mr. W. Twelvetrees of the Oshawa Suburban Road Commission, an investigation of subsoil conditions has been carried out at the above site.

The field work for the soils investigation was done on September 9 1971 using a truck-mounted hollow stem power auger drill. Two boreholes were drilled to a minimum depth of 30 feet at the locations shown on the site plan portion of Figure 2. Samples were collected at 2- to 5-foot intervals with a 2-inch open-end drive sampler, while recording standard penetration resistances (ie=N-values). Elevation references for the boreholes were obtained from the plan and profile provided by the Commission.

This report summarizes the results of the soils survey and presents recommendations for the foundation design. A site plan and an inferred soil stratigraphy are outlined on Figure 2. Individual borehole data summaries are included as Figures 3 and 4, while Appendix "A" lists some of the soils symbols and terminology used in the report.

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

SOIL CONDITIONS

The site lies in a drumlinized till plain known as the South Slope, an area separating the glacial lake Iroquois Plain from the interlobate Oak ridges Moraine to the north. Locally, the East Oshawa Creek has cut a meandering channel into the till plain and deposited fine sand silt on the floor of the creek valley.

The subsoils at the site consist mainly of compact sand with some gravel content. A veneer (5 ft.) of loose fine sand and silt covers the compact sand at BH #2, while east of the proposed structure, at BH #1, the upper 13 feet of the overburden consists of very loose to loose fine to medium sand. The looseness of the sand (N=4 to 8 blows per foot) suggests that it is a post-glacial outwash deposit.

Below elevation 523 feet, approximately, the sandy subsoils become very dense with standard penetration resistances ranging from 35 to over 100 blows/ft. The dense sand zone continues below elevation 501.6 feet which was the maximum depth investigated.

Aside from the upper silt and peat material in BH #2 the only other variation from a sand texture in the soil depsoits at this site occurred between elevation 522 and 525.5 feet in BH #2 where a layer of stiff sandy silt was encountered.

(SOIL CONDITIONS continued on next page)

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

SOIL CONDITIONS (cont.)

The natural ground water table in the relatively free-draining sand subsoils is controlled by the level of East Oshawa Creek. At the time of the field work, the creek water level was at elevation 533 feet.

FOUNDATION CONSIDERATIONS

In order to use conventional spread footings at this site, it is recommended that they be located at or below elevation 522 feet in the very dense sand stratum at that level. The allowable loading for the footings placed at this level on undisturbed ground should not exceed 7000 lbs/sq. ft. for design purposes.

Because of potential dewatering problems at this site (see following section), a pile-supported structure should be considered as an alternative to spread footings. A displacement-type pile such as a closed-end pipe pile or a timber pile is recommended.

It is anticipated that piles would be driven to elevation 510 feet, approximately, where the allowable capacity of a size 12 timber pile would be 20 to 25 tons and that of a 10 3/4-inch pipe pile would be 50 to 60 tons. The above values are for estimating purposes; the actual pile design selected should be reviewed to determine design capacities.

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

EXCAVATION CONSIDERATIONS

Excavation at this site will be mainly in fine sand with silt lenses and medium to coarse sand lenses. In order to remove material below the water table, it will be necessary to lower it below the level of the excavation.

The most effective technique for dewatering this site would be a well-point system. The effective use of well points will allow construction of footings "in the dry" and reduces the possibility of "quicking" conditions which would loosen and disturb the subsoils below the footing level.

SCOUR PROTECTION

The recommended depth for footings will result in about 7 or 8 feet of cover over the footings in the channel area. This should provide adequate scour protection although the fine sand below the river bed will be highly erodable. If severe flooding of the East Oshawa Creek is expected, then scour protection of the channel should be considered.

A pile-type foundation on the other hand has much superior resistance to scour activity. No special scour protection will be required if piles are used to support this structure.

SOILS REPORT - OSHAWA CREEK BRIDGE, SUBURBAN ROAD #3

EROSION PROTECTION

The approach embankments for this structure will probably be composed of the fine silty sand from the adjacent cut to the east. This material will be easily eroded and will require rip-rap protection up to the high water level. Sodding of the slopes above that level will protect the slopes against runoff erosion.

REGISTERED PROFESSIONAL ENGINEER
J. A. HAYES
PROVINCE OF ONTARIO

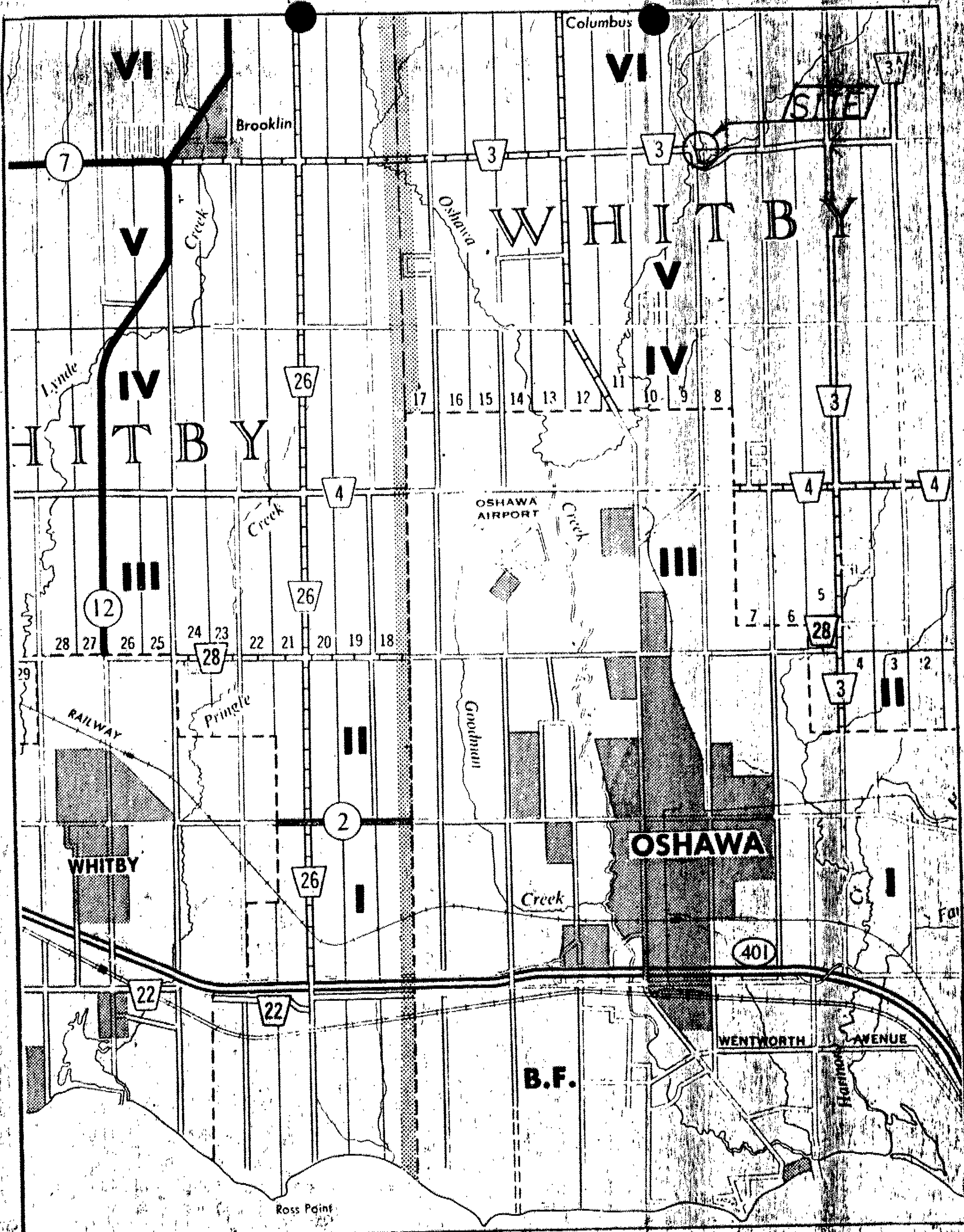
Submitted by:

SITE INVESTIGATION SERVICES LIMITED

per J A Hayes

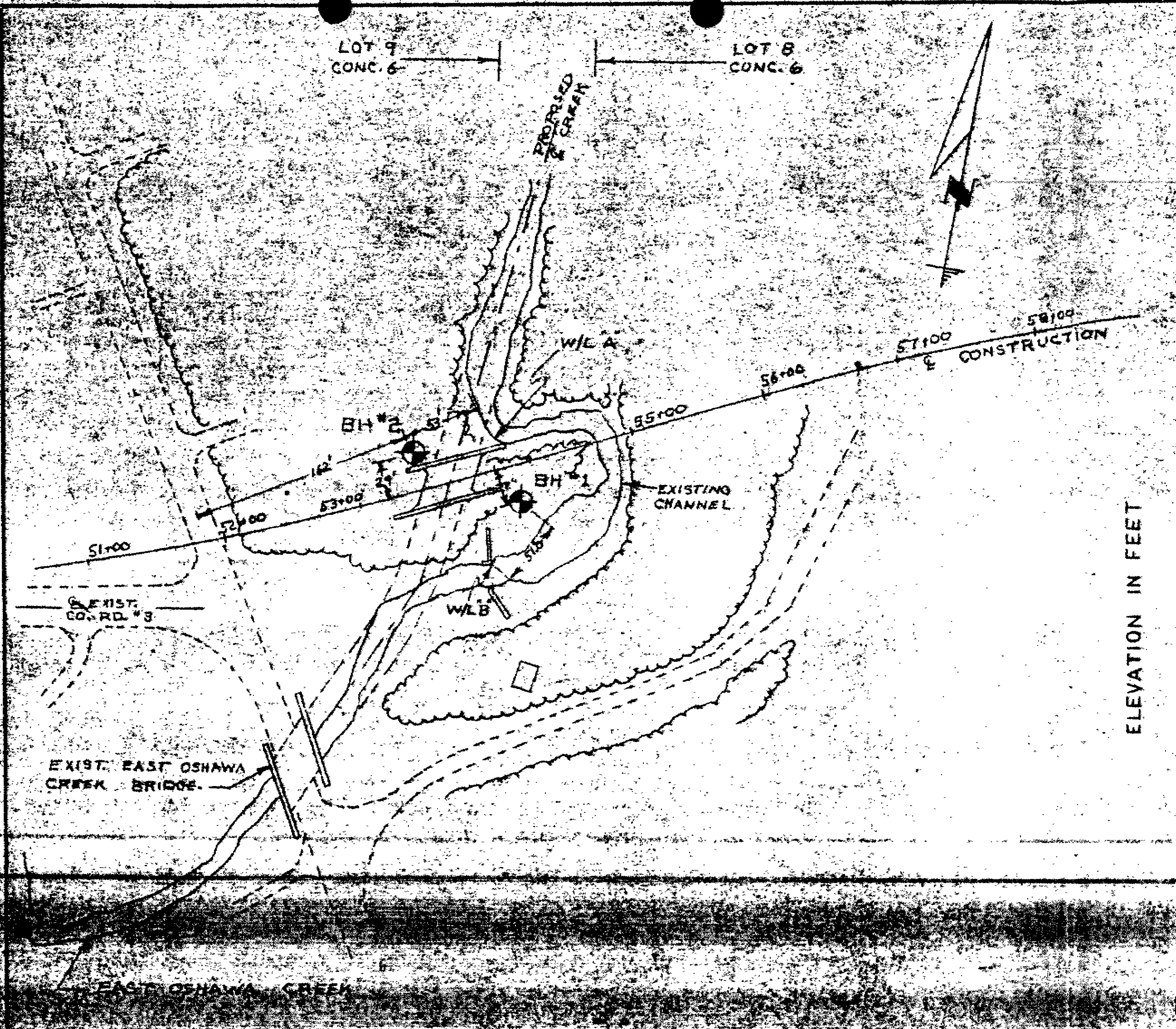
J. A. HAYES, P. ENG.

JAH/df



SITE INVESTIGATION SERVICES LTD.

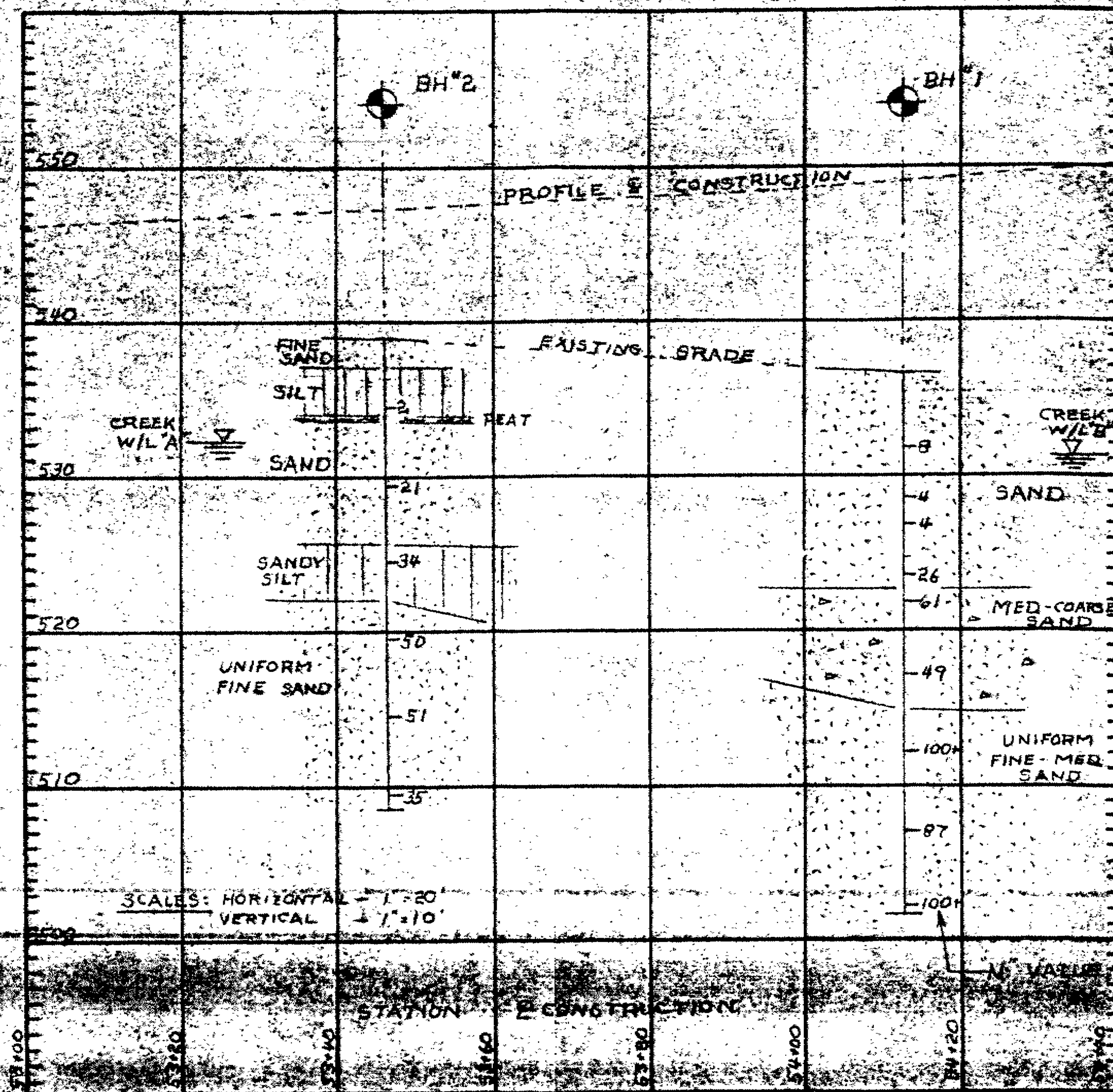
STRUCTURE – LOT 9, CONC. IV,	SCALE: 1" = 1 mi.	DATE: SEPT./71
TWP. OF EAST WHITBY	DRAWN: R.E.	FIGURE 1



SITE PLAN

SCALE: 1" = 100'

INFERRED SOIL STRATIGRAPHY



NOTE: SOILS DATA APPLIES ONLY TO THE ACTUAL BOREHOLE LOCATION. CONDITIONS MAY BE DIFFERENT AT OTHER PARTS OF THE SITE.

SITE INVESTIGATION SERVICES LIMITED

71-97

"STRUCTURE"
OSHAWA SUBURBAN ROAD # 3
LOT 9, CONCESSION VI, WHITBY TWP.

[illegible]	DWN. BY [illegible]	DATE: SEPT. 1971	FIGURE No. 2

MAILING ADDRESS
P.O. Box 216, Postal Station "K"
TORONTO 12, ONT.

MONTREAL, QUEBEC
620 CATHCART ST.
UNIVERSITY 6-6871

AROUND THE WORLD

Site

22-148

RAYMOND
CONCRETE PILE COMPANY, LIMITED

HIGHWAY NO. 7, UNIONVILLE, ONTARIO
293—2486 TELEPHONES 364—3644

SOIL INVESTIGATION REPORT

PROJECT:	Proposed Bridge Reconstruction
SITE:	DeHart's Bridge Concession 7, Whitby Township
CLIENT:	County of Ontario Whitby, Ontario.
TOPOGRAPHY:	At the time of the field work, a location plan and profile were supplied by the County. Elevations were supplied, based on a bench mark as shown on the borehole location plan.
DATE OF FIELD WORK:	21 November to 22 November 1961
OUR JOB NUMBER:	Raylin B-1230-T
CLIENT's PROJECT NUMBER:	B - 68
DATE OF REPORT:	1 December 1961.

INTRODUCTION

Two boreholes were made by the Raymond Concrete Pile Co. Ltd. at the above site, for purposes of evaluating soil conditions for foundation design of the proposed bridge construction.

The borings were made by standard exploratory techniques, using 2½" casing. The Standard Penetration Test was performed every 2 to 3 feet to a depth of 15 feet, and at 5 foot intervals thereafter.

INTRODUCTION - Continued

A record was kept of the number of blows required to drive the 2" O.D. Sampling Spoon one foot, using a 140 lb. weight falling freely 30 inches. Soil samples were obtained after completion of each driving test.

Ground water levels were not observed. However, due to the granular nature of the soil deposits and nearness of the stream, for all intent and purpose the ground water level would be that of the stream.

SOIL CONDITIONS

Soil conditions observed at the two locations were similar and are loose to dense brown gravelly sand underlying 6 inches to 2'-4" of topsoil, extending to a depth of 8.5 feet below ground surface. Underlying the brown sand is a dense very silty fine grey sand, extending to completion of both boreholes. At the location of borehole #2 the grey sand extended to elevation 40, at which depth the N value is recorded as 100 blows for 9 inches, or practical refusal.

CONCLUSIONS

Assuming that the bridge foundations will be placed some 3 to 4 feet below present creek bottom, this would place the bottom of the foundation at approximate elevation 51.

Below elevation 54 foundations will be in the dense grey sand having an average minimum N value of 26, this being based on borehole #1. With an N value of 26, and making reference to Terzachi and Peck, a soil bearing value of 4000 pounds per square foot is recommended with a maximum allowable settlement of 1 inch.

CONCLUSIONS - Continued

It is pointed out that with the deposits being sand, as excavations are taken below the ground water level, water problems will arise, and if a differential hydrostatic head is formed, a possible "quick" condition will be formed. This condition should not be allowed, since it will affect and reduce the above bearing value.

RAYMOND CONCRETE PILE COMPANY LIMITED

James Hodd

James Hodd, P. Eng.
Manager - Soil Investigation Department

jh/c

2M 40 Pads-2-58 Bor. 401

RAYMOND
CONCRETE PILE COMPANY LTD.

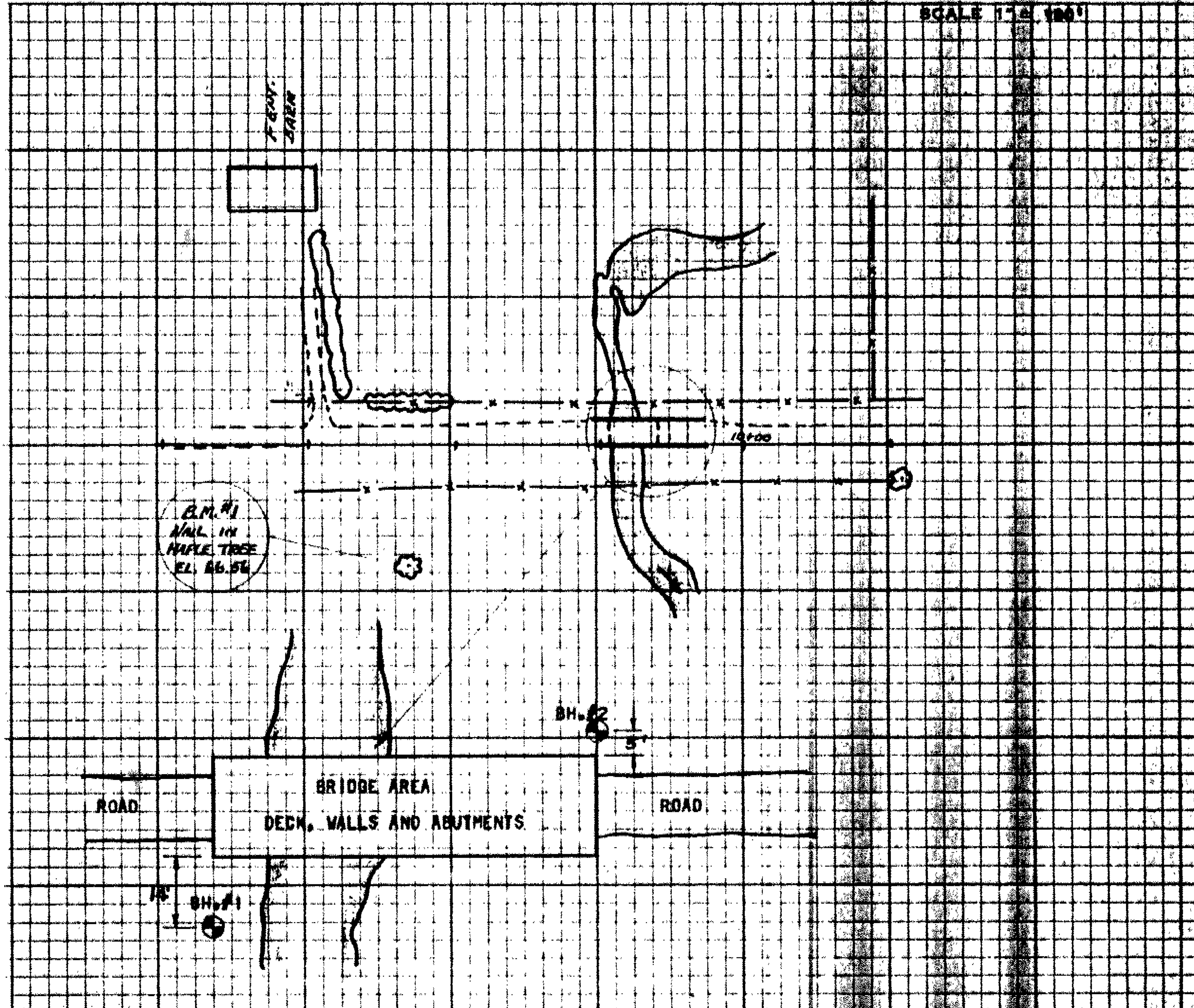
LOCATION PLAN

To COUNTY OF ONTARIO — Date NOVEMBER 19 61

Address WHITBY, ONTARIO

Project B-68 DeHART'S BRIDGE

CON. 7, TOWNSHIP OF WHITBY



SCALE 1" = 50'

Compass Points

This boring report prepared in the TORONTO OFFICE of the Raymond Concrete Pile Company Ltd.

By ... HOOD

Job No. B-1230-1

Page ... of ...

5M 50 Pads-1-30

TEST BORING REPORT

RAYMOND

CONCRETE PILE COMPANY LTD.

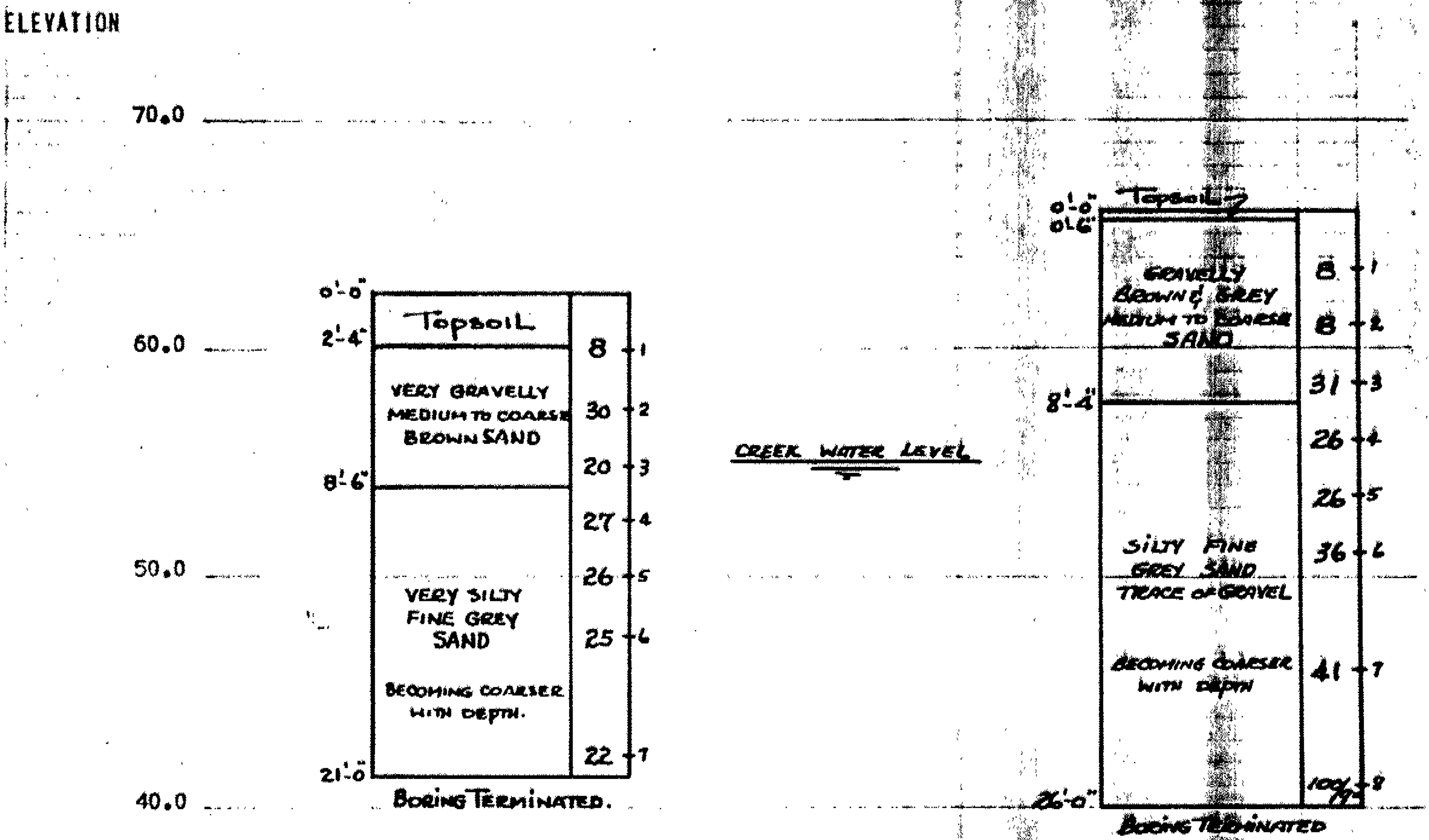
SOIL TEST DIVISION

To COUNTY OF ONTARIO Date NOVEMBER 1961 Job No. B-1230-T

Location of Borings DEHART'S BRIDGE, CON. 7, WHITBY TOWNSHIP

All borings are plotted to a scale of 1" = 8 ft. using BENCH MARK AS SHOWN as a fixed datum.

No. No. 1 No. No. 2



Classifications are made by VISUAL inspection.

Water levels (WL). Figure indicates time of reading (hours) after completion of boring. Water levels indicated are those observed when borings were made, or as noted. Porosity of the soil strata, variations of rainfall, site topography, etc., may cause changes in these levels.

Figures in right hand column indicate number of blows required to drive 2" O.D. sampling pipe one foot, using 140-lb. weight falling 30 inches.

Total Footage

Foreman R. KITCHENER

Classification by R. KITCHENER

Sheet of

M E M O R A N D U M

TO: V. Boehnke
Head
Structural Section
Central Region

DATE: 93 03 24

ATTENTION: Wade Young

FROM: Foundation Design Section

RE: Foundation Component of Preliminary Design
W.P. 326-88-01 & 282-86-01
Hwy. 407 from Hwy. 48 to Hwy. 115
Whitby Link (407 to 401)
Oshawa Link (407 to 401)

This is a proposal for the level of effort for the foundation component of preliminary design. Please consider the number of boreholes proposed to be a suggestion for discussion purposes. The proposal is intended to be conceptual and to illustrate a foundation investigation approach that balances risk and cost.

The request for the Hwy. 407 preliminary design suggested a minimum level of effort while the request for the links expected full coverage. It is understood that the design and construction phases of these projects are not scheduled for over 20 years. The purpose of our discussions to date has been to determine a consistent and appropriate level for all 3 projects.

Historically, preliminary design investigations have been carried out at most structure locations and at any other sites where groundwater, slope stability, settlement or organic terrain concerns were anticipated. Due to the number of sites at the 407 projects (assumed to be in the order of 250), such an approach would cost over $500K and take over one year to complete in-house. If consultants were hired the cost would be increased by 50%, while time would be reduced by less than 50%. (These costs and times are approximations to illustrate the magnitude of the project.)

Our initial assessment of foundation aspects of the alignment has been based on a review of air photos, geological maps, well drilling data and the geotechnical planning reports prepared by Geocon. Based on that information and our knowledge of the area, we do not anticipate any foundation problems that would force alteration of the selected alignments. However, we are not ~~be~~ able to preclude the possibility of localized areas where foundation problems might arise (without drilling boreholes at each site).

.../2

In view of the distant design and construction phases for this project and the high costs for a full preliminary design investigation, we propose a compromise level of effort for preliminary design purposes:

* 30 boreholes for 407
* 10 boreholes for each link

We anticipate that the cost for this level of foundation investigation and reporting would be in the order of $80K in-house and $120K by consultants. Of course, if these investigations discovered critical sites, supplementary investigations would be carried out.

The boreholes would be assigned to
- complex structure sites
- environmentally sensitive sites associated with impacts on groundwater
- high fills over 8m
- deep cuts over 8m

It should be understood that this 'compromise' level of investigation will not positively identify foundation types (spread footings or deep foundations) or loading recommendations, although the information obtained will facilitate guestimates.

As agreed in our meeting of March 3/93, the foundation investigation program should satisfy the comfort level of all parties involved. We understand that the project team will meet to discuss this proposal and reach a consensus on the appropriate level of effort.

If there are any questions, please call.

D. Dundas
D. Dundas, P.Eng.
Sr. Foundation Eng.

cc: P. Reynolds
D. Mackie
C. Lumley

MEMORANDUM

Central Region, Transportation Planning Section
3rd Floor, Atrium Tower, 1201 Wilson Avenue
Downsview, Ontario M3M 1J8
TEL: (416) 235-5482 FAX: (416) 235-4382

TO: DISTRIBUTION LIST DATE: September 25, 1991

RE: **HWY 407/TRANSIT TRANSPORTATION CORRIDOR ROUTE PLANNING, PRELIMINARY DESIGN AND ENVIRONMENTAL ASSESSMENT STUDY, HWY 48 IN MARKHAM TO HWY 35/115 IN NEWCASTLE**

In May and June, 1991 the Ministry presented for review and comment a "technically preferred route" for the proposed Highway 407/Transit facility in the above area. Presentations were given to other government ministries and agencies, technical representatives of municipalities and to municipal councils or planning committees. A series of Public Information Centres were then held, one in each of the directly affected municipalities, (attached brochure).

The Project Teams for the above studies are now reviewing and responding to comments from external contacts. Additional investigations and modifications will be undertaken as necessary to confirm and obtain general agreement for the proposed route before undertaking the preliminary design phase of the studies.

In May 1991, prior to external contacts, the Project Teams presented the proposed route to MTO Management and designated technical contacts from other Ministry offices with a request for comments.

Attached for your information is a plan of the "technically preferred route" as presented to external contacts following our May 1st, 1991 internal presentations. (Plans at a scale of 1:10,000 as well as 1:20,000 are available if required.)

To complete the review of the "technically preferred route" we are requesting that your office advise us of any final comments you may have regarding the proposed route at the present level of planning. (If significant modifications occur as a result of the current review process an update and opportunity for further comments will be provided).

/...2

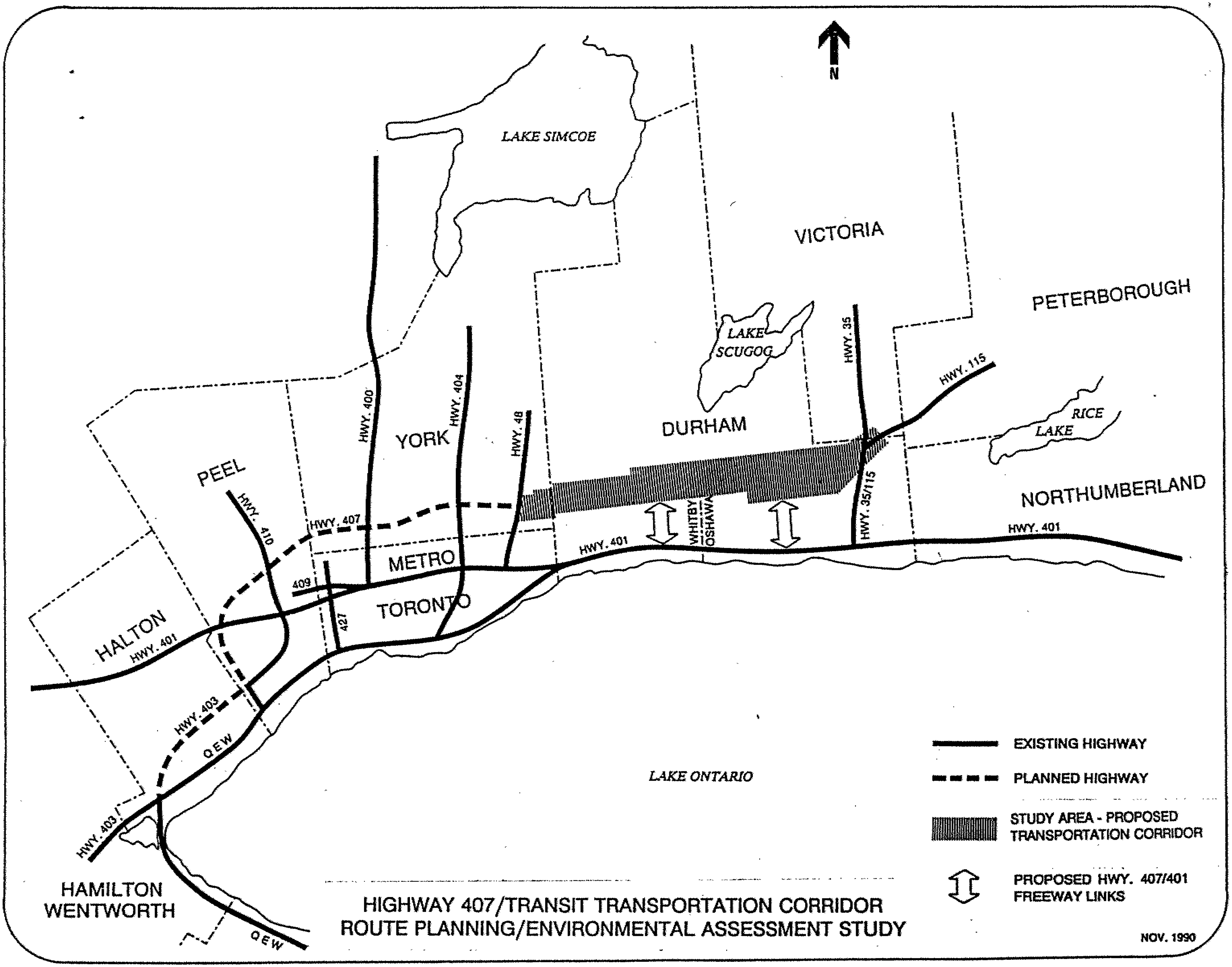
A full documentation of route selection will occur later in this phase following a final decision on the alignment. If your office requires information at the present time regarding background studies, data, or the evaluation process please contact the undersigned.

Your response regarding the "technically preferred route" by October 30, 1991 will be appreciated. Should you have any questions regarding this request or the studies in general please call.

Patrick Reynolds
Project Manager
Hwy 407 Studies - Hwy 48 to Hwy 35/115

Attach.

cc: C. Lumley
K. Harding
D. Coutts - PARKER CONSULTANTS
R. Smith - PARKER CONSULTANTS
A. Minchev - FENCO
I. Upjohn - FENCO



HIGHWAY 407/TRANSIT TRANSPORTATION CORRIDOR
ROUTE PLANNING/ENVIRONMENTAL ASSESSMENT STUDY

HWY 407/TRANSIT ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY

(HWY 48 TO HWY 35/115)

TECHNICALLY PREFERRED AND ALTERNATIVE ROUTES -- MAY, 1991

Thickson Rd

Small Profile

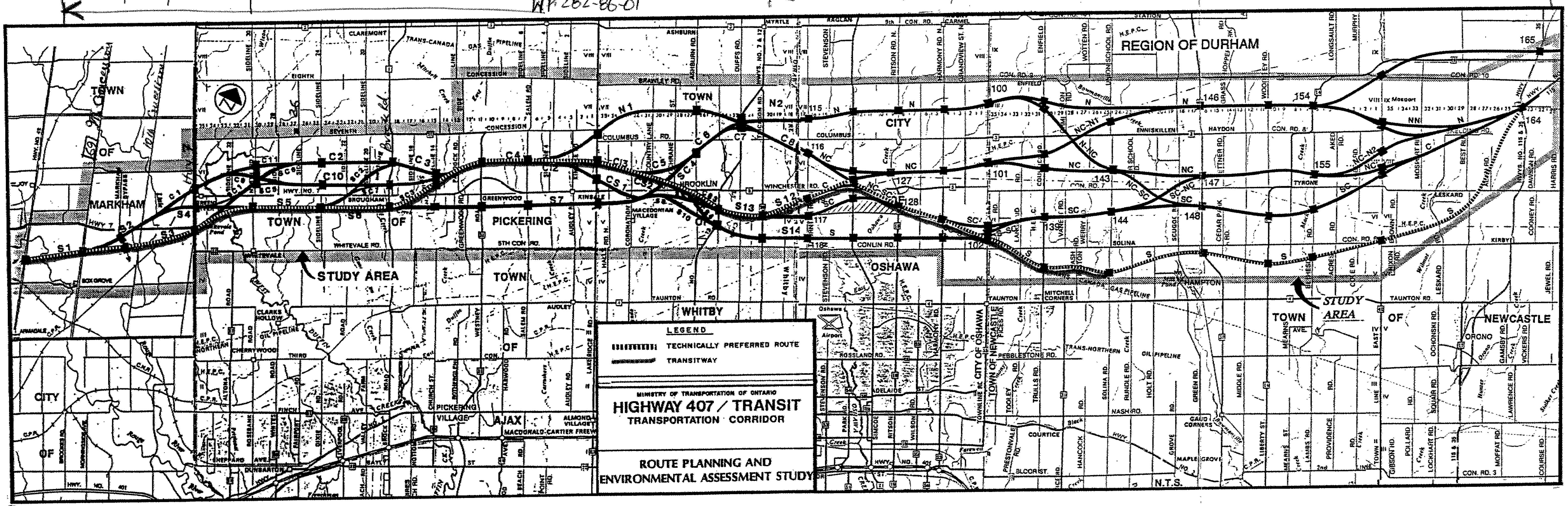
Small Profile

Large Profile

Conc 30

WP 282-86-01

WP 326-88-01



Lavalin

MEMORANDUM

TO	Mr. Pat Reynolds, P.Eng. MTO Transportation Section	DATE	May 30/90
FROM	I. Corbett, P.Eng. - Geocon	PROJECT No.	53425/T11547-2
SUBJECT			

RE: HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY
PRELIMINARY ROUTES - GEOTECHNICAL APPRAISAL
WHITBY-OSHAWA BOUNDARY EAST TO HWY 115/35 - PARKER SECTION
WP 326-88-01

This memo outlines the results of our preliminary geotechnical appraisal of the proposed alternative routes for Highway 407 between the Whitby-Oshawa Boundary east to Highway 115/35. A copy of these routes, as supplied by C.C Parker Consultants Ltd., indicates that four basic routes are under consideration. Specifically, these include a Southerly Route (denoted S), two Central Routes (denoted NC and SC) and a North Route (denoted N). In addition to these main route corridors, several short parallel sections and/or crossovers between the four alignments are also under review at this time.

We understand that these routes are still preliminary and that they do not represent the final alignments to be subjected to a detailed route comparison study. However, at this stage of the route selection process, a preliminary appraisal of the geotechnical conditions along each of the proposed routes is required.

Geotechnical Appraisal

A preliminary analysis of the prevailing geotechnical conditions for this portion of the Highway 407 Route Corridor was presented in a Technical Paper by Geocon, issued in Draft format on January 26, 1990. Within that report, Drawing T11547B-02 presented the location of "Geotechnical Hazards" within this area of the route corridor. At this preliminary stage, the geotechnical appraisal of the proposed route alignments has been limited to their interaction with these identified areas. It should be noted, that the geotechnical hazard areas presented on the above quoted drawing, were selected based largely on air-photo interpretation and their anticipated geotechnical conditions have not been confirmed by field investigation.

In general, the proposed routes are favourably located with respect to the geotechnical hazards indicating, that for the majority of their lengths the routes traverse areas with good foundation conditions with respect to allowable bearing pressure, slope stability, etc. However, as discussed in the technical paper, the region to the North and East of this portion of the route corridor is located either on or close to the Oak Ridges Moraine and subsequently comprises an area of quite high relief. While the subsoils in this region are considered competent, it is anticipated that, due to the undulating nature of the terrain, deep cuts and fills will be required for any potential alignment traversing this section. To the South and West, away from the Oak Ridges Moraine, the fine grained nature of the subsoils render the subgrades frost susceptible.

A detailed analysis of the interrelationship between the proposed routes and the geotechnical hazards, is presented in Table 1. Also contained in Table 1, is a brief statement on the anticipated geotechnical conditions within the hazard area. Three areas are of particular note, namely two areas of high water table located to the southwest of Enfield and the southwest of Enniskillen, and the Oak Ridges Moraine. In both of the former areas, the anticipated subsoil conditions are considered to be comprised of deposits which will be both soft and deep. Expected problems within the latter area will be as discussed above.

In conclusion therefore, at this preliminary stage, the geotechnical conditions along the North Route appear to limit the viability of this route. However, we understand that a potential route in this region of the route corridor is required for evaluation purposes. The identified hazardous areas along the remaining routes (Table 1), consist of a small percentage of the total route lengths and are representative of the range of geotechnical conditions that typically exist within these lengths of the route corridors. The full impact of these variations and those of the northern route together with other pertinent geotechnical conditions will be addressed during the detailed route comparison stage when more site specific information on the subsurface conditions within the identified hazard areas at other key locations will have been obtained.

We trust that this preliminary geotechnical appraisal is sufficient for your present needs. Should you have any questions or require any further information, please do not hesitate to contact this office.

IC:dtj

cc: Mr. Doug Coutts, P.Eng.
C.C. Parker Consultants

Enclosed:

Table 1 - Highway 407 Route Planning and Environmental Assessment Study.
Proposed Routes - Preliminary Geotechnical Appraisal.
Whitby/Oshawa Boundary East to Highway 115/35.

TABLE 1
HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY
PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL
WHITBY/OSHAWA BOUNDARY EAST TO HIGHWAY 115/35

Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
N	Whitby/Oshawa Boundary	Hwy 115/35	26.9	Erosion along creek at Ritson Road	Erosion Protection at creek crossing
				Areas of high water table	Shallow *3 Soft Deposits
				- 1.2 East of Ritson Road	100 m long
				- at West Townline Road	50 m long
				- immediate vicinity of Enfield Road	100 m long
				- at Solina Road	200 m long
				- 50 m East of Regional Road 14	150 m long
				Areas of High Water Table	Deep*3 Soft Deposits
				1.0 km East of West Townline Road	120 m long
				East of Aked Road undulating terrain	Potential deep cuts and/or fills
NC	Whitby/Oshawa Boundary	Darlington Townline Road	21.8	Erosion along creek at Ritson Road	Erosion protection at creek crossing
				Areas of High Water Table	Shallow Soft Deposits
				- 2.5 km East of Thornton Road	- 50 m long
				- 4.0 km East of Grandview Road	- 300 m long
				- 20 m East of West Townline Road	- 100 m long
				- at Regional Road 14	- 150 m long
				Areas of High Water Table	Deep Soft Deposits
				- 200 m East of Holt Road	- 250 m long
				East of Aked Road undulating terrain	Potential deep cuts and/or fills
SC	Whitby/Oshawa Boundary	Darlington Townline Road	22.0	Areas of High Water Table	Shallow Soft Deposits
				-300 m East of Harmony Road	- 100 m long
				-100 m West of Old Scugog Road	- 150 m long
				- at Bethesda Road	- 150 m long

TABLE 1
HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY
PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL
WHITBY/OSHAWA BOUNDARY EAST TO HIGHWAY 115/35

Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
SC (cont'd)				East Aked Road undulating Terrain	Potential Deep Cuts and/or Fills
S	Whitby/Oshawa	Hwy 115/35	29.8	Areas of High Water Table - 300 m East of Leask Road - at Cole Road - at Regional Road 42	Shallow Soft Deposits - 150 m long - 100 m long - 150 m long
				Erosion along creek, 700 m West of Ritson Road	Erosion protection at creek crossing
				East of Aked Road Undulating Terrain	Potential Deep Cuts and/or Fills
C	Whitby/Oshawa Boundary	Ritson Road	3.6	None	
C	Darlington Townline Road	Hwy 115/35	5.5	Area of High Water Table 300 m West of Mosport Road	Shallow Soft Deposits - 150 m long
NC-SC	Simcoe Road	Ritson Road	1.7	None	
(SC-S) (S-SC)	Harmony Road	Courtice Road	3.9	None	
NC-N1	West Townline Road	1.6 km West of Regional Road 57	6.4	Area of High Water Table at Courtice Road	Shallow Soft Deposits - 170 m long
N-NC	Enfield Road	Solina Road	3.3	None	
SC-NC	Holt Road	Regional Road 57	2.0	Area of High Water Table 0.5 km East of Holt Road	Deep Soft Deposits - 200 m long
NC-N2	Bethesda Road	Darlington Townline Road	2.4	Area of High Water Table 200 m East of Bethesda Road	Shallow Soft Deposits - 100 m long

TABLE 1

HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY

PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL

WHITBY/OSHAWA BOUNDARY EAST TO HIGHWAY 115/35

Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
NC-N2 (cont'd)				East of Aked road Undulating Terrain	Potential Deep Cuts and/or Fills

1) Geotechnical hazards as noted were interpreted from Geocon Drawing No. T11547B-2 entitled "Highway 407 Route Planning and Environmental Assessment Study (Whitby/Oshawa Boundary East to I35/115) (WP-282-06-01) - GEOTECHNICAL HAZARDS"

2) Routes analyzed were presented on Drawing supplied by Parker Consultants dated May 1, 1990.

3) In the above table "Shallow" refers to deposits less than 3.0 m thick and "Deep" represents deposits between 3 and 10 m thick.

Lavalin

MEMORANDUM

TO	Mr. Pat Reynolds, P.Eng. MTO Transportation Planning Section	DATE	May 30/90
FROM	I. Corbett, P.Eng. - Geocon	PROJECT No.	53425/T11547-1
SUBJECT			

RE: HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY
PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL
HIGHWAY 48 EAST TO WHITBY-OSHAWA BOUNDARY - FENCO Section
WP 282-86-01

This memo outlines the results of our preliminary geotechnical appraisal of the proposed alternative routes for Highway 407 between Highway 48 east to the Whitby-Oshawa Boundary. A copy of these routes, as supplied by Fenco Engineers Inc., indicates that from Highway 48 to Salem Road, two basic routes are under consideration. Specifically, these include a Southerly Route (denoted S) and a Central Route (denoted C). East of Salem Road, a third potential alignment, to the north of the Central Route (denoted N), is also under consideration. In addition to these main route corridors, several short parallel sections and/or crossovers between the three alignments are also under review at this time.

We understand that these routes are still preliminary and that they do not represent the final alignments to be subjected to a detailed route comparison study. However, at this stage of the route selection process, a preliminary appraisal of the geotechnical conditions along each of the proposed routes is required.

Geotechnical Appraisal

A preliminary analysis of the prevailing geotechnical conditions for this portion of the Highway 407 Route Corridor was presented in a Technical Paper by Geocon, issued in Draft format on January 26, 1990. Within that report, Drawing T11547A-02 presented the location of "Geotechnical Hazards" within this area of the route corridor. At this preliminary stage, the geotechnical appraisal of the proposed route alignments has been limited to their interaction with these identified areas. It should be noted, that the geotechnical hazard areas presented on the above quoted drawing, were selected based largely on air-photo interpretation and their anticipated geotechnical conditions have not been confirmed by field investigation.

In general, the proposed routes are favourably located with respect to the geotechnical hazards indicating, that for the majority of their lengths the routes traverse areas with good foundation conditions with respect to allowable bearing pressures, slope stability, etc. However, as discussed in the technical paper, the predominant foundation soils within this portion of the route corridor comprise of frost susceptible materials. These conditions are however applicable to all of the routes and are not discussed further.

A detailed analysis of the interrelationship between the proposed routes and the geotechnical hazards, is presented in Table 1. Also contained in Table 1, is a brief statement on the anticipated geotechnical conditions within the hazard area. The information presented in Table 1, indicates that the most southerly alignments traverse several extinct gravel pits which will require considerable volumes of fill and as a result, at this very preliminary stage, are less favourable than the Central or Northern routes. Of particular note along the Central Route, is the presence of a high water table area within the C4 route alignment. This area is highlighted because it is anticipated that the soim conditions at this location will be comprised of a combination of deposits which are both soft and deep. As such, special measures will have to be taken to cope with these subsoils such as excavation, isolation or pre-loading. The remaining hazardous areas intersected by the proposed routes, based on available information at this time, are not considered to pose major geotechnical problems although, they will result in an increase in costs above the norm.

In conclusion therefore, none of the proposed routes traverse areas which are considered to comprise of such poor geotechnical conditions to warrant route relocation based on this consideration alone. The identified hazardous areas along the routes, as outlined in Table 1, consist of a small percentage of the total route lengths and are representative of the range of geotechnical conditions that typically exist within these lengths of the route corridors. The full impact of these variations and other pertinent geotechnical conditions will be addressed during the detailed route comparison stage when more site specific information on the subsurface conditions within the identified hazard areas and at other key locations will have been obtained.

We trust that this preliminary geotechnical appraisal is sufficient for your present needs. Should you have any questions or require any further information, please do not hesitate to contact this office.

IC:dtj

cc: Mr. Ian Upjohn, P.Eng.
Fenco Engineers Inc.

Enclosed:

Table 1 - Highway 407 Route Planning and Environmental Assessment Study.
Proposed Routes - Preliminary Geotechnical Appraisal
Highway 48 East to Whitby/Oshawa Boundary

TABLE 1

HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY

PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL

HIGHWAY 48 EAST TO WHITBY/OSHAWA BOUNDARY

Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
S1	Highway 48	Ninth Line	2.2	None	
S2	Ninth Line	Regional Road 30	4.9	None	
S3	Ninth Line	North Road	6.8	None	
S4	Tenth Line	Regional Road 30	2.1	None	
SC1	Regional Road 30	Sideline 30	2.7	None	
S5	North Road	Sideline 24	2.5	High Water Table Area 100 m West of Sideline 24	Shallow*3 Soft Deposits - Length 200 m
S6	Sideline 24	Westney Road	5.9	High Water Table Area - East of Sideline 24 Gravel Pit - 1.0 km East of Sideline 24 Gravel Pit - 4.5 km East of Sideline 24	Shallow Soft Deposits - Length 250 m Deep Road Fills - Length 200 m Deep Road Fills - Length 350 m
SC2	Sideline 24	Brock Road	3.0	High Water Table Area East of Sideline 24	Shallow Soft Deposits - Length 300 m
SC3	Brock Road	Sideline 1	2.2	None	
S7	Westney Road	Coronation Road	5.6	High Water Table Area - 1.3 km East of Westney Road Gravel Pit - 2.5 km East of Westney Road Gravel Pit - 4.0 km East of Westney Road	Shallow Soft Deposits - Length 250 m Deep Road Fills - Length 250 m Deep Road Fills - Length 200 m
SC4	Coronation Road	Regional Road 1	3.1	Gravel Pit - Adjacent to Coronation Road	Deep Road Fills - Length 300 m
S8	Coronation Road	Highway 12	3.5	Gravel Pit - Adjacent to Coronation Road	Deep Road Fills - Length 250 m

TABLE 1
HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY
PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL
HIGHWAY 48 EAST TO WHITBY/OSHAWA BOUNDARY

Route Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
S9	Coronation Road	Thickson Road	5.0	Gravel Pit - Adjacent to Coronation Road	Deep Road Fills - Length 250 m
S10	Highway 12	Whitby/Oshawa Boundary	3.0	High Water Table Area - Immediately East of Highway 12 High Water Table Area - 300 m East of Highway 12	Shallow Soft Deposits - Length 100 m Shallow Soft Deposits - Length 400 m
S11	Thickson Road	Whitby/Oshawa Boundary	1.2	None	
S12	Thickson Road	Whitby/Oshawa Boundary	1.3	High Water Table Area - 0.5 km East of Thickson Road	Shallow Soft Deposits - Length 200 m
C1	Regional Road 30	Sideline 30	2.3	High Water Table Area - Just East of Regional Road 30 River Bank Erosion - 0.5 km East of Regional Road 30	Shallow Soft Deposits - Length 200 m Erosion Protection to Bridge Abutment Across River Possibly Foundation Instability
C2	Sideline 30	Brock Road	5.0	None	
C9	Sideline 30	Sideline 1	7.6	High Water Table Area - 0.7 km East of Brock Road	Shallow Soft Deposits - Length 100 m
C3	Brock Road	Sideline 1	1.7	None	
C4	Sideline 1	Salem Road	3.4	High Water Table Area - 1.0 km East of Sideline 1	Deep*3 Soft Deposits - Length 350 m

TABLE 1

HIGHWAY 407 ROUTE PLANNING AND ENVIRONMENTAL ASSESSMENT STUDY

PROPOSED ROUTES - PRELIMINARY GEOTECHNICAL APPRAISAL

HIGHWAY 48 TO WHITBY/OSHAWA BOUNDARY

Route Identification	Assumed Route Limits From	To	Length (km)	Geotechnical Hazards Within Route Limits	Anticipated Associated Geotechnical Conditions
C5	Salem Road	Regional Road 1	6.4	None	
CS1	Side Road 4	Coronation Road	3.3	Gravel Pit - 3.3 km East of Side Road 4	Deep Road Fills - Length - 80 m
C6	Regional Road 1	Duffs Road	2.1	High Water Table Area - 0.2 km East of Regional Road 1	Shallow Soft Deposits - Length 250 m
C8	Duffs Road	Whitby/Oshawa Boundary	2.4	None	
N1	Salem Road	Duffs Road	8.5	High Water Table Area - 0.3 km East of Pickering Whitby Boundary High Water Table Area - 1.0 km West of Duffs Road	Shallow Soft Deposits - Length 400 m Shallow Soft Deposits - Length 300 m
N2	Duffs Road	Whitby/Oshawa Boundary	2.0	None	

NOTES:

1) Geotechnical Hazards as noted above were interpreted from Geocon Drawing No. T11547A-02 entitled "Highway 407 Route Planning and Environmental Assessment Study (Hwy 48 East to Whitby/Oshawa Boundary) (WP-282-86-01) - GEOTECHNICAL HAZARDS"

2) Routes analysed were presented on Fenco Engineers' Drawing dated March 27, 1990

3) In the above table "Shallow" refers to deposits less than 3.0 m thick and "Deep" represents deposits between 3 and 10 m thick.

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M14-244

DIST. 6 REGION

W.P. No. 91-78-00

CONT. No.

W. O. No.

STR. SITE No.

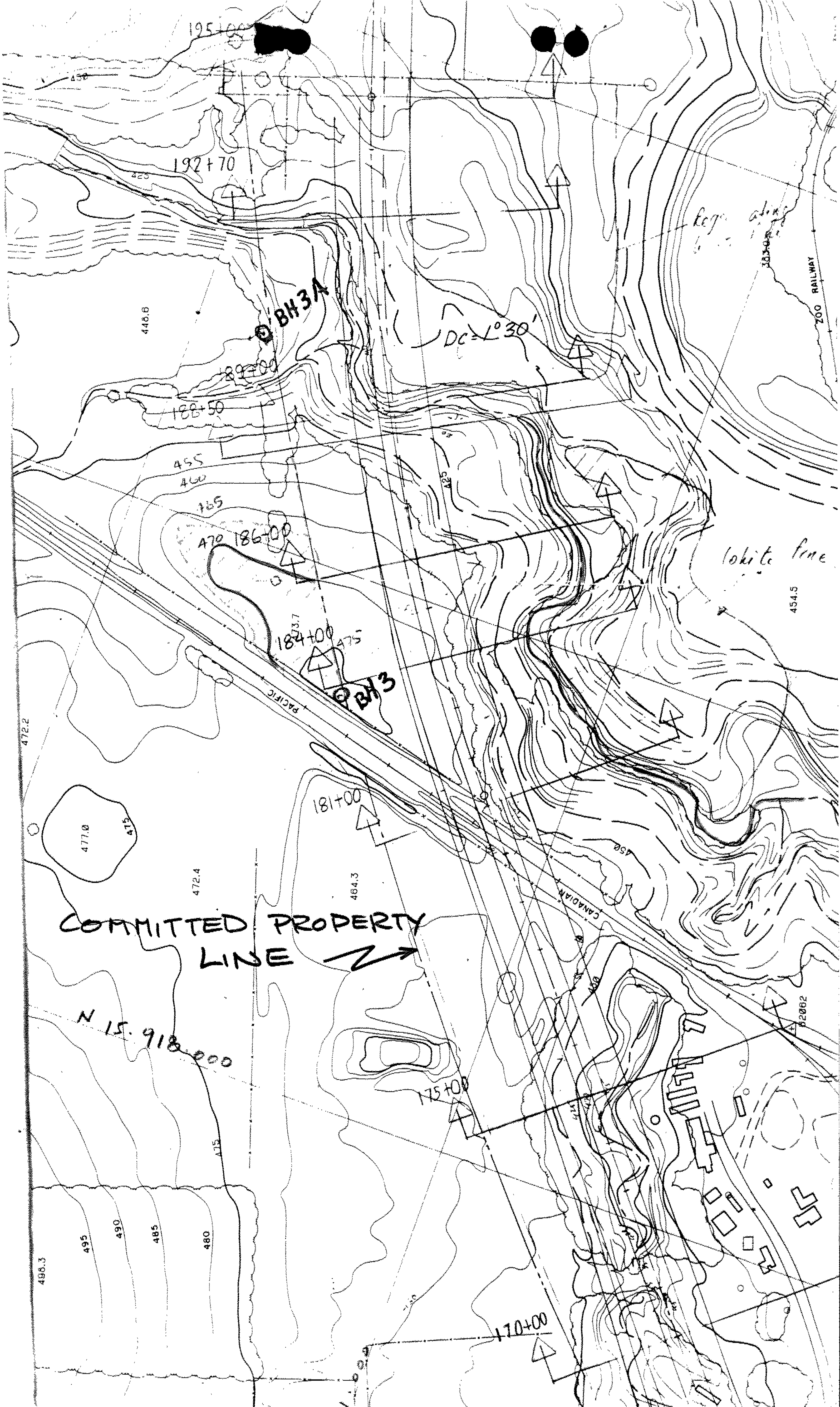
HWY. No. E.M.T.C.

LOCATION SLOPE STABILITY

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:


195+00
430
192+70
425
448.6
BH3A
189+00
188+50
DC=1°30'
ZOO RAILWAY
455
460
465
470
186+00
473.7
184+00
475
BH3
PACIFIC
454.5
472.2
181+00
477.0
475
472.4
464.3
450
CANADIAN
COMMITTED PROPERTY LINE
N 15.918.000
82062
175+00
475
498.3
495
490
485
480
170+00

Cut Back slope adjacent to Miller Property

Option ① 2:1 side slopes c̄ 10' Berm with interceptor ditching

Require Exc. of some Miller Property to elev. 267

Option ② 1.75:1 side slopes c̄ 2 × 5' berm with interceptor ditching c̄ subdrains

Requires No Additional Grading

Option ③ 1.75:1 side slopes c̄ 2 × 10 berms with interceptor ditching & subdrains

Requires Exc. of limited Miller Property to elev 270

Toe Slopes

① Requires Protection against toe erosion

② Steep natural slopes may require counter-fort drains.

or

③ Provide C.S.P. in areas where creek encroaches and provide 2:1 slopes up to 25' using mid height 10' wide berms >25' and benching standard.

memorandum

Ontario

To: Mr. R.D. Gunter
Head, Geotechnical Section
Central Region

Date: 1980-03-19

Attention: Mr. A. Shopoff

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

GEOCRES # 30M14-244

Re: Slope Stability
Station 175+00 to 200+00
W.P. 91-78-00, E.M.T.C.

In your letter to us dated 1980 02 20, you requested our Office to carry out an investigation to assess the slope stability in critical areas at Sta. 184+00 of the proposed East Metro Transportation Corridor. Our verbal recommendations for the areas in question were made at a meeting on 1980 03 13 between Mr. M. Thompson, Mr. I. Williams, Mr. A. Shopoff, Mr. M. Devata and Mr. M. MacLean. We are hereby confirming our verbal recommendations.

Our slope stability recommendations are based on the results of the Feasibility Foundation Investigation Report for the East Metro Freeway issued January, 1979 under W.P. 25-69-00. The investigation indicates that in the area of concern subsoil conditions consist of an extensive deposit of a generally hard glacial till deposit extending to depths of up to 85 feet below ground surface.

We understand that at Sta. 184+50 (refer to attached sketch), the required E.M.T.C. grading, left of centerline, using 2:1 side slopes with a 10 foot wide mid-height berm will require property in excess of a committed property line. Current proposals call for maintaining the property line by constructing retaining walls up to 30 feet high. At this location we recommend temporary easement of a limited amount of Miller property, regrading, and possible landscaping to accommodate the 2:1 slope with a mid height berm within our committed property line. It should be noted that the suggested regrading would be carried out on a small high knob at the extreme limits of Miller property and would, in our understanding of Miller's development proposals, be to the benefit of the property owner. The natural slope, right of centerline, will be stable provided one of the following alternatives are carried out.

1) Protection of the toe of slope against scour from Malvern Drain by means of rip-rap. Longterm maintenance may require the installation of some counterfort subdrains in the face of the natural slope.

2) Protection of the toe of slope against scour by maintaining the Malvern Drain in a culvert of adequate hydraulic size, and grading over the culvert to form a berm to improve the stability of the natural slope.

...../2

If it is not possible to carry out either of the above alternatives because of other factors, i.e. environmental constraints, then the highway alignment should be shifted westerly to enable the natural side slope to eventually stabilize without encroaching on the E.M.T.C. at a 3:1 slope.

If you have any further questions, please do not hesitate to call us.

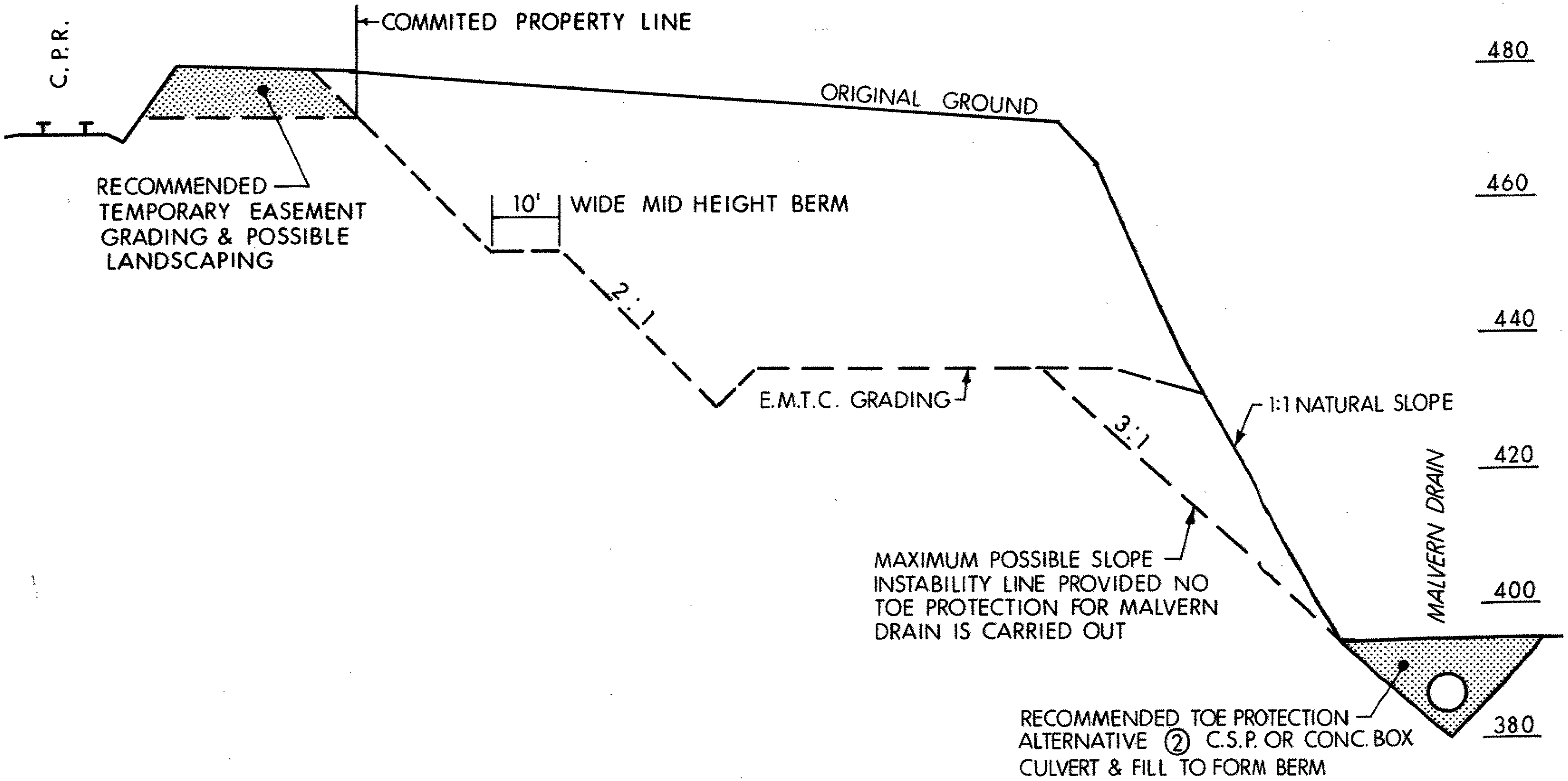
M. MacLean

MM:MD:ea

M. MacLean
Project Foundations Engineer

For: M. Devata
Senior Foundations Engineer

cc: M. Thompson
I. Williams, M.M. Dillon



E. M. T. C.
STA. 184 + 50
N.T.S.

WP 91-78-00

MEMO TO: File

CC: All in Attendance, Murray Thompson

FROM: Ian Williams

SUBJECT: EMTC Preliminary Design Study

FILE: 8277-01

DATE: 14 March 1980

MEETING WITH MTC GEOTECHNICAL OFFICE

On Friday 14 March 1980 a brief meeting was held with representatives of MTC geotechnical office (head office). This meeting was a followup to the meeting held on 13 March.

Those in attendance were:

Mr. M. Devata	-	MTC Geotechnical Section
Mr. M. McLean	-	" " "
Mr. I. Williams	-	M. M. Dillon Limited

At the 13 March meeting the group, in discussing the currently recommended design for EMTC in the vicinity of Morningside Creek, had reviewed incorrect cross sections in the vicinity of Sta.184. Those cross sections (relevant to an earlier abandoned scheme) showed a large retaining wall on the east side of EMTC adjacent to Morningside Creek.

The currently adopted scheme allows comparatively minor westerly shift in the centre line of EMTC and eliminates the need for this retaining wall. The latest scheme (see Sta.184) locates EMTC as far east as reasonable whilst maintaining the existing natural slope on the channel bank.

The consultant asked the MTC representatives their opinion of this scheme.

Mr. Devata and Mr. McLean noted that the scheme would be acceptable from a soils point of view and would eliminate the need for the retaining wall or the major north-south culvert to carry the creek (this had been discussed at the previous meeting on 13 March).

It would however be necessary to take measures to ensure that the natural channel bank did not erode over time due to the creek flow at the bottom. This could be accomplished by either erosion protection or by placing the creek in a culvert along its existing location.

The consultant asked the representatives opinion if environmental concerns made it impossible to do any remedial work in the creek bottom.

Mr. McLean and Mr. Devata replied in this case it would be necessary to shift the EMTC alignment further to the west to protect for a flatter natural slope (e.g. 2:1) together with a bench. It was noted that such a westerly shift would in fact approximate the other more westerly alternatives discussed at the 13 March meeting.

Mr. Devata noted that any stability problems possibly caused by vibration due to the highway operation would not be significant.

IW:ml

memorandum

Ontario

To: Mr. M. Devata,
Soil Mechanics Office,
Main Floor,
West Building.

Date: 1980-02-20

Central Region.

RECEIVED
FEB 26 1980
Pavement and Foundation Design Section

W.P. 91-78-00, E.M.T.C.
SLOPE STABILITY
STATION 175+00 TO
STATION 200+00

M.M. Dillon Limited requested for our comments regarding slope stability and erosion control for the E.M.T.C. from Station 175+00 to Station 200+00. The horizontal alignment within this section is controlled by the Rouge River on the east side and the committed property line on the west side. Also the vertical alignment is controlled by the C.P.R. Spur Line Crossing E.M.T.C. at Station 181+00±.

Because the proposed 2:1 cut-back slope with 10' mid-height berm encroaches the committed property line for about 15', a retaining wall about 20' from the property line is proposed (refer to cross-section Station 184+00, roll #2).

Since this investigation involves high cut-back slope on the west side, almost 1:1 natural slope on the east side (1) (refer to cross-section Station 184+00, roll #2), retaining wall as high as 50' on the east side (refer to cross-section (2) Station 182+50, roll #1) and retaining wall close to mid-height cut-back slope (3) (refer to cross-section Station 184+00, roll #2), we are asking you to do the investigation.

Attached are: Copy of the request from M.M. Dillon Ltd., copy of my comments for the E.M.T.C. from Sheppard Avenue to Finch Avenue, two rolls of cross-sections, profile and plan for this section.

For your information, I am also attaching a copy of a report dealing with long term safe slope stability for the west bank, Rouge River, South of Finch Avenue.

A. Shopoff

AS:lc

A. Shopoff,

for: R.D. Gunter,
Head, Geotechnical Section.

c.c. Ian Williams, P. Eng.
Project Manager
M.M. Dillon Ltd.
482-5656

Rec. for Pre Design Only.

7540-1318 (10/78)

JAMES F. MacLAREN LIMITED
CONSULTING ENGINEERS

WINDSOR MONCTON LONDON HALIFAX OVERSEAS

321 BLOOR ST. EAST, TORONTO 5, ONTARIO TEL 416 924-7411 CABLE "JAYMAC"

REFERENCE NO 133

October 28, 1971

Municipality of Metropolitan
Toronto,
Department of Parks and Recreation,
10th Floor, East Tower,
City Hall,
TORONTO 1, Ontario

Attention: Johnson, Sustronk, Weinstein, [illegible]
and Associates Limited,
819 Yonge Street,
TORONTO, Ontario

Report on Valley Crest Setback Limits, West Bank, Rouge River, South of Finch Avenue

Gentlemen:

In the light of potential future development along the Rouge River Valley, our firm was invited to discuss the details of establishing setback limits for development adjacent to the river valley wall. The section of river under study is the west bank of the Rouge Valley, extending about 5000 feet south of Finch Avenue.

It was agreed that the following detailed terms of reference would provide a reasonable basis for establishing a limit for potential development:

i) Review the geological history, conduct a field examination of the site geology, and determine the likelihood of significant micro-geological deviations.

ii) Review existing methods of soils investigation and laboratory testing and determine acceptable factors of safety against erosion and the methods of calculation.

iii) Determine existing slopes in the area and the conditions required to maintain future stable slopes.

iv) Review the purpose of potential methods of enforcement of regulations.

v) Recommend objectives and content of crest setback regulations, including monitoring procedures.

vi) Submit a report on the results of the study.

The required work has now been completed and the following represents the required report on the results of the study.

Data Collection

In order to properly evaluate the existing conditions along the west bank of the river, it was necessary to utilize numerous sources of information.

Initially, the investigation consisted of a review of all available soils reports, maps, etc., applicable to the area, to become familiar with the regional geology. An investigation of sequential aerial photographs (1954, 1960, 1968, 1970) of various scales was then conducted to analyse local geologic and soil conditions, drainage patterns, historical development along the river (i.e. changes in land use, filling of river banks, etc.) and the general meandering trends of the river over the past 15 years.

A field investigation of the site was then made by members of our firm and Golder Associates, Consulting Geotechnical Engineers, in order to further evaluate local soil conditions, and to determine preliminary parameters necessary to formulate the setback recommendations.

The analysis of the findings on the site conditions are shown in a separate report by Golder Associates, entitled "Slope Stability Considerations, West Bank, Rouge River". Extensive use of the Golder Report has been made in the preparation of this report.

Cross-sections were prepared for respresentative valley slopes from aerial photography by Lockwood Survey Corporation Limited and used to determine existing slopes.

Site and Gelology

The area under consideration is located along the west bank of the Rouge River adjacent to the site of the proposed Metropolitan Zoo in the Borough of Scarborough, Ontario, as shown in Figure 1. The river meanders its way through a valley about 1000 feet wide. Inertia of the stream at bends accelerates erosion on the outside ot the bends, developing meanders. Progressive meander is outward and downstream on the bends, working and reworking the entire floodplain without achieving horizontal stability unless artificially restrained. The progressive river meanders were plotted from the sequential photography to outline the future trends of the river, and to indicate the extent and location of required bank protection devices. The western bank may be divided into a northern area and a southern area separated by a small tributary creek flowing into the Rouge River through a heavily wooded valley. Figure 1 also shows the vertical sections determined from aerial photography.

In the northern area, the top of the slope is approximately 130 feet above the river and the land behind the crest slopes gradually down to the west a total of 15 feet over a distance of 400 feet. In the southern area the top of the slope is approximately 90 feet above the river and the land behind the crest is generally flat.

The geology of the area is adequately outlined in a report by P. F. Karrow entitled "Pleistocene Geology of the Scarborough Area", Ontario Department of Mines, Geological Report No. 46, 1967.

The upper strata generally consists of buff sandy tills which grade with depth into fine sandy silt tills. Below depths of 65 to 85 feet layers of stratified coarse sands, micaceous silty tills and peaty beds are evident and continue to the bottom of the exposes slopes.

Geologically, the Rouge River is in a young state and the present valley walls, cannot be considered to have established their geologically long term stable slope angle. In two obvious locations there is active erosion of the detritus at the toe of the slope by river action during high flow flood stages. The removal of this material is contributing to the general long term migration of the valley walls away from the river.

Slope Stability

An analysis of the factors which effect the stability of natural slopes is presented in Appendix "A". Although detailed soil characteristics at the site were not determined, it was possible to establish a probable range of values for the area based on examinations of the exposed slopes and comparisons with investigations and events at other locations of similar geologic origin.

These estimated values of soil parameters were used to determine the theoretical long-term crest position, and the safe slope angle was calculated for a factor of safety against movement of 1.5. The calculations suggest that slopes slightly flatter than 3 (horizontal) to 1 (vertical) would be appropriate for the study area.

Assuming that further toe erosion of the river is prevented, it may be assumed that the toe of the slope will remain relatively fixed, and the gradual long-term surficial erosion from seepage will, with time, flatten the slopes.

Thus, the crest of the present slopes will gradually move westward away from the river until a safe slope angle consistent with the strength of the soil is reached.

Discussion and Recommendations

It is apparent that the erosion of the toe of the valley wall slope must be prevented to permit the slopes to attain their natural angle of repose. This protection can be afforded by the use of gabions or rip rap. The design of the protective devices should allow for the passage of groundwater readily from the slope to the river. Any device that will cause a rise in the existing groundwater level will reduce the stability of the slopes and accelerate the flattening of the slopes.

The long-term stable slope of the valley wall is in the order of 3.5 horizontal to 1 vertical. The zone of future potential slope crest movement is an area varying from 160 to 305 feet from the top of the existing slope, depending on the specific location. It is possible that this distance may be reduced depending on the results of detailed soils investigations in specific areas.

As a result of the foregoing, the following recommendations are made:

1. In order to properly control development in the area subject to slope crest movement the land outlined in Figure 2 should be purchased.

2. Toe erosion protection should be placed along a reconstructed slope of two horizontal to one vertical in the locations shown in Figure 2.

All of which is respectfully submitted.

Yours very truly,

D. P. Sexsmith

D. P. Sexsmith, P. Eng.
Group Manager

R. G. Graham

R. G. Graham, P. Eng.
Project Engineer

DPS:rf

APPENDIX I

A. MECHANICS OF SLOPE STABILITY

The factors which influence the ability of a slope to resist gravitational movement downwards into an adjacent valley may be summarized as follows, and a graphical representation of these variable is given on Figure 1 of this Appendix.

Slope Geometry

While complicated and compound slopes are normally observed in nature a slope may be characterized by an overall slope angle (β) and the total vertical height (H).

Weight of Soil;

or "γ" pounds per cubic foot.

Soil Strength;

Which is typified by an effective angle of internal resistance, ϕ', and an effective cohesion, c', (or shear strength at zero normal effective pressure). The shear strength along possible failure surfaces, which is the critical strength condition, is related to the applied effective normal pressure, σ_n' , in the following equation:

$$\text{Shear strength} = c' + \sigma_n' \tan \phi'$$

Groundwater conditions

Variations in the groundwater elevation will influence the stability of slopes. In general, the higher the groundwater elevation, the more unstable the slope. For convenience in numerical analysis, the groundwater may be expressed as the ratio of the water pressure to the existing soil overburden pressure, in the following form:

$$ru = \frac{\text{groundwater pressure}}{\text{overburden pressure}} = \frac{\gamma_w h_w}{\gamma h} \quad \text{(see Fig.1)}$$

External Conditions

Changing external conditions, such as erosion of the toe of a slope or the construction of buildings near the crest, will alter the stability of the slope by increasing the slope angle or by increasing the weight which must be resisted along a critical failure surface. A wide variety of external conditions may be possible.

B. WEST SLOPE CONDITIONS

While each of the previous factors will vary from site to site, it is possible to establish a probably range of values for a particular location based upon exposed slopes at the specific site and similarities with other locations of similar geologic origin.

Slope Height

Based upon the vertical sections shown in Figure 1, the slope height in the northern area will range from about 100 ft. to 140 ft., while in the southern area, the present slope height ranges from 70 ft. to 110 ft.

Slope Angle

The present slopes in the study area may be divided into two groups. At sections 1 and 5, toe erosion and seepage under flood conditions have created bare scarps, resulting in compound slopes with a steep upper face and a talus of colluvial material near the toe. In the remaining sections, natural tree and brush cover has stabilized the slopes at slightly flatter angles. The following table summarizes the present range of values:

Slope Condition	RANGE OF EXISTING SLOPE ANGLES FROM Slope Angle	cot	TO Slope Angle	cot
Upper portion of eroded slopes	54°	0.72	56°	0.67
Lower portion (talus) of eroded slopes	13°	4.1	31°	1.6
Upper portion of wooded slopes	38°	1.3	47°	0.9
Lower portion of wooded slopes	23°	2.3	28°	1.8

Previous investigations in the upper reaches of Black Creek near Troutbrooke Drive in the Borough of North York have indicated that stable grassed slopes may exist at slopes in the order of 18° or 3 (horizontal) to 1 (vertical) for the stratified silts and varved clays which exist at that locality. When these slopes were artificially steepened by the placement of fill to create large level areas for backyards, slope movement occurred and remedial measures were required.

Similarly, an earlier investigation in the till soils along the upper reaches of the Humber River near St. Lucie Drive indicated that the slopes were in an incipient state of failure at slope angles between 20° and 25° (or between 2.8 and 2.1 horizontal to 1 vertical). In this case, slope movement had been on heavily wooded slopes, and assisted by a relatively high ground-water table combined with erosion at the toe of the slope. Extensive remedial measures and flattening of the overall slope were required.

These values indicate the probable range of long term slope angles which may be established in the region of the Rouge River.

Weight of Soil

The typical range of unit weight of soil for tills in the Toronto area is between 125 pounds per cubic foot and 140 pounds per cubic foot.

Soil Strength

Groundwater seepage was evident near the bottom of the slope near section 5 in the stratified sands and silty till soils, and minor slumps and earth flows were evident. Assuming that the seepage flow is parallel to the surface and that the factorof safety against soil movement is 1, it may be estimated from the following relationship that the composite effective friction angle for the stratified deposits is in the order of 26° to 28°.

$$\text{Factor of Safety} = \frac{\gamma' \tan \phi'}{\gamma \tan \beta}$$

Seepage was not evident in the colluvial or talus material which has accumulated near the toe of the slope at section 1, although the soil was moist. For this condition, the slope angle is approximately equal to the angle of internal friction for the soil. It is therefore suggested that the effective angle of friction is in the order of 31° for the sandy till materials near this location.

Typical values for till soils in southern Ontario, with the value computed from the unstable slope conditions at St. Lucie Drive are given below:

	c' Lbs/sq.ft.	ø'
Upper range	150	35°
St. Lucie Drive	250	28°
Lower range	400	20°

These values will vary with the plasticity and clay content of the till soils, which is normally assessed by the Atterberg Limits.

Groundwater Conditions

In the absence of any known groundwater conditions, it is difficult to establish a probable range of values. Seepage conditions in the southern section indicate possible values in the order of r_u = 0.2 to 0.3 but seepage conditions under spring time conditions are not known.

C. LONG TERM SAFE SLOPE CONDITIONS

In the absence of specific geotechnical data about the soils in the study area, the long term safe slope angle for the west bank of the Rouge River cannot be determined exactly.

On the basis that further toe erosion by the river is prevented it may be presumed that the toe of the slopes will remain relatively fixed, and that gradual long term surficial erosion, from seepage will, with time, flatten the slopes. Thus, the crest of the present slopes will move westwards away from the river until a safe slope angle consistent with the strength of the soil is obtained.

In order to obtain a reasonable estimate of the maximum long term crest position, typical soil parameters were assumed for a variety of groundwater conditions, and the safe slope angle was calculated for a factor of safety against movement of 1.5. A factor of safety (or uncertainty) of 1.5 was selected because of the approximate nature of the calculations. Sometimes a value lower than 1.5 may be appropriate depending upon the precision with which the soil strength and loading conditions are known. This slope angle in turn permitted the distance back from the toe of the slope to be calculated, and thus gave an indication of the ultimate crest location.

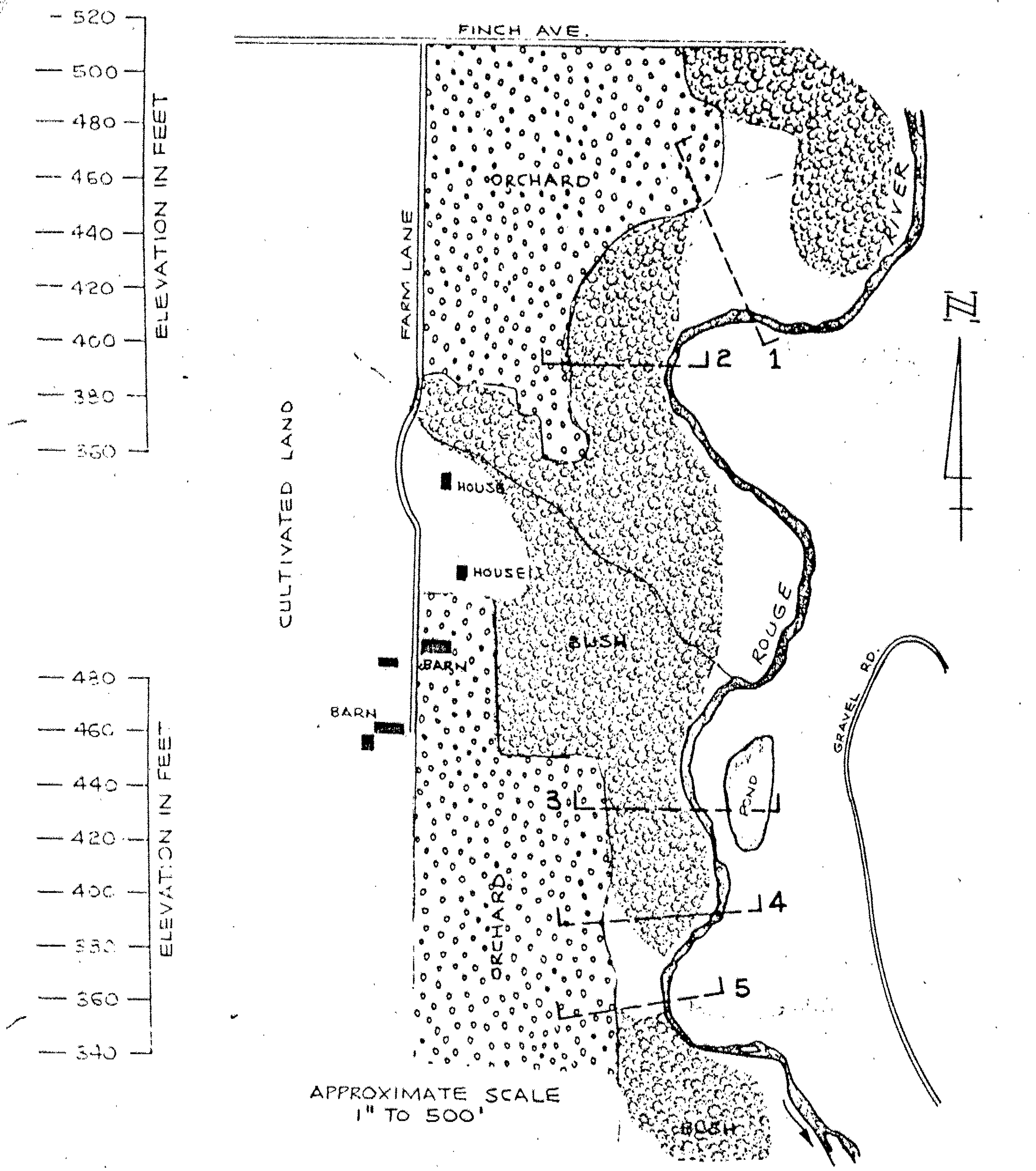
The results of these calculations are given on Figure 1 of this Appendix. Assuming that groundwater conditions are such that a probable value of r_u = 0.3 is applicable the safe distance back from the existing toe of the slope for varying heights is as follows:

Assumed strength c'	ø'	Slope height	Slope length	(horizontal)	to	(vertic
375	25°	70ft.	250ft	3.6	to	1
375	25°	110ft.	410ft.	3.7	to	1
175	35°	140ft.	420ft.	3.0	to	1

These values would suggest slopes slightly flatter than the 3 (horizontal) to 1 (vertical) which were evident for the marginally stable slopes reported in earlier studies.

KEY PLAN AND SLOPE PROFILES

FIGURE 1



APPROXIMATE SCALE
1" TO 500'

Date OCT. 6/70.

Golder Associates

Drawn
Chkd.
Appd.

M. M. DILLON LIMITED

consulting engineers and planners

BOX 219, STN. K, TORONTO, CANADA M4P 2G5 • (416) 482-5656 • CABLE: DILLENG • TELEX 064-7540

OUR FILE: 8277-01
YOUR FILE:

22 January 1980

Mr. R. D. Gunter, P.Eng.
Head, Geotech. Section
Ministry of Transportation and
Communications
Central Region
3501 Dufferin Street
Downsview, Ontario
M3K 1N6

Attention: Mr. A. Shopoff

EMTC Preliminary Design Study

Dear Sir:

Enclosed are the following plans:

No.	Description
FP41	Plan 200'=1" showing the EMTC from approximately Sheppard Avenue to Finch Avenue.
FP41A	Profile of EMTC for the same section.
FP41B	Cross-sections for the same section.

The topography and soils conditions in the area between Sta.175 to Sta.200 are such that we have some concerns over the current designs. South of Sta. 175 there are certain other concerns which are already under investigation by the Geotechnical Office and have been the subject of recent discussions between Mr. A. Shopoff and the writer.

The following factors are relevant to the design of EMTC in the section between Sta.175 to Sta.200:

...continued

- Property controls: no significant realignment to the west can be accommodated due to an earlier commitment by the Ministry to observe the illustrated property line through the Miller property south of Sta.181.

  There are certain significant geotechnical advantages in keeping the alignment as far west as possible and this has been done on the attached plans through the use of retaining walls.

  Obviously no significant easterly shift in the alignment is feasible due to the proximity of the Metro Zoo.

- Profile controls: the EMTC must cross under the CPR spur line at Sta. 181±. South of Sta.181± the profile of EMTC is under review based upon previous Geotechnical comments concerning the EMTC/Sheppard Avenue area.

- Environmental concerns: between Sta.187 and Sta.194 the EMTC crosses the Morningside Creek which is tributary to the Rouge River. Between Sta.189 and Sta.192+70 the EMTC in fact runs along a north-south section of the creek. This creek has been identified as having some natural environmental significance in the area.

It can be anticipated that the exact design of the EMTC in this area will be subject to scrutiny and criticism because of perceived environmental effects. These effects include bank stability at the Morningside Creek, and erosion concerns. Other information in the area has identified that the Rouge River Valley itself has comparatively unstable banks. It is therefore possible that the same situation would apply to the Morningside Creek. Our concerns over possible bank instability are illustrated by the cross-section at Sta.184+00.

We would appreciate comments on the overall stability and erosion situation in this area. Specific recommendations to eliminate or minimize these problems will be included in the relevant environmental assessment report.

Yours truly,

M. M. DILLON LIMITED

Ian Williams

Ian Williams, P.Eng.
Project Manager

IW:ml

cc: M.Thompson

DILLON

Mr. W.C. Friedmann,
Supervisor, Planning Unit,
Central Region.

Regional Geotechnical Section,
Central Region.

Mr. M. Thompson

79 11 13

91-78-00
W.P. ~~25-69-00~~, E.M.T.C.,
Sheppard Avenue to Finch Avenue,
District 6, Toronto.

As requested, we are forwarding the following comments regarding the proposed alignment, profiles, encroaching the theoretical limit of the slope stability and treatment of the tributary creek, Station 177+00± to Station 195+00±.

(1.) Alignment

We have no comments pertaining to the proposed alignment except from Station 177+00± to Station 195+00±, which will be discussed in detail under the heading (4.) "Treatment of the Tributary Creek, Station 177+00± to Station 195+00±".

(2.) Profiles

As stated on our previous memorandum to you dated August 24, 1978, the subsoil to a depth of 20' consists of fine to very fine sandy loam to sandy clay loam till. Below 20', the soil consists of extremely hard very fine sandy clay till which will require ripping prior to excavation. Also, numerous water bearing seams of sand, on the average one inch thick, were encountered throughout the till deposit. These water bearing seams will undoubtedly require a dewatering system. For this reason, 10' wide benches on mid-height cut back slopes over 30' in height and intercepting ditches for the run-off water at the top of the back slopes will be required.

Based on the soils conditions here the following are our comments for the four alternatives submitted by your Office.

(a.) Alternative I

(i) Advantage

This alternative has no vertical curve from

(continued ...2.)

(... continued)

the C.P.R. spur, Station 180+00± northerly and runs on a 0.5% slope which provides excellent and uniform longitudinal ditch and subdrain drainage at all cuts and provides more than the required noise barrier here.

(ii) Disadvantages

Cuts are quite deep, specifically at Station 215+00± where the cut is about 36' deep, which will require 10' wide benches at the mid-height of the cut back slopes, interceptor ditches at the top of the cut back slopes are required. Additional property may be needed for the interceptor ditches. If severe water bearing strata is encountered at any elevation of the cut back slopes, expensive slope treatment will be required.

(b.) Alternative II

(i) Advantages

This alternative has almost the same advantages as the Alternative I.

(ii) Disadvantages

Since most of the cuts are deeper than 20' in some locations (Station 215+00± is about 30' deep), this alternative has almost the same disadvantages as the Alternative I except this alternative will require less property.

(c.) Alternative III

(i) Advantages

This alternative is the most favourable as it has all the advantages of the previous two alternatives. In addition the need for benching the cut slopes and providing interceptor ditches is eliminated. Also, if severe water bearing strata are encountered, minimum treatment will be required to stabilized the cut slopes. Because less property will be required, the alignment can be shifted further to the east, towards the previously determined limit of slope stability.

(continued ... 3)

(ii) Disadvantages

No comments.

(d.) Alternative IV

From the soils point-of-view, construction, cost, etc., this alternative is the most acceptable. It requires less property than any of the other three alternatives, minimizes excavation, earth surplus, eliminates benching, intercepting ditches, (if severe water bearing strata is encountered), the cost for the treatment of cut back slopes will be minimized.

However, this alternative does not meet the noise barrier requirements (minimum 15' to 20') and since the profile is depressed at Station 236+00±, a storm sewer from Station 236+00± either northerly to Rouge River crossing (Station 242+00±), or southerly to the ditch crossing at approximately Station 218+00± will be required.

(3.) Encroachment the Limits of the Theoretical Slope Stability

The limits of the slope stability shown on the plan runs almost parallel with the proposed alignment, whereas the horizontal distance between the Rouge River and the slope stability limits line varies from 200' at Station 221+00± and 500' at Station 214+00±.

James F. MacLearen Limited of Toronto have prepared a detailed Slope Stability Report for the west bank of the Rouge River for this location. Based on their detailed investigation, they came to the conclusion that the long term safe slope ratio for this area cannot be determined exactly and that gradual long term surficial erosion from seepage will, with time, flatten the slopes. They suggested slopes lightly flatter than 3:1, which is evident for the marginally stable slopes, as reported in earlier studies.

In conclusion, the long term stable slope of the valley wall is in the order of 3.5:1 (3.5 horizontal to 1 vertical).

In order to determine accurately the limits of the Slope Stability, a cross-section at 200' to 500' intervals should be prepared. Then at 3.5:1 the slope from the toe of slope should be projected upward to establish the limits of the slope stability.

(continued ...4.)

(... continued)

This limit should not be encroached. If the limit of the established slope stability is encroached, particularly in areas with severe abnormal ground water conditions, any water bearing layer located just under the ditch line and sloping transversally towards the Rouge River has the potential to create slope stability problems. During wet periods external water from the surface added to the internal water of the water bearing sand layer could increase the internal pressure, thus decrease the cohesiveness of the particles within the water bearing layer. This coupled with the weight of the road load could result in shear failure within the water bearing layer. There are some cases in the Niagara (Fonthill) area where part of the road moves laterally almost parallel with the slope.

(4.) Treatment of the Tributary Creek, Station 177+00± to Station 195+00±

The most critical location of E.M.T.C. alignment is at the vicinity of Station 182+50± where the alignment is controlled by the C.N.R. spur on the west side and the creek on the east side. The vertical distance on the west side particularly at the east ditch line is about 45'. Here a 15' wide bench at the mid-height of the cut back slope and intercepting ditch for the run-off water at the top of the back slope will be required. If severe water bearing strata is encountered, very expensive cut back slope treatment will be required. This may affect the railway tracks and if this occurs, a retaining wall may have to be built.

On the east side, as you show on the cross-section, a retaining wall 38' high and about 500' long will be required. If this alignment is accepted, the retaining wall should be extended upward for another 10' to serve as a guiderail between the road and the creek. Since the transversal transition here is near the centreline of the northbound lanes and the existing slope is nearly 1:1, heavy grading will be required. (Refer to benching Standard DD-414.) Another retaining wall or creek realignment will be required from Station 188+00± to Station 192+00±.

To eliminate retaining walls, increase the distance between the C.P.R. spur and the centreline E.M.T.C. and

(continued ...5.)

(... continued)

possible elimination of benching requirements (Standard DD-414), and 15' wide benches at the mid-height cut back slope, the following is suggested:

- Re-align the creek from Station 180+00± to Station 184+00± westerly and the E.M.T.C. centreline easterly to a location where the re-aligned creek will run along the centreline E.M.T.C. median.
- Construct culvert along the centreline E.M.T.C. median for the new creek.
- Re-align the creek westerly from Station 188+50± to Station 192+00±.

If any clarification or additional information is required, please feel free to contact this Office.

AS/RDG:saw

A. Shopoff
For: R.D. Gunter
Head, Geotechnical Section

Appendix B

Previous Investigations

GEOTECHNICAL INVESTIGATION
PROPOSED ZOOMOBILE BRIDGE
NEAR INDO-MALAYAN PAVILION
TORONTO ZOO
SCARBOROUGH, ONTARIO

Report

to

CHISHOLM, FLEMING AND ASSOCIATES

Thurber Engineering Ltd.
170 Evans Avenue, Suite 101
Etobicoke, Ontario
M8Z 5Y6
Phone: 416-503-3600
Fax: 416-503-3010

P.K. Chatterji, P.Eng.
Review Principal

LICENSED PROFESSIONAL ENGINEER
April 12/99
S. M. PEAKER
PROVINCE OF ONTARIO

April 12, 1999
File: 19-2211-7

Scott Peaker, P.Eng
Associate, Project Engineer

TABLE OF CONTENTS

Drawings

List of Appendices

1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out by Thurber Engineering Ltd. (TEL) for a proposed bridge crossing a ravine adjacent to the Indo-Malayan Pavilion at the Toronto Zoo in Scarborough, Ontario. This investigation was completed by TEL for Chisholm, Fleming and Associates (CFA), as authorized by Mr. Eric Tuson, P.Eng.

The purpose of the investigation was to determine the subsurface conditions in the vicinity of the proposed abutment and pier locations and based on that information, to provide geotechnical recommendations for the design and construction of shallow foundation elements.

The contents of this report are subject to the attached Statement of General Conditions. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report.

2. PROJECT AND SITE DESCRIPTION

We understand that, as part of circulation improvements at the Toronto Zoo, it is proposed to construct a three-span prefabricated steel (Eagle) bridge crossing an approximately 18m deep ravine. The bridge will link existing paths located between the Indo-Malayan Pavilion and the Indian Rhinoceros Pavilion and will provide access for the Zoomobile and for Zoo service vehicles. The bridge will be supported on two piers located within the valley and on reinforced cast-in-place concrete abutment walls, constructed near the opposing crests of the ravine. The total span is approximately 70.5m.

The site is located in a ravine leading off the Little Rouge River. The ravine slopes are well vegetated with trees but have minimal undergrowth. There is an existing steeply inclined asphalt-paved roadway cut into the southern valley slope with a low gabion retaining wall providing grade separation. The ravine slopes are inclined at approximately 2H:1V.

The existence of younger trees along the slope faces with up-turned growth suggests that surficial soils along the slope are creeping. In addition, we noted at least two small slip failures evident in the lower third of the northern ravine slope near the proposed bridge alignment. The exposed soils within the failed soil masses consisted of very moist sandy silt with some clay and organic material.

We understand that the existing timber trestle bridge to the west of the proposed bridge site has experienced some problems with surficial erosion/sloughing which resulted in exposure of the footings. We further understand that this problem was rectified through the construction of new crib walls and erosion control measures at the abutments.

A creek, which is reported to have only intermittent eastward flow (flow is primarily during spring thaw), follows a very narrow channel along the base of the ravine.

3. METHOD OF INVESTIGATION

The field investigation for this project was carried out on March 17 and 22, 1999 and consisted of advancing four (4) boreholes, to depths ranging from 1.7m to 7.7m. The boreholes were advanced in the vicinity of the pier and abutment locations as approximately shown on the attached Borehole Location Plan, Drawing No. 19-2211-7-01. Control points denoting the pier and abutment locations were pre-staked in advance of the work by the surveyors, Sexton McKay Limited.

Borehole 99-4 was drilled using a truck-mounted CME-55 drill rig equipped with 100mm diameter solid stem augers at the south abutment location, while the remaining borings 99-1 through 99-3 were advanced using a portable tripod and cathead unit (70lb and 140lb hammers) since road access to the pier and north abutment locations was not available and tree clearing was not permitted. Drilling work was undertaken by Eastern Soil Investigations Limited of Courtice, Ontario who were supervised by a Thurber technologist.

During drilling of the boreholes, continuous Standard Penetration Tests (SPT) with associated split spoon samples were completed within the boreholes advanced using the portable equipment. SPT blow counts ('N' values) as shown on the borehole logs of Appendix A have been adjusted to account for the reduced driving energy in cases where the 70lb hammer was used. Limited depths of penetration were achieved at the proposed pier locations using the hand sampling equipment due to the dense nature of the subsoils combined with the hazards of working on the relatively steep slopes. In order to obtain additional geotechnical information to greater depths at these two locations, an access trail and staging areas would have to be constructed. Within the deeper BH99-4, SPT sampling was undertaken at conventional intervals. The undrained shear strength of cohesive soil samples was measured by pocket penetrometer testing.

Groundwater levels were noted both during and upon the completion of drilling. An open-standpipe piezometer (sealed at surface) was installed in Borehole 99-4 in order to permit monitoring of more stabilized groundwater levels. A follow-up groundwater level measurement was taken in the BH99-4 piezometer approximately two and one half weeks following installation.

Upon completion of the field investigation, all recovered samples were taken to TEL's laboratory for detailed visual examination and moisture content determinations. In addition, selected samples of the native soils were subjected to water soluble sulphate content determination testing (BH99-1, 1.2-1.8m; BH99-2, 0.6-1.2m) and grain size analyses (BH99-1, 3.0-3.7m; BH99-3, 1.8-2.1m). One soil sample from BH99-4, 6.1-6.2m depth was also subjected to Atterberg Limits testing. The results of this work are summarized on the attached borehole logs of Appendix A and are presented in Figures B1 and B2 of Appendix B.

The ground surface elevations and offset distances at the borehole locations were measured with respect to staked working points placed by Sexton McKay Limited.

4. SUBSURFACE CONDITIONS

4.1 Stratigraphy

Based on the subsurface conditions observed in Boreholes 99-1 through 99-4, the general stratigraphy consists of a veneer of topsoil overlying a sequence of cohesionless silt and sand to sandy silt till, underlain by more cohesive silty clay/clayey silt tills. At the north abutment within BH99-4, a thin layer of fill soil was also encountered, presumably to raise the grades adjacent to the existing pathway. The upper metre to 1.5m of soil encountered on the ravine slopes near the proposed pier locations appears to be more highly softened than at the abutment locations. This may be a result of groundwater/surface water infiltration through the valley slopes, combined with greater exposure to weathering.

Generalized descriptions of the encountered stratigraphic layers are provided below; however, for more detailed information, the reader should consult the borehole logs of Appendix A.

Topsoil
A veneer of topsoil, ranging in thickness from approximately 0.3m at BH99-2 to approximately 0.6m at BH99-4, was encountered at the boring locations. The topsoil is described as being sandy loam with trace rootlets and wood fragments and a natural moisture content in the range of about 24% to 58% was measured in the samples tested.

Suspected Fill
Within Borehole 99-4, underlying the topsoil and extending to a depth of about 1.5m, a layer of silty sand fill with a trace of clay and trace gravel, occasional topsoil pockets was encountered. Based on SPT 'N' of 15, this unit is considered to be compact. The one retrieved sample of the fill had a moisture content of 10%.

Silt and Sand Deposits
A deposit of light brown silt and sand was encountered above approximate elevation 135m within BH99-1. This deposit appeared to be thinly laminated. Within BH99-1 this unit had SPT 'N' in the range of 15 to 43, corresponding to a compact to dense consistency (dense below ~1.2m). The natural moisture content of selected sample of the silt and sand decreased from about 17.5% below the topsoil to about 6% near the base of the deposit.

Sand and Silt Till to Silty Sand Till Deposits

At the south abutment location within BH99-4, as well as within both pier boring locations BH99-2 and 99-3, a dark brown sand and silt till to sandy silt till was encountered. The sandy silt till was encountered above approximate elevation 132.5m within BH99-4. In this boring, the till was found to contain a trace of clay and a trace gravel, with occasional cobbles and inferred boulders based on augering resistance and high SPT 'N' values in excess of 80 blows per 300mm advance. Within BH99-3, the silty sand deposit encountered below a depth of about 0.4m was interpreted to be reworked till material to about 1.8m depth, then becoming native till of similar gradation. In this borehole, the relative density of the deposit ranges from loose (SPT 'N' of 7) to dense (SPT 'N' of 35) with consistency increasing with increasing depth.

The natural moisture content of the silty till deposits was measured to be in the range of 5% to 12% (more typically about 7 to 10%), with the more moist material being encountered generally at shallower depths.

Silty Clay to Clayey Silt Till Deposits

A mottled, fissured, grey-brown silty clay till to clayey silt till was encountered at varying depths within BH99-1, 99-2 and 99-4. This till deposit contains a trace to some sand and a trace of gravel and was typically found below the upper silt and sand till unit within the depths investigated.

The silty clay/clayey silt till is typically described as having low plasticity (ML to CL). The results of one Atterberg limits test (BH99-4, 6.2m depth) are presented in Figure B2 of Appendix B which yielded the following results:

Plastic Limit:	9.2%
Moisture Content:	12%
Liquid Limit:	12%
Plasticity Index:	2.8%

The natural moisture content of samples of this deposit ranged from about 6 to 19% with shallower deposits exhibiting higher moisture contents. The estimated optimum water content for this material would likely be in the range of 10% to 14%; accordingly, some of the shallow excavated silty clay till will have moisture contents near to, or in excess of, optimum.

4.2 Groundwater

Groundwater was encountered within BH99-1 at a depth of ~4m below grade on completion of drilling. This should be considered as a short-term observation. Seepage was noted into BH99-4 during drilling at about 6.3m depth and a more stabilized water level was measured in the open standpipe piezometer in this borehole at approximately 3.1m below grade (approx. elevation 135.5m) 18 days after installation of the piezometer. No long term observations of water levels in the borings at the pier locations are available; however, at the time of the investigation, groundwater was observed to be seeping through the slopes at these locations.

4.3 Results of Water-Soluble Soil Sulphate Testing

The results of analytical testing of two (2) selected soil samples for water soluble sulphate content are summarized as follows:

BH	Depth	Soil Type	Water Soluble Sulphate Content (%)
99-1	1.2-1.8m	Silt and Sand	0.04%
99-2	0.6-1.2m	Silty Clay Till	0.06%

The measured range of water soluble sulphates in the tested samples, according to CAN/CSA A23.1-94, represents a 'low' degree of exposure to Portland cement concrete.

5. GEOTECHNICAL RECOMMENDATIONS

5.1 General

The results of subsurface drilling at this site within the depths investigated indicate that generally favourable conditions for support of spread footings are available near or below the depth of frost penetration of 1.4m. Provided that the abutment and pier spread footing foundation bases are not disturbed or softened during construction (eg. by mechanical means, by surface water or groundwater infiltration) modest bearing capacities can be assumed in the design as outlined in the following section.

It should be noted, however, that the anticipated founding depth for the piers (3.5m below grade) exceeds the maximum depth investigated in BH99-2 and BH99-3. Given the access and environmental constraints, it was not possible to extend these borings deeper during the investigation by Thurber. As such, the assumption has been made in this report that the soils encountered at the depths of borehole termination are similar to the soils at and below founding level. This assumption must be verified by this office at the time of foundation construction in order to confirm that the bearing capacities and earth pressure parameters recommended herein are appropriate. *It must also be recognized that in the event that less favourable soils are encountered at the design founding level, then modifications to the pier footings may be warranted. In this regard, the design of temporary shoring works should include sufficient allowance/redundancy such that the pier bases can be widened and or deepened if necessary.*

5.2 Recommended Geotechnical Design Parameters

5.2.1 Spread Footings

Bearing Capacity - Pier and abutment footings founded on competent undisturbed dense or very stiff to hard native soils, which are constructed using good construction practices and no basal disturbance, may be designed for the following bearing resistances:

factored ULS capacity:	425kPa
SLS geotechnical capacity:	275kPa

These capacities assume that the inclination of the ravine slopes do not exceed 26.5 degrees above horizontal (2H:1V) downslope of the foundation elements. The bearing resistance calculation assumes that the base of the pier footings are buried a minimum of 3.5m below grade and the abutment footings should be founded at or below the following elevations:

North Abutment (BH99-1): 136.6m (min. 1.4m depth for frost cover requirements)
South Abutment (BH99-4): 136.4m (min 2.2m depth to reach suitable founding soils)

The foregoing SLS capacities assume an allowable total settlement of less than 25mm.

The foregoing capacities must be further reduced as outlined in the OHBDC for inclined resultant forces. As noted in Section 5.1 of this report, the design bearing capacities must be verified by Thurber at the time of footing excavation.

It is recommended that the prepared footing bases, once approved by this office should be protected from groundwater and surface water infiltration, trafficking and weathering by means of placement of a 150mm concrete 'mudslab' (20MPa).

Lateral Resistance - The lateral resistance of the footings against sliding may be calculated as the sum of the available passive resistance of the downslope soils against the footing plus the frictional base resistance. The following equation may be used to calculate the factored ULS lateral resistance of the footings, per unit width of footing:

$$Plat = (f_{rp})\, K_p \gamma' d^2/2 + (f_{rs})\,(w)(W')\tan\phi'$$

where:

$f_{rp} = 0.5$
$f_{rs} = 0.8$
$K_p = 1.0$ (assumes a 2H:1V backslope or flatter)
$\gamma' = 10kN/m^3$

d = depth of cover above underside of footing
w = width of footing measured parallel to line of action
W' = normal pressure acting on footing, less the uplift pressure
tanϕ' = 0.42 on dense silt and sand or very stiff to hard tills

5.2.2 Subgrade Reaction Below Pier Bases

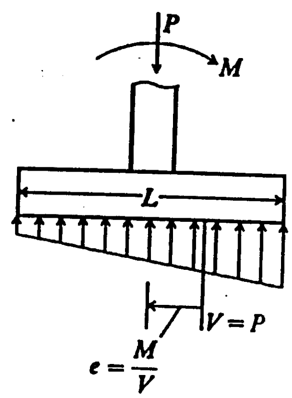
For the calculation of pier base rotation, Bowles (Foundation Analysis and Design, 1996) gives the following equation for calculation of flexible and rigid footing base rotation under moment due to elastic compression of the soil:

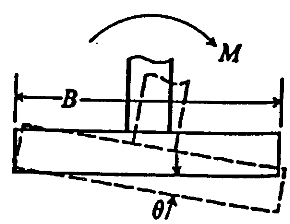
$$\tan \theta = [(1-\mu^2)/E_s]\,[M/(B^2L)]\,I_\theta$$

Refer to Bowles Table 5-5 for Influence Factors, I_θ
and assume:
μ = 0.35 for dense silty sand
E_s = 30,000 kPa to 50,000 kPa for dense, saturated silty sand

If you prefer to use a spring method, the modulus of subgrade reaction may be estimated as:

$k_s = E_s / [B(1-\mu^2)]$ in units of kN/m²/m





$$\tan\theta = \frac{M}{B^2L}\left(\frac{1-\mu^2}{E_s}\right)I_\theta$$

TABLE 5-5
Influence factors I_θ to compute rotation of a footing

L/B	Flexible	Rigid†
0.1	1.045	1.59
0.2	1.60	2.42
0.50	2.51	3.54
0.75	2.91	3.94
1.00 (circle)	3.15 (3.00)*	4.17 (5.53)*
1.50	3.43	4.44
2.00	3.57	4.59
3.00	3.70	4.74
5.00	3.77	4.87
10.00	3.81	4.98
100.00	3.82	5.06 = $16/\pi$

For rigid:
$I_\theta = 16/[\pi(1 + 0.22B/L)]$

*For circle B = diameter.

†There are several "rigid" values; these are from equations given by Taylor (1967, Fig. 9, p. 227). They compare reasonably well with those given by Poulos and Davis (1974, p. 169, Table 7.3).

5.2.3 Earth Pressures Acting on Permanent Retaining Walls

Lateral Earth Pressure Distribution - A triangular earth pressure distribution should be assumed to act against the abutments and any wingwalls.

The unfactored lateral earth pressure p, at any depth h, may be calculated in accordance with:

$p = K(\gamma h + q)$

where:

h = depth below ground surface to point of interest in metres
$\gamma = 21 kN/m^3$ for compacted OPSS Granular 'B' fill (for active calculation), assumes that the abutment is provided with a weeping tile drain (free-draining)
$\gamma = 17 kN/m^3$ for undisturbed or replaced native soils (for passive calculation)
q = appropriate permanent or temporary surcharge
and K is defined in the following table:

	Abutments	Piers
Ka (unrestrained wall)	0.40 (includes compaction surcharge, semi-rigid wall)	0.74 (assumes a 2H:1V up-slope)
Kp	1.0 (assumes a 2H:1V backslope)	1.0 (assumes a 2H:1V backslope)

5.2.4 Earth Pressures Acting on Temporary Shoring

Temporary shoring is required to be constructed up-slope of the proposed pier locations in order to safely excavate the pier footing bases and to prevent slope failure above the excavation. Shoring should be designed by a Professional Engineer who is a specialist shoring designer. It is recommended that the shoring design be reviewed by Thurber for general compliance with the recommendations of this report and for the assessment of global stability of the shoring system.

The shoring system must be installed prior to excavation into the slope face and be carefully staged such that the internal and global stability of the shoring system is satisfied and the stability of the ravine slope is not compromised as the excavation progresses.

A uniform rectangular earth pressure distribution should be assumed for the design of braced flexible temporary shoring systems in accordance with the 3rd edition of the Canadian Foundation Engineering Manual. The lateral earth pressure p (kPa), acting at any depth h (m), may be calculated in accordance with the following expression:

$$p=0.65\ Ka\ (\gamma H)$$

where:
p = lateral earth pressure in kPa acting at depth h
γ = 20kN/m^3
H = maximum excavation depth in m
h = depth to point of interest in m
Ka = 0.74 assuming a backslope no steeper than 2H:1V

Hydrostatic pressures have not been included in the above pressure distribution based on the assumption that the sheathing or lagging will be free-draining in nature. If this is not the case (eg. if sheet piling is implemented) then the appropriate hydrostatic pressure should be included in the design.

For the design of soldier piles, a passive pressure coefficient of 3.2 may be assumed, acting over 3 time the pile width. This Kp value assumes that the soldier piles are set back from the slope face at least 1x the depth of pile embedment.

This office should be consulted regarding an allowable bearing capacity for the design of inclined rakers. The allowable bearing capacity will be a function of the depth of the raker footing embedment, the raker inclination, the proximity of the raker footing to the slope face and the soil properties at founding level.

No soil should be stockpiled within a distance equal to one half of the depth of the excavation from the edge of the supported excavation. If this cannot be avoided, the soil surcharge must be incorporated into the shoring design. Surface runoff should be directed away from the excavations.

5.3 Construction Recommendations

5.3.1 Backfill Against Abutments & Wingwalls

Backfill behind the abutment walls and wingwalls within a 45 degree wedge from the base of the excavation (assuming competent soils at the base) should consist of free-draining OPSS Granular 'B' sand and gravel up to the level of the pavement sub-basecourse. The sand and gravel should be carefully compacted to a minimum of 96% of Standard Proctor Maximum Dry Density (SPMDD) at a placement moisture content within ±2% of optimum using light, hand-held equipment so as not to damage or to apply excessive compaction pressures against the abutment wall.

A weeping tile with filter fabric sock should be placed at the base of the granular drainage fill behind the abutments and wingwalls and sloped a minimum of 2% towards either wing wall. The weeping tile should extend along the back side of the wingwalls and discharge beyond the end of the wingwalls. The outlets of the weeper should have unimpeded drainage and be provided with suitable protection from rodent entry and freezing.

5.3.2 Excavations and Excavated Material

All excavations and trenching work should be carried out in conformance with the Ontario Occupational Health and Safety Act.

Excavations for the abutments should be sloped back as follows:

- 1H:1V to the base of the excavation at the north abutment,
- 1H:1V to within 1.2m of the base of the excavation at the south abutment.

The pier locations must be shored in advance of any excavation work.

Some groundwater infiltration into all of the foundation excavations and particularly the pier foundation excavations is anticipated. This should be controllable using strategically placed sumps, ditches and pumps.

The soils excavated at each of the foundation elements will vary from one location to the next. If it is planned to reuse the site soils as backfill or for use below landscaped areas, topsoil should be carefully stripped, segregated and stockpiled for reuse. None of the excavated soils can be considered as free-draining material and as such, they should not be used directly against abutment walls or where free-drainage or frost adhesion is of concern. However, with the exception of some of the shallow native soils directly below the topsoil (which will be excessively moist to achieve a high degree of compaction), the excavated soils should be suitable to be used as compacted fill in less critical areas. Stockpiled soils to be reused in engineered applications should be tarped over. Soil stockpiles should not be placed on the ravine slopes.

5.3.3 Surficial Slope Stability

Analysis of the global stability of the ravine valley slopes was outside of the scope of the current investigation. Deeper borings and additional analyses would be required to address global slope stability in a quantitative fashion.

It should be recognized that a surficial soil creep condition exists at this site, as evidenced by up-slope (bent) growth in young trees. This may be attributable to discharge of groundwater along the face of the lower ravine slopes and weathering/loss of cohesion of the upper deposits. At least two relatively small soil failure scarps were noted at the time of the investigation, located near the lower third of the north ravine slope in the vicinity of the proposed bridge structure. Each of the scarps was approximately 3 to 5m in width and of similar height. It is important that the stability of surficial soils in the vicinity of the foundation elements be improved as part of the works in order to ensure that sloughing and potential undermining and exposure of the foundation elements (to frost or additional erosion) does not occur, particularly since access to the pier bases may be restricted once the project has been completed.

It is recommended that the stability of surficial soils both upslope and downslope of the pier bases be improved by:

1) improving surficial drainage (through the addition of French drains and/or flexible weepers) to allow groundwater discharge through the slope face around the pier foundations. French drains should be constructed of 19mm clear crushed limestone completely enveloped in non-woven Class 2 geotextile which daylight onto the slope face in an area protected from surface runoff with rip rap. Rip rap should also be underlain by a non-woven Class 2 geotextile. In the event that the French drain is constructed directly against the face of the shoring (assuming a free-draining timber lagged shoring system), the drain can be replaced in these areas by means of a drainage geocomposite such as Terradrain 200 by Terrafix or Miradrain 6000 by Mirafi or approved equivalent. The geocomposite should be carefully detailed to tie into the conventional French drain; and

2) dressing the slope above and below the pier base down to the creek channel using high-friction, erosion resistant material such as rip rap or articulating interlocking pavers underlain by geotextile (to reduce runoff rates and stabilize the surficial soils). The rip rap should be coincident with the existing slope face so as not to impose a surcharge load on the slope face; and/or

3) locally reducing the slope inclination and provision of earth retention works (retaining walls or reinforced soil structure) to accommodate the grade change.

It is recognized that some of the above 'hard' engineered provisions to enhance surficial stability may not be consistent with TRCA and Zoo expectations for preserving the ravine environment. These compromises must be weighed relative to the inconvenience of repairs to the slope and the importance of protecting the bridge foundation elements.

6. CLOSURE

Should you have any questions or require clarification on any point, please do not hesitate to contact this office. Thank you for providing Thurber Engineering Ltd. with the opportunity to be of service on this project.

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

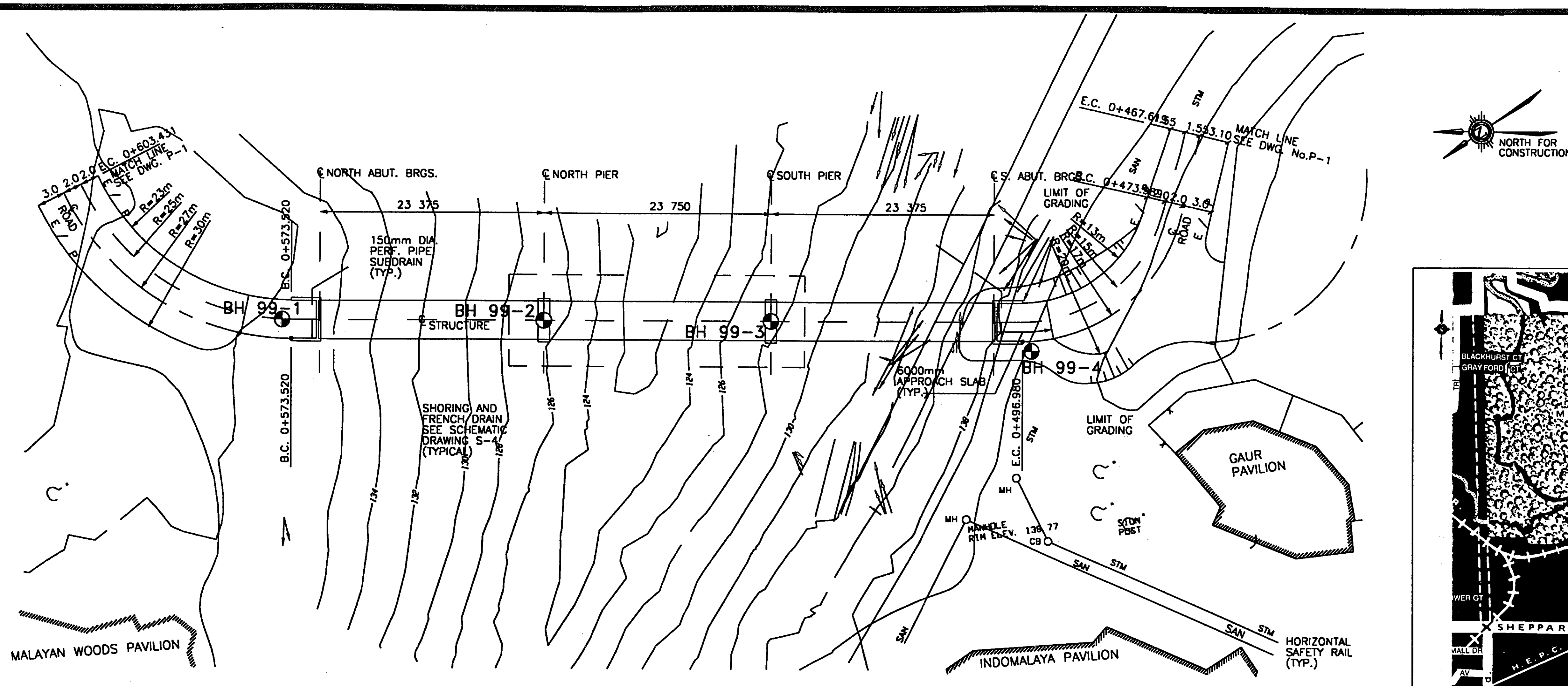
4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

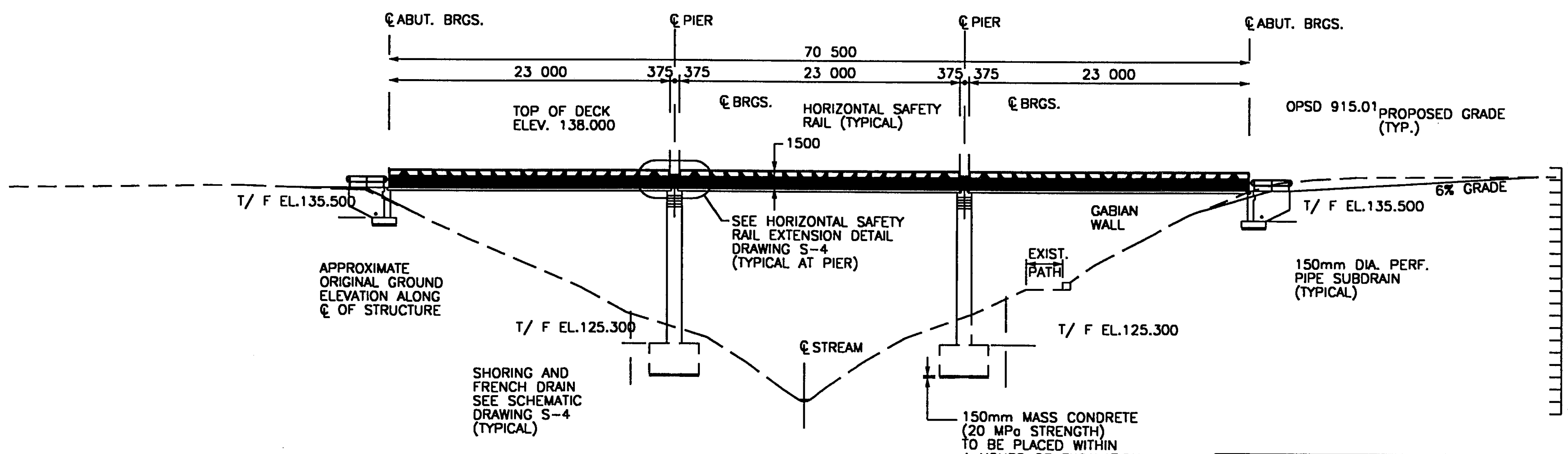
a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)



PLAN
1:250

SITE PLAN
NOT TO SCALE



ELEVATION

ENGINEER	SMP	CHISHOLM FLEMING & ASSOCIATES CONSULTING ENGINEERS
DRAWN	WM	GEOTECHNICAL INVESTIGATION PROPOSED ZOO-MOBILE BRIDGE TORONTO ZOO
DATE	APRIL 1999	
APPROVED	PKC	
SCALE	~1:500	BOREHOLE LOCATION PLAN

THURBER

DRAWING No.
19-2211-7-01

DRAWING REFERENCE: CHISHOLM FLEMING & ASSOCIATES, GENERAL ARRANGEMENT
DWG S-1 CONTRACT 18 (99-XX) DATED MARCH 30/99

APPENDIX A

Borehole Logs

SYMBOLS AND TERMS USED ON TEST HOLE LOGS

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT[(1)] "N" VALUE
Very Soft	Less than 10	Less than 2
Soft	10 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction
1) Laboratory Triaxial Testing
2) Field Insitu Vane Testing
3) Laboratory Vane Testing
4) SPT value
5) Pocket Penetrometer

4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR TEST HOLE LOGS

SYMBOLS FOR SAMPLE TYPE

■	Shelby Tube		A - Casing
◪	SPT	◫	Grab/Auger sample
⊠	No Recovery	◫	Core

● MC - Moisture Content (% by Weight) as determined by sample]

▼ Water Level

C_{vane} Shear Strength Determination by Field Insitu Vane

C_{pen} Shear Strength Determination by Pocket Penetrometer

C_{lab} Shear Strength Determination using a Laboratory Vane Apparatus

C_U Undrained Shear Strength determined by Unconfined Compression Test

(1) SPT Standard Penetration Test - refers to the number the blows from a 63.5kg hammer falling through 0.76m to advance a 60 degree truncated cone 0.3m.

BOREHOLE GRAPHIC SYMBOLS

THURBER

SOILS

- FILL
- ORGANICS
- CLAY
- SILT
- SAND
- GRAVEL
- COBBLES
- SILTY CLAY
- CLAYEY SILT
- SILTY SAND
- SAND & GRAVEL
- CLAYEY SILT TILL
- SILTY CLAY TILL
- SANDY SILT TILL

ROCK

- SHALE
- LIMESTONE
- SILTSTONE
- GRANITE

OTHER

- CEMENT GROUT
- BENTONITE GROUT
- CONCRETE
- WATER
- BENTONITE SEAL

THURBER

TTCHTCH2 6209 95/03/14

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS $W_L < 50\%$	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. ($W_L < 30\%$).
		CI	Inorganic clays of medium plasticity, silty clays. ($30\% < W_L < 50\%$).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS $W_L > 50\%$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

THURBER

RECORD OF BOREHOLE 99-1

PROJECT : Zoo Mobile Bridge at Indo-Malayan Pavillion
LOCATION : Toronto, Ontario
STARTED : 1999 March 17
COMPLETED : 1999 March 17

SHEET 1 OF 1
DATUM

THURBER

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, U - ▲; 40, 80, 120, 160) / WATER CONTENT, PERCENT (wp, w, wl; 10, 20, 30, 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		138.00							
	MOTORIZED TRIPOD	**TOPSOIL**, clayey, trace sand, trace rootlets, dark brown, very moist		0.00	1	SS	12		58.2		
		SILT and SAND, fine grained, occasional silt lenses, compact to dense, light brown: (ML-NONPLASTIC/SM)		137.54 0.46	2	SS	15				
1					3	SS	43				
2					4	SS	30				
					5	SS	31				
3		**CLAY**, silty, to SILT, clayey, some sand, trace gravel, some oxidized lenses, hard, brown to grey: (TILL)(CL-ML)		135.10 2.90	6	SS	75	%Gr/%Sa/%Si/%Cl 0/8/64/28			
4					7	SS	40				
		END OF BOREHOLE AT 4.27m. BOREHOLE BACKFILLED WITH DRILL CUTTINGS. WATER LEVEL AT 4.0m ON COMPLETION.		133.73 4.27							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

SHALLOW/SINGLE INSTALLATION
WATER LEVEL (date)

DEEP/DUAL INSTALLATION
WATER LEVEL (date)

LOGGED : MB
CHECKED : PKC

THURBER

RECORD OF BOREHOLE 99-2

THURBER

PROJECT : Zoo Mobile Bridge at Indo-Malayan Pavillion
LOCATION : Toronto, Ontario
STARTED : 1999 March 22
COMPLETED : 1999 March 22

SHEET 1 OF 1
DATUM

Boring method: 70lb HAMMER

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	126.93			
TOPSOIL, clayey, trace sand, trace wood fragments, dark brown, very moist	0.00	1	SS	1
CLAY, silty, trace sand, trace gravel, occasional sand lenses, trace topsoil inclusions, firm to very stiff, brown to grey: (TILL)(CL)	126.63 / 0.30	2	SS	6
		3	SS	29
SAND and SILT, trace to some gravel, dense, brown, moist: (TILL)	125.35 / 1.58			
END OF BOREHOLE AT 1.68m. BOREHOLE DRY ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS.	125.25 / 1.68			

NOTE: SPT 'N' factored to reflect 70lb hammer.

Column headings: DEPTH SCALE (metres); BORING METHOD; SOIL PROFILE; STRATA PLOT; SAMPLES; COMMENTS; SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, U - ▲; 40, 80, 120, 160); WATER CONTENT, PERCENT (wp, w, wl; 10, 20, 30, 40); ADDITIONAL LAB. TESTING; PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

SHALLOW/SINGLE INSTALLATION — WATER LEVEL (date)

DEEP/DUAL INSTALLATION — WATER LEVEL (date)

LOGGED : MB
CHECKED : PKC

THURBER

RECORD OF BOREHOLE 99-3

PROJECT : Zoo Mobile Bridge at Indo-Malayan Pavillion
LOCATION : Toronto, Ontario
STARTED : 1999 March 22
COMPLETED : 1999 March 22

SHEET 1 OF 1
DATUM

THURBER

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	WATER CONTENT, PERCENT (w)
		GROUND SURFACE	127.93					
	70lb HAMMER	**TOPSOIL**, silty, some sand, trace gravel, trace rootlets, trace wood fragments, dark brown, wet	0.00	1	SS	7		
		SAND, fine grained, silty, some gravel, trace wood fragments, loose, light brown, moist: (SM)(POSSIBLE FILL/REWORKED TILL)	127.51 0.43	2	SS	7		
1		occasional pockets of clayey silt till (POSSIBLE FILL/REWORKED TILL)	126.72 1.22	3	SS	14		
2		**SAND and SILT**, some gravel, trace silt, trace clay, dense, brown, moist: (TILL)	126.11 1.83	4	SS	35	%Gr/%Sa/%Si/%Cl 14/54/20/12	
		END OF BOREHOLE AT 2.13m. BOREHOLE DRY ON COMPLETION. BOREHOLE BACKFILLED WITH DRILL CUTTINGS. NOTE: SPT 'N' factored to reflect 70lb hammer.	125.80 2.13					

STRATA PLOT | SHEAR STRENGTH: Cu, KPa — nat V - ✚, rem V - ●, Q - ✕, U - ▲ — 40, 80, 120, 160 | WATER CONTENT, PERCENT — wp ⊢ ○w ⊣ wl — 10, 20, 30, 40 | ADDITIONAL LAB. TESTING | PIEZOMETER OR STANDPIPE INSTALLATION

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

SHALLOW/SINGLE INSTALLATION — WATER LEVEL (date)

DEEP/DUAL INSTALLATION — WATER LEVEL (date)

LOGGED : MB
CHECKED : PKC

THURBER

RECORD OF BOREHOLE 99-4

PROJECT : Zoo Mobile Bridge at Indo-Malayan Pavillion
LOCATION : Toronto, Ontario
STARTED : 1999 March 22
COMPLETED : 1999 March 22

SHEET 1 OF 1
DATUM

THURBER

BORING METHOD: 100mm SOLID STEM AUGERS

DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	138.63			
TOPSOIL, clayey, sandy, trace rootlets, trace wood fragments, dark brown	0.00	1	SS	6
SAND, silty, some gravel, trace clay, occasional topsoil pockets, compact, brown, moist: (FILL)(SM)	138.03 / 0.61	2	SS	15
SILT, sandy, some clay, trace gravel, very stiff, brown: (TILL)(ML)	137.11 / 1.52	3	SS	29
SILT, sandy, trace clay, trace gravel, occasional cobbles and boulders inferred, very dense, brown: (TILL)(ML-NONPLASTIC)	136.35 / 2.29	4	SS	85
hard drilling		5	SS	88
becoming grey		6	SS	90/ 225
CLAY, silty, to SILT, clayey, some sand, trace gravel, grey: (TILL)(ML) trace of seepage at ~6.3m	132.54 / 6.10	7	SS	60/ 100
SILT, clayey, some sand, trace gravel, grey: (TILL)(CL-ML)	131.01 / 130.92 / 7.62 / 7.71	8	SS	

END OF BOREHOLE AT 7.72m.
Piezometer installation consists of 19mm diameter Schedule 40 PVC pipe with a 0.61m slotted screen.

WATER LEVEL READINGS:

DATE	DEPTH (m)	ELEV. (m)
04/09/99	3.10	135.50

COMMENTS

SHEAR STRENGTH: Cu, KPa — nat V - ✚ Q - ✖ rem V - ● U - ▲ — 40 80 120 160

WATER CONTENT, PERCENT — wp ⊢—○w—⊣ wl — 10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: 19mm PIEZOMETER; BENTONITE 138.03; CUTTINGS; 133.61; FILTER SAND 133.30; SLOTTED SCREEN 132.69; 132.08; 130.91

DEPTH SCALE (metres): 1, 2, 3, 4, 5, 6, 7, 8, 9

GROUNDWATER ELEVATIONS

▽ SHALLOW/SINGLE INSTALLATION — WATER LEVEL (date) 04/09/99
▼ DEEP/DUAL INSTALLATION — WATER LEVEL (date)

LOGGED : MB
CHECKED : PKC

THURBER

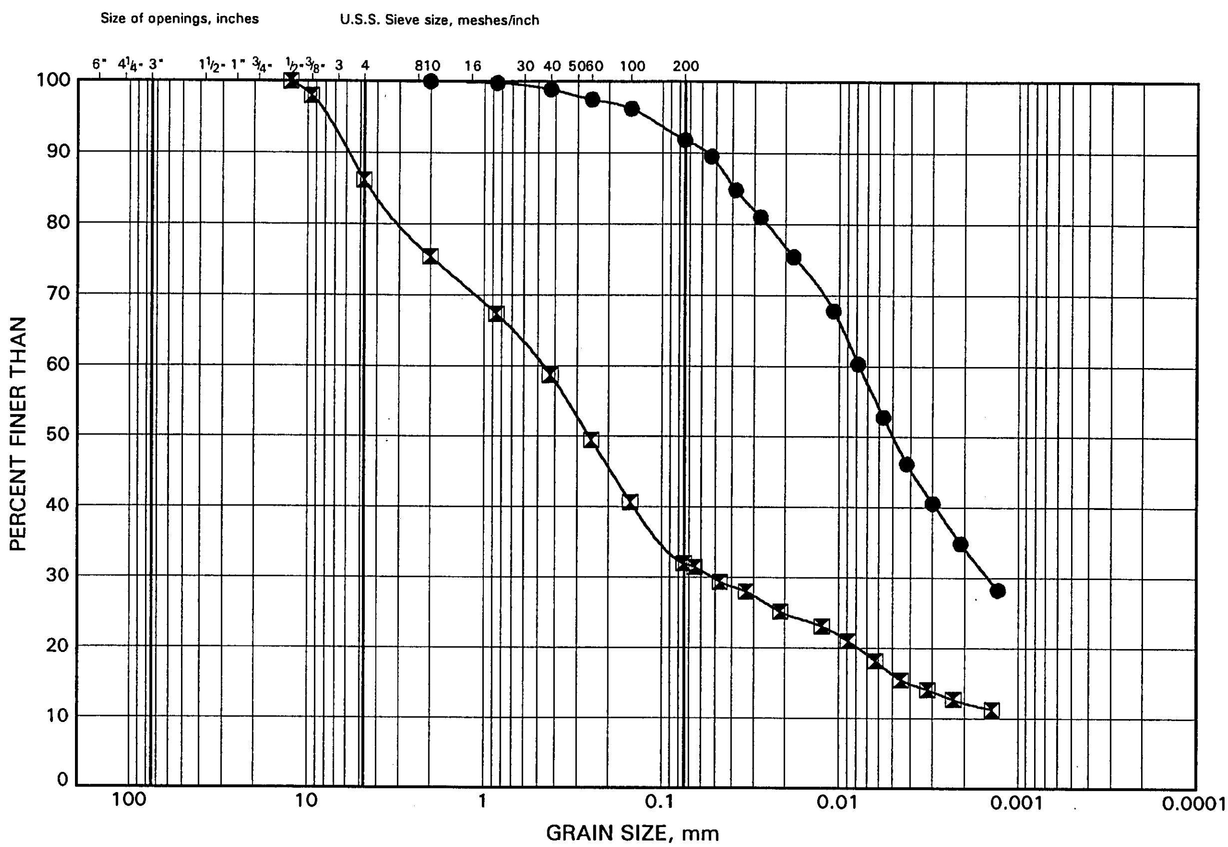
APPENDIX B

Results of Geotechnical Laboratory Testing:
Grain Size Analyses
Atterberg Limits Determination

Zoo Mobile Bridge at Indo-Malayan Pavillion

GRAIN SIZE DISTRIBUTION

FIGURE B1



COBBLE SIZE	COARSE	FINE	COARSE	MEDIUM	FINE	SILT and CLAY
	GRAVEL		SAND			FINE GRAINED

SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	99-1	3.35	134.65
⊠	99-3	1.98	125.95

Date April 1999

Project 19-2211-7

THURBER

Prep'd WM

Chkd. SMP

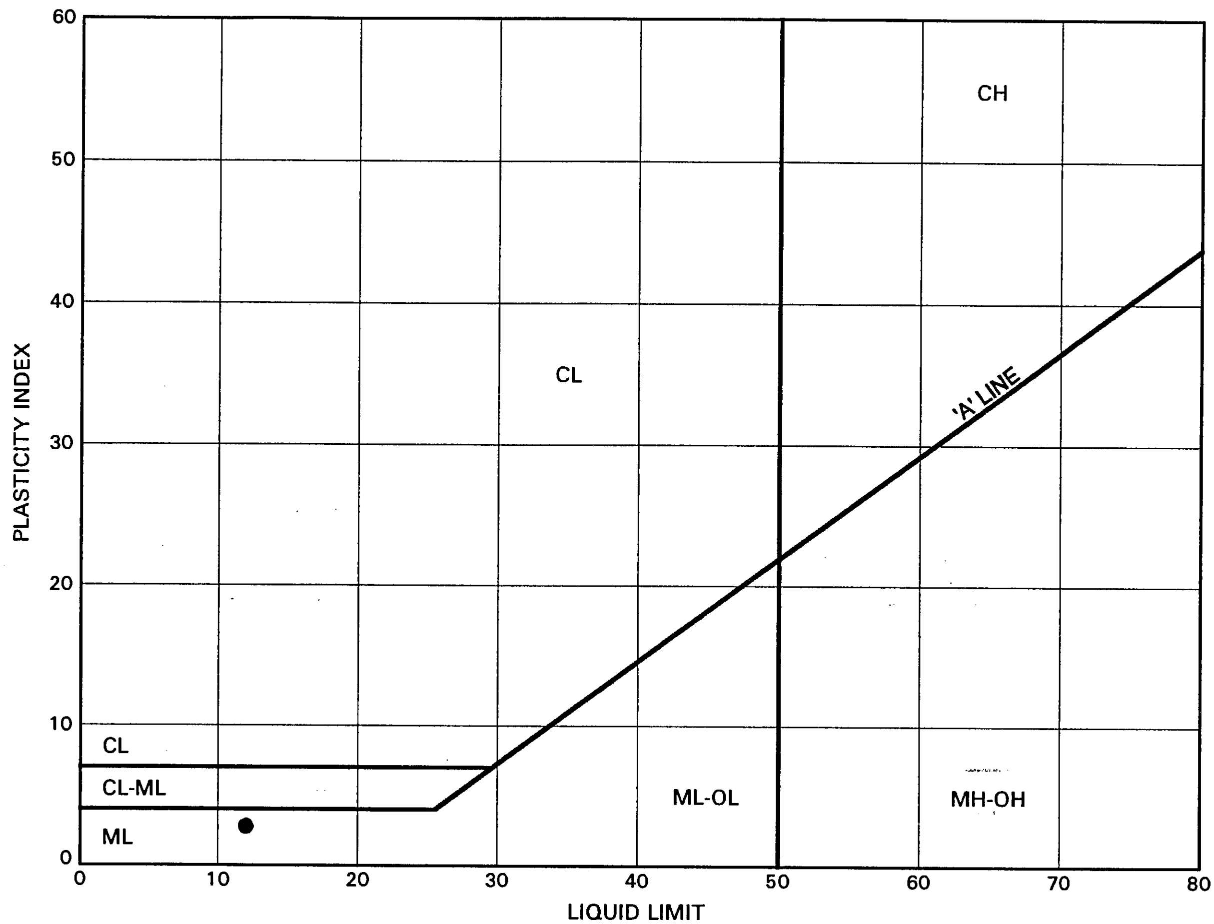
THURBGSD 2117 99/04/07

THURBER

Zoo Mobile Bridge at Indo-Malayan Pavillion

ATTERBERG LIMITS TEST RESULTS

FIGURE B2



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
●	99-4	6.15	132.49

Date April 1999

Project 19-2211-7

THURBER

Prep'd WM

Chkd. SMP

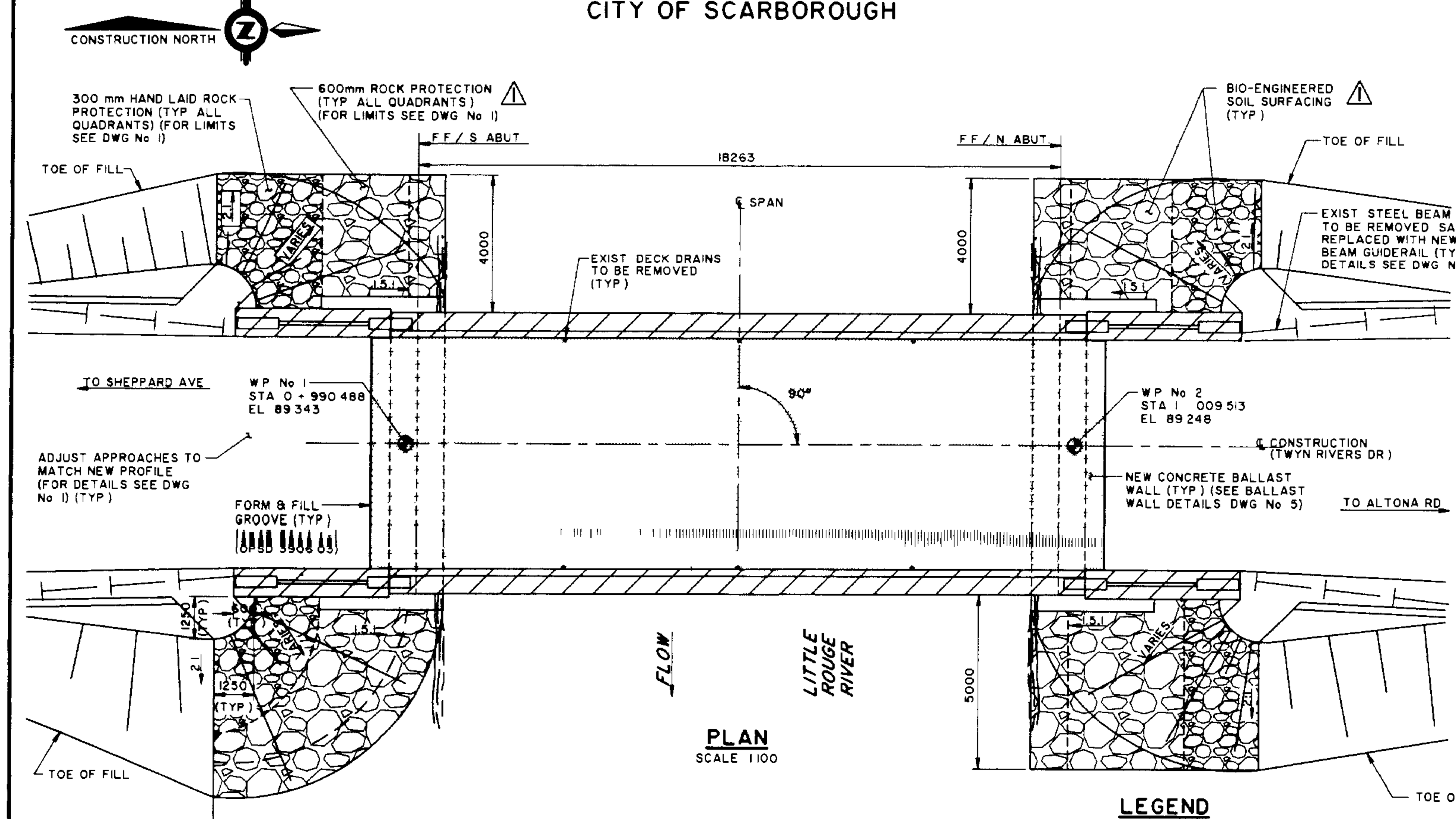
TTCALTR 2117 99/04/07

THURBER

Appendix C

Bridge Design Drawings

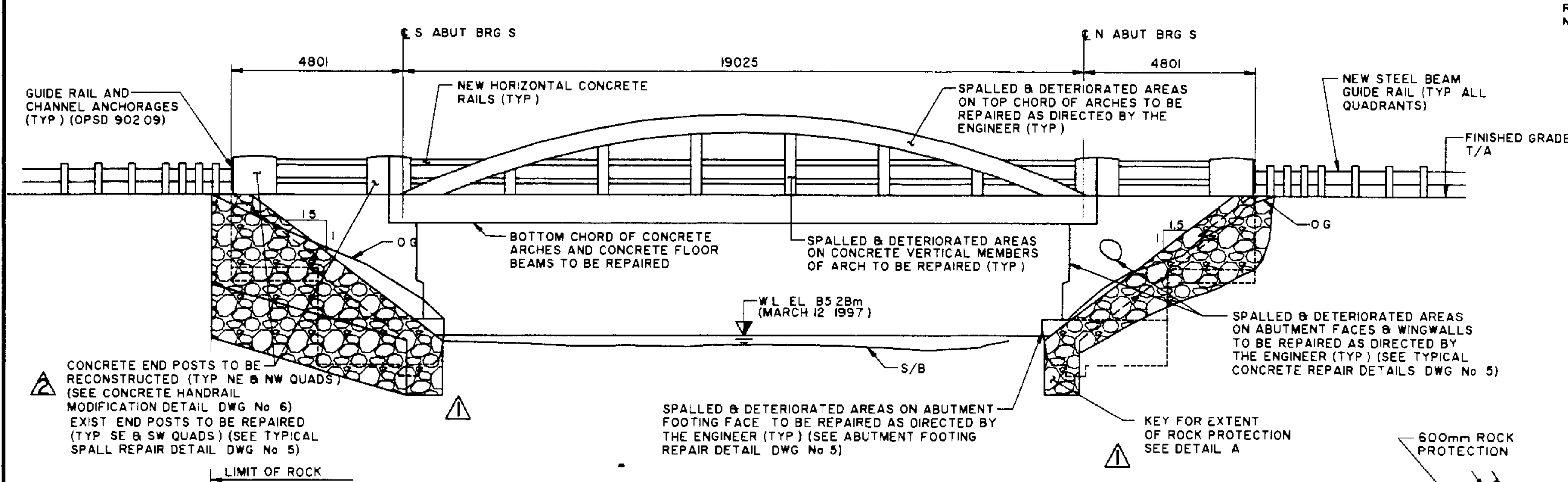
CITY OF SCARBOROUGH



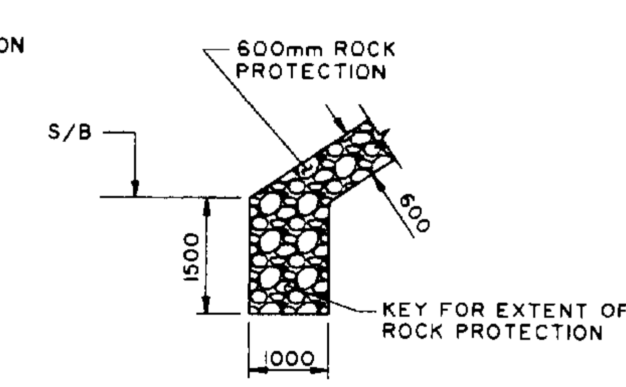
PLAN
SCALE 1:100

LEGEND

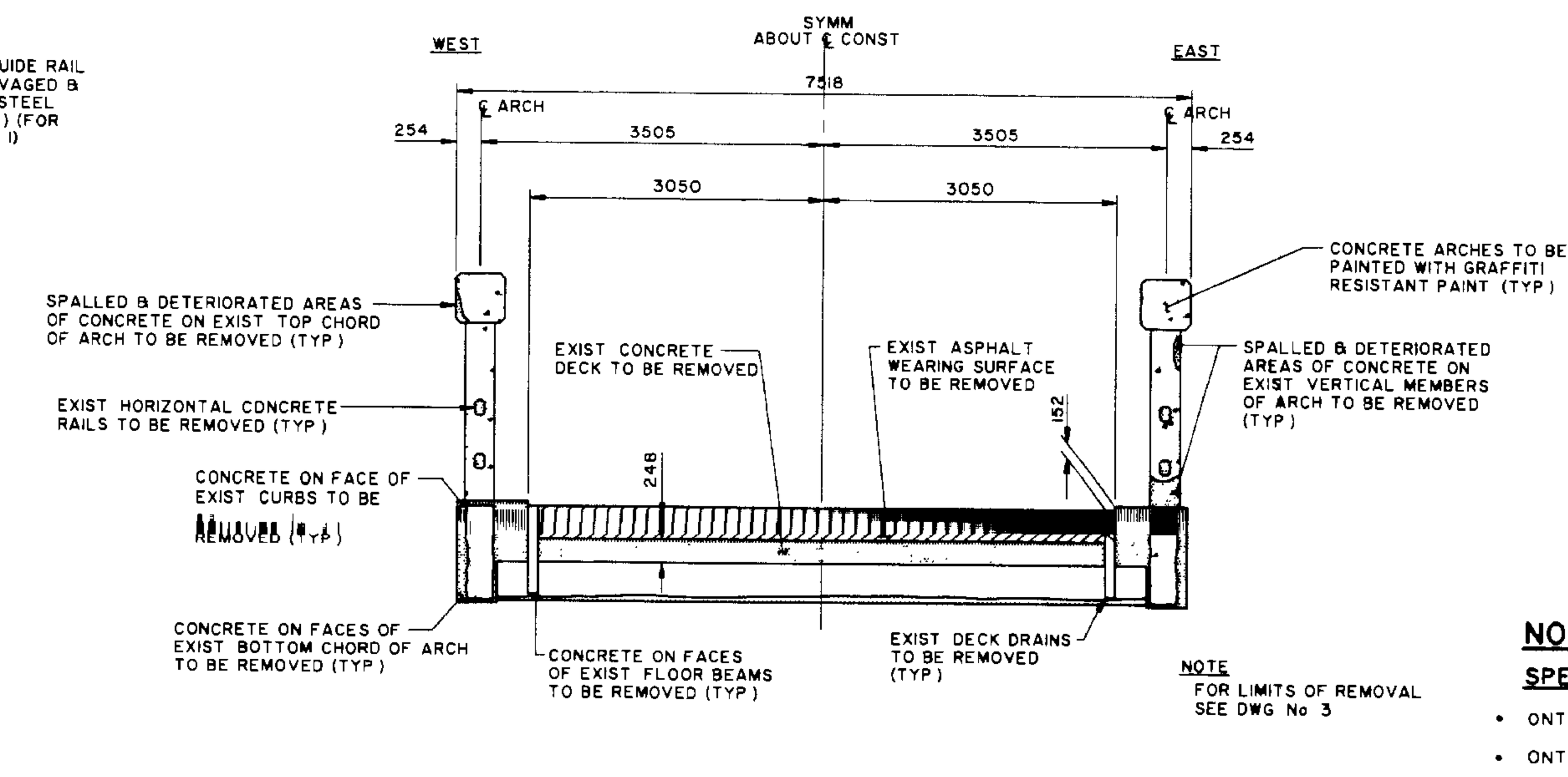
- DENOTES AREA OF DECK TO BE REPLACED WATERPROOFED & PAVED
- DENOTES AREA OF CURBS TO BE OVERLAID
- W L DENOTES WATERLINE
- S/B DENOTES STREAMBED
- O G DENOTES ORIGINAL GROUND
- W P DENOTES WORKING POINT
- T/A DENOTES TOP OF ASPHALT
- F F DENOTES FRONT FACE



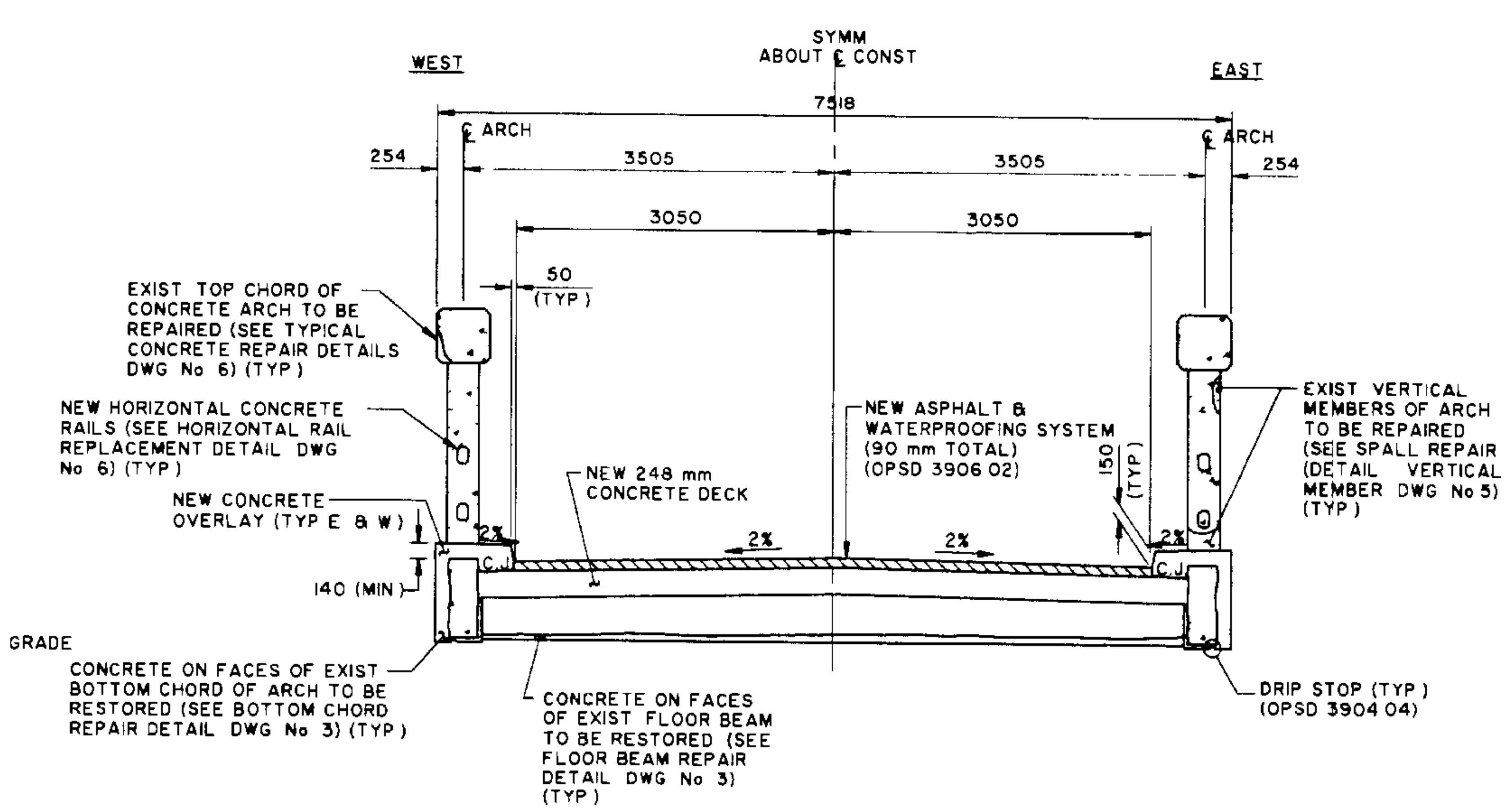
ELEVATION
SCALE 1:100



DETAIL 'A'
SCALE 1:75



EXISTING DECK SECTION
SCALE 1:50



NEW DECK SECTION
SCALE 1:50

NOTES

SPECIFICATIONS

- ONTARIO PROVINCIAL STANDARD SPECIFICATIONS DIVISION 9
- ONTARIO HIGHWAY BRIDGE DESIGN CODE 1991

  LIVE LOAD O H B D C - 91 + 90mm ASPHALT & WATERPROOFING SYSTEM (EXCEPT RAILING SYSTEM) L1=15 TONNES L2=27 TONNES L3=37 TONNES

CONCRETE

- ALL CONCRETE 30 MPa
- MAXIMUM AGGREGATE SIZE 13.2mm REPAIRS, 19mm ALL OTHER CONCRETE
- ALL CONCRETE REPAIR MATERIALS SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER S SPECIFICATIONS

  ALL EXPOSED CONCRETE EDGES TO HAVE 20mm CHAMFER UNLESS OTHERWISE NOTED

CLEAR COVER TO REINFORCEMENT

DECK	70 ± 20 mm (TOP) 40 ± 10 mm (BOTTOM)
FLOOR BEAMS	40 ± 10 mm
REMAINDER (EXCEPT AS NOTED)	70 ± 20 mm

REINFORCING STEEL

ALL REINFORCING STEEL SHALL BE IN ACCORDANCE WITH C S A G30 18M 1992 GRADE 400 UNLESS OTHERWISE NOTED

REINFORCING STEEL SHALL BE FIELD CUT AS DIRECTED BY THE ENGINEER AND AS A NON PAY ITEM

REINFORCING BARS WITH PREFIX C DENOTE COATED BARS

FOR CONSTRUCTION SEQUENCE SEE DWG No 3

NOTES TO CONTRACTOR

CONTRACTOR TO CHECK ALL RELEVANT STRUCTURE DIMENSIONS AND ELEVATIONS SHOWN ON THE DRAWINGS AND ADJUST DIMENSIONS AND ELEVATIONS AS REQUIRED TO MATCH EXISTING STRUCTURE AND AS APPROVED BY THE ENGINEER

- ANY DAMAGE DONE TO THE EXISTING STRUCTURE DURING REMOVALS OR RECONSTRUCTION SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE ENGINEER AND AT NO COST TO THE OWNER

REFERENCE DRAWINGS

- DETAILS OF THE EXISTING STRUCTURE HAVE BEEN DERIVED FROM DRAWINGS OF MAXWELL S BRIDGE BY THE TOWNSHIP OF SCARBOROUGH ENGINEERING DEPARTMENT DATED AUG 8 1927

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS-66-97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON-ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
2	JAN 98	AS CONSTRUCTED	DMG	DLB
1	JUNE 97	REVISED PER MTRCA COMMENTS	DMG	DLB

LICENSED PROFESSIONAL ENGINEER C T SPRINGER PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER D L BAXTER PROVINCE OF ONTARIO

SEAL

5002-S-5

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

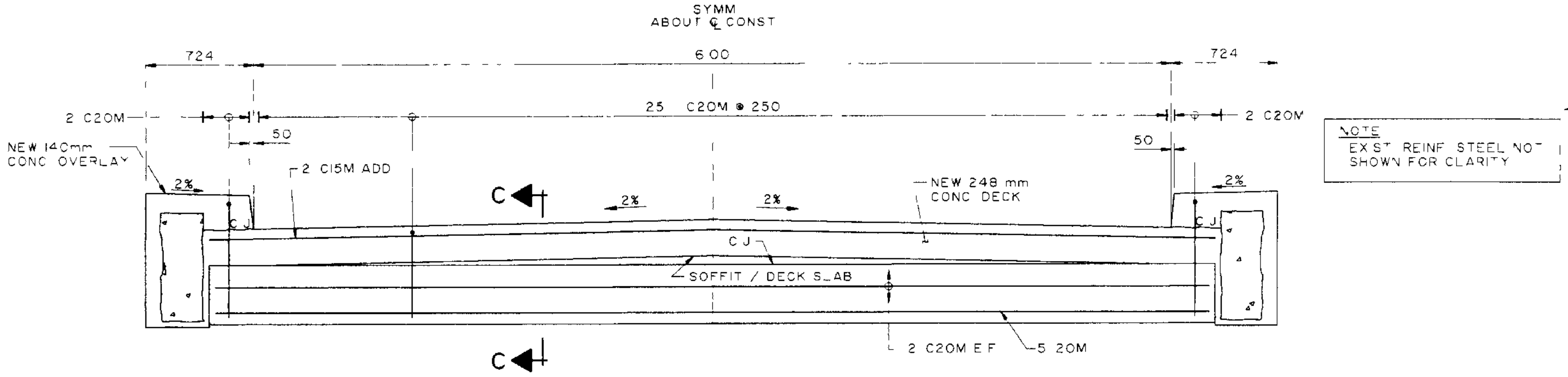
STRUCTURAL REHABILITATION OF THE MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

GENERAL ARRANGEMENT

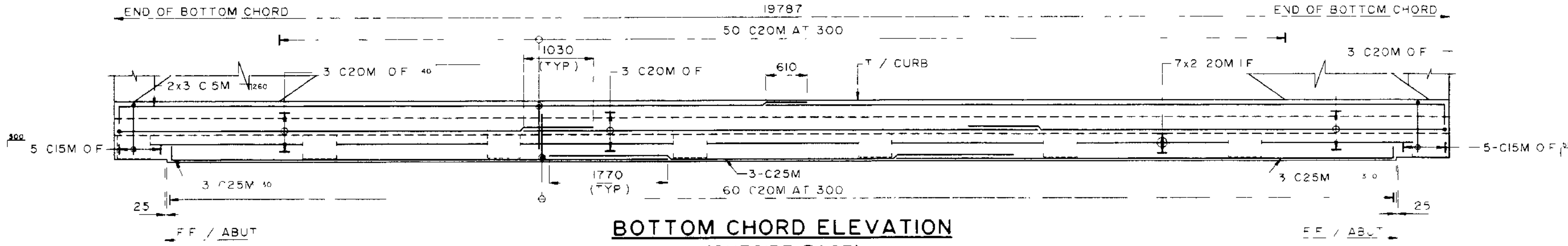
DESIGN	CTS	DRAWN	DMG	CHECK	DLB	PROJECT	42-18696-03
SCALES	AS NOTED			ACAD FILE NAME	MAX_GA	DRAWING NUMBER	2
DATE	MAY 1997						

C:\MAX\MAX_GA 06/24/98 11:21

2363F

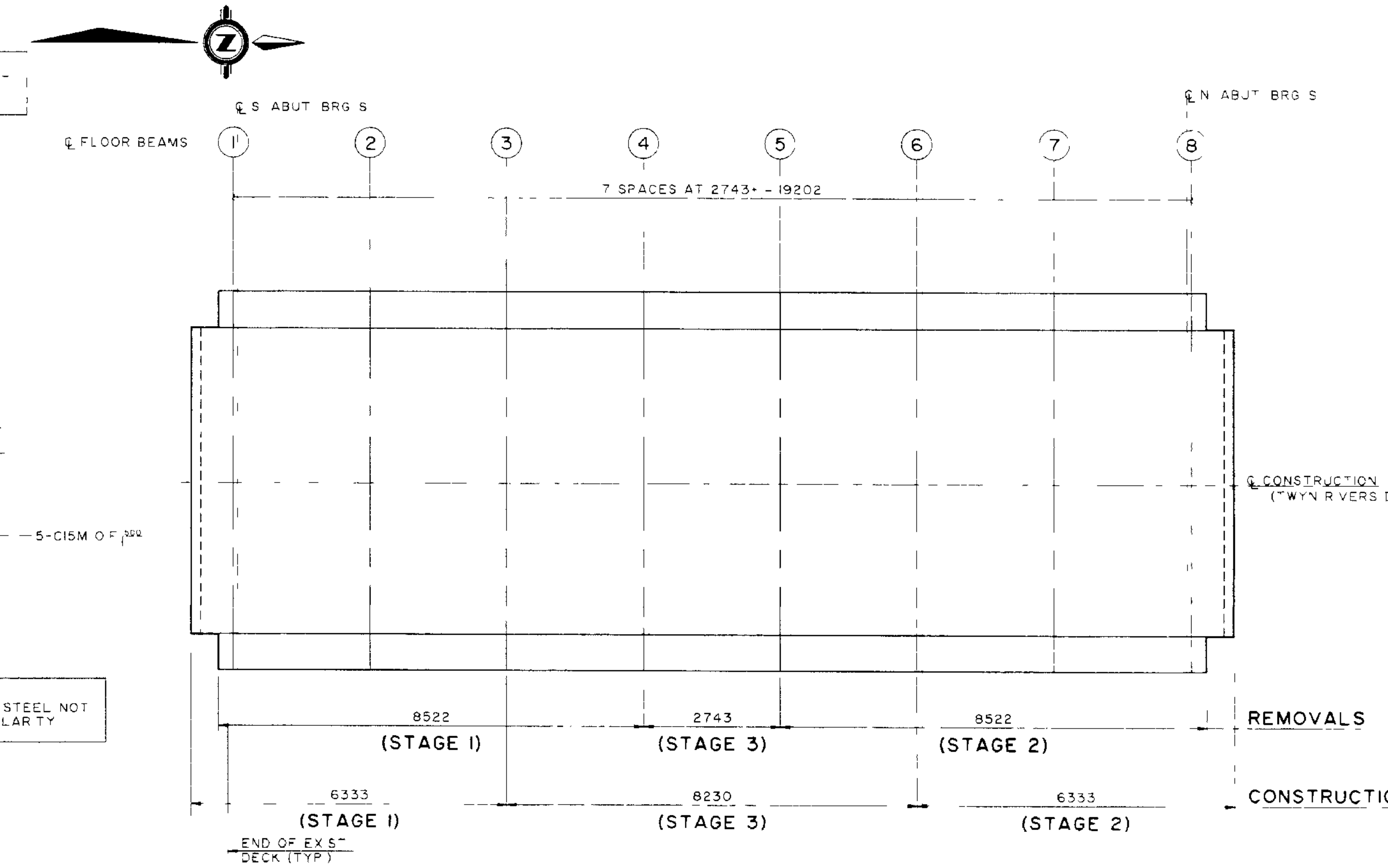


FLOOR BEAM REPAIR
SCALE 1:25



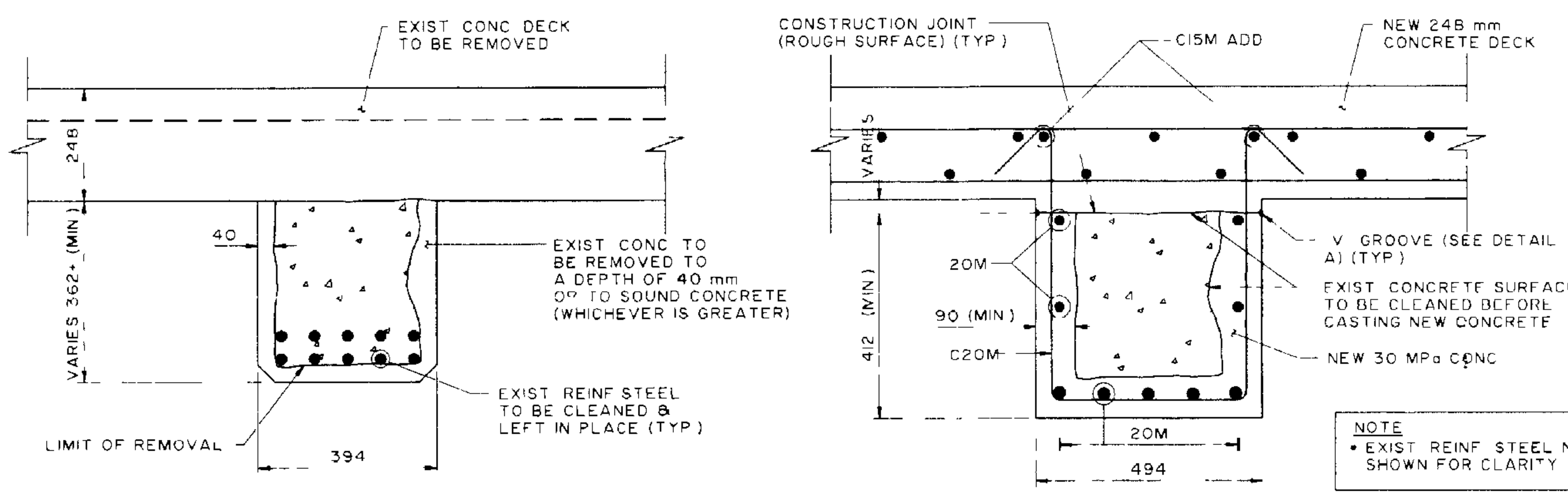
BOTTOM CHORD ELEVATION
(OUTSIDE FACE)
SCALE 1:50

NOTE
EXIST REINF STEEL NOT SHOWN FOR CLARITY



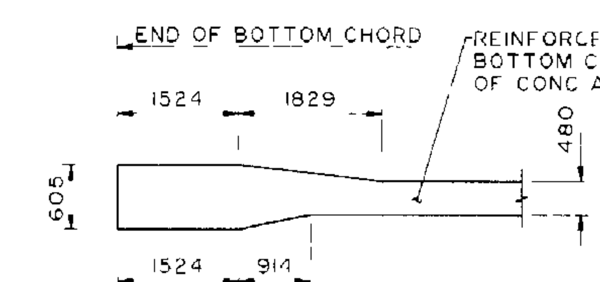
PLAN
SCALE 1:75

NOTE
EXIST REINF STEEL NOT SHOWN FOR CLARITY

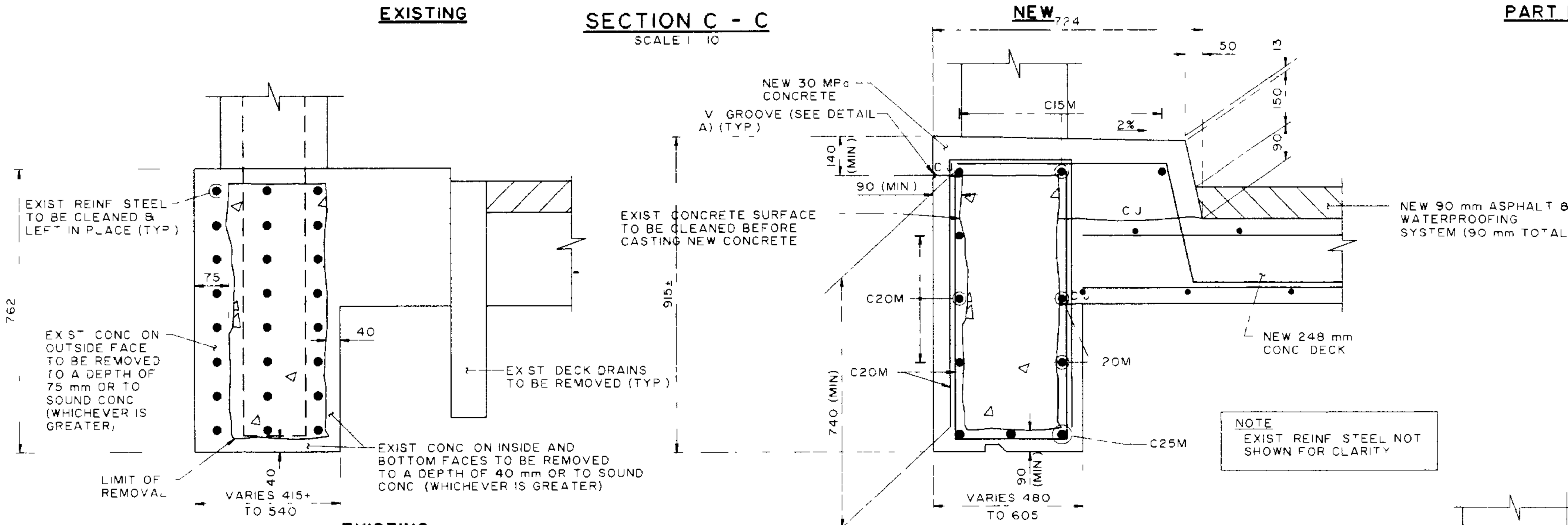


SECTION C - C
SCALE 1:10

NOTE
* EXIST REINF STEEL NOT SHOWN FOR CLARITY

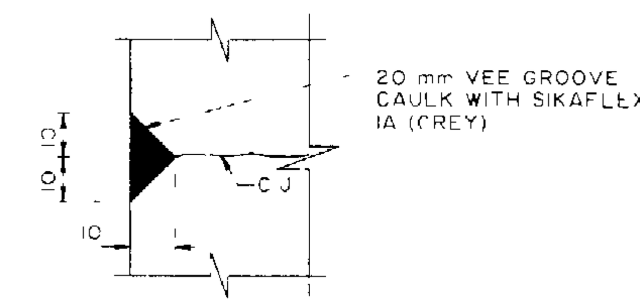


PART PLAN - BOTTOM CHORD
SCALE 1:75



TYPICAL BOTTOM CHORD REPAIR
SCALE 1:10

NOTE
EXIST REINF STEEL NOT SHOWN FOR CLARITY



DETAIL A
(AT FLOOR BEAMS & BOTTOM CHORDS)
N T S

CONSTRUCTION SEQUENCE

STAGE 1

① REMOVE EXISTING CONCRETE DECK S BALLAST WALL AND S END POSTS ON DECK AND CARRY OUT REMOVALS TO FLOOR BEAMS (Nos 1 TO 3) BOTTOM CHORDS OF ARCHES AND CURB FACES

② REINFORCE EXISTING CONCRETE FLOOR BEAMS (Nos 1 TO 3) AND BOTTOM CHORDS OF ARCHES AND RECONSTRUCT BALLAST WALL

③ PLACE NEW CONCRETE DECK

STAGE 2

STAGE 2 REMOVALS SHALL NOT COMMENCE UNTIL ALL CONCRETE PLACED IN STAGE 1 HAS REACHED A COMPRESSIVE STRENGTH OF 20 MPa

○ REMOVE EXISTING CONCRETE DECK N BALLAST WALL AND N END POSTS ON DECK AND CARRY OUT REMOVALS TO FLOOR BEAMS (Nos 6 TO 8) BOTTOM CHORDS OF ARCHES AND CURB FACES

② REINFORCE EXISTING CONCRETE FLOOR BEAMS (Nos 6 TO 8) AND BOTTOM CHORDS OF ARCHES AND RECONSTRUCT BALLAST WALL

③ PLACE NEW CONCRETE DECK

STAGE 3

STAGE 3 REMOVALS SHALL NOT COMMENCE UNTIL ALL CONCRETE PLACED IN STAGE 2 HAS REACHED A COMPRESSIVE STRENGTH OF 20 MPa

① REMOVE EXISTING CONCRETE DECK AND CARRY OUT REMOVALS TO FLOOR BEAMS (Nos 4 & 5) BOTTOM CHORDS OF ARCHES AND CURB FACES

② REINFORCE EXISTING CONCRETE FLOOR BEAMS (Nos 4 & 5) AND BOTTOM CHORDS OF ARCHES

③ PLACE NEW CONCRETE DECK

④ REMOVE EXISTING CONCRETE END POSTS ON WINGWALLS

⑤ CARRY OUT REMOVALS TO CURBS ON WINGWALLS

⑥ PLACE CONCRETE OVERLAY ON CURB FACES OVER FULL LENGTH OF STRUCTURE

⑦ RECONSTRUCT CONCRETE END POSTS ON DECK AND WINGWALLS

⑧ WATERPROOF AND PAVE THE ENTIRE BRIDGE DECK

⑨ PAVE APPROACHES

MISCELLANEOUS

CARRY OUT REPAIRS TO TOP CHORD AND VERTICAL MEMBERS OF CONCRETE ARCHES

CONSTRUCT NEW HORIZONTAL CONCRETE RAILS

CARRY OUT PATCH REPAIRS TO CONCRETE ABUTMENTS AND WINGWALLS

CARRY OUT REPAIRS TO FOOTINGS

LICENSED PROFESSIONAL ENGINEER C T SPRINGER PROVINCE OF ONTARIO Aug 1998

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66 97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
△	JAN 98	AS CONSTRUCTED	DMG	DLB

REGISTERED PROFESSIONAL ENGINEER D L BAXTER PROVINCE OF ONTARIO
SEAL

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

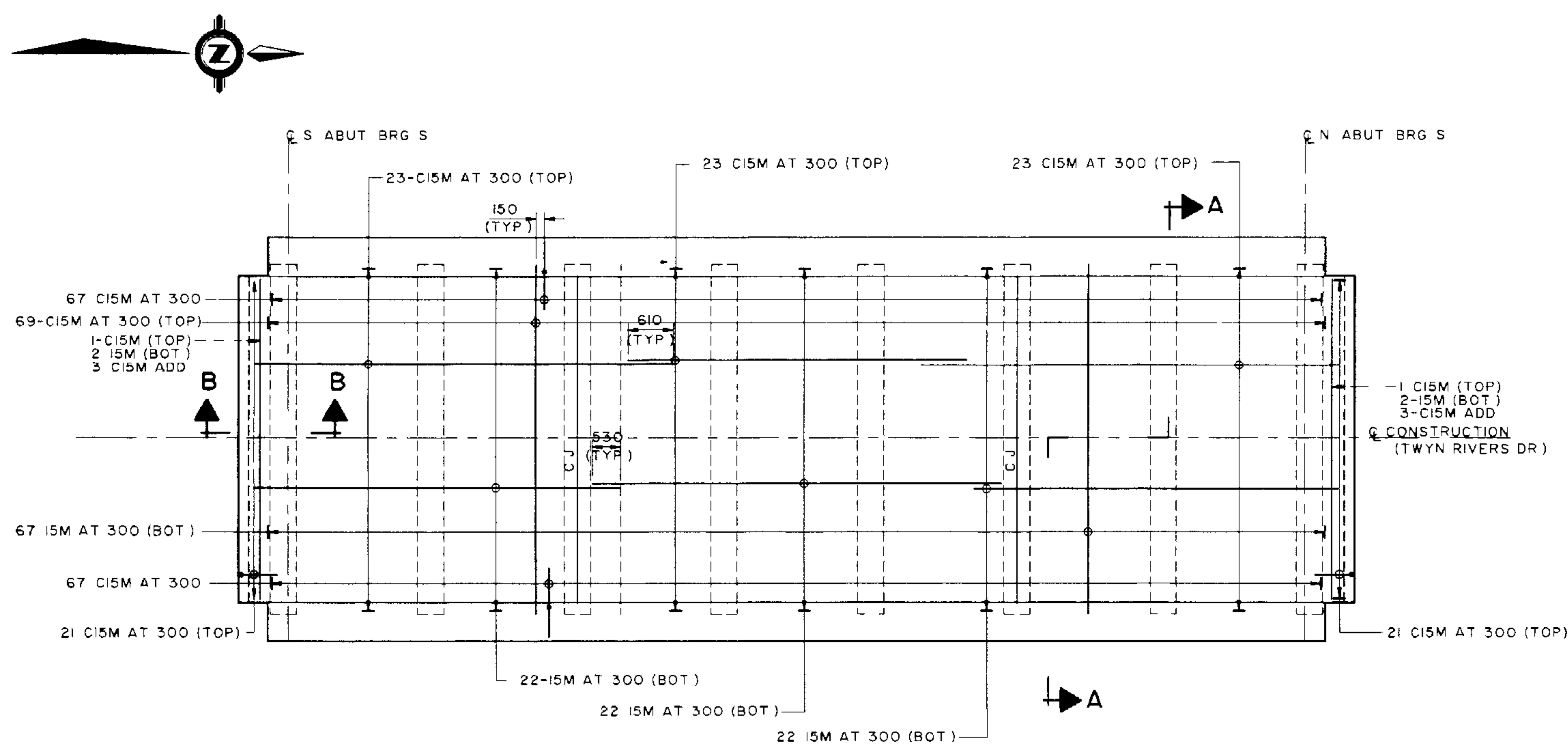
5002-S-6

STRUCTURAL REHABILITATION OF THE
MAXWELL S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

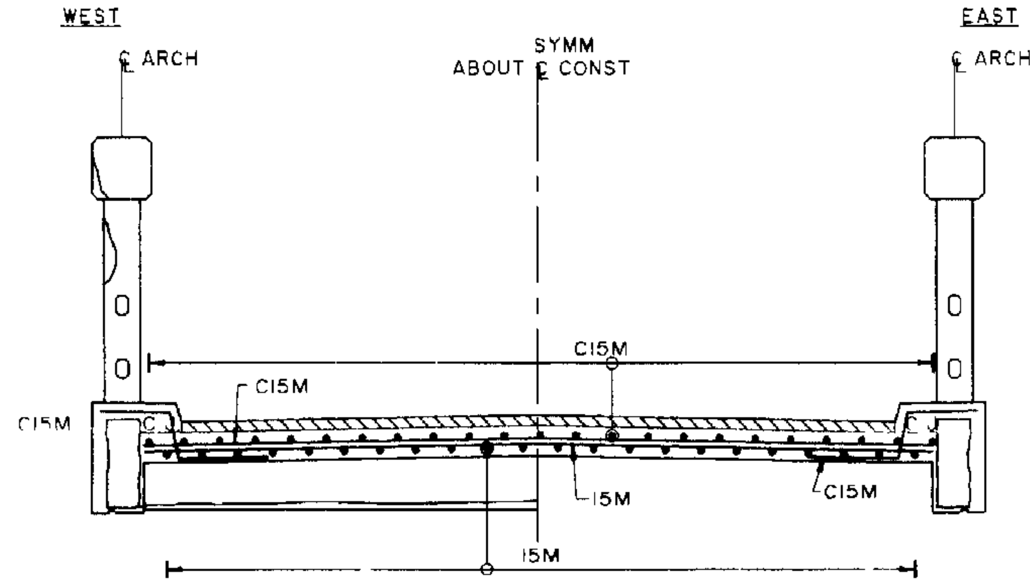
REINFORCING DETAILS AND STAGING

DESIGN	CTS	DRAWN	DMG	CHECKED	DLB	PROJECT	42 18696 03
SCALES	AS NOTED			ACAD FILE NAME	MAX 03	DRAWING NUMBER	3
DATE	MAY 1997						

23636



PLAN
SCALE 1:75

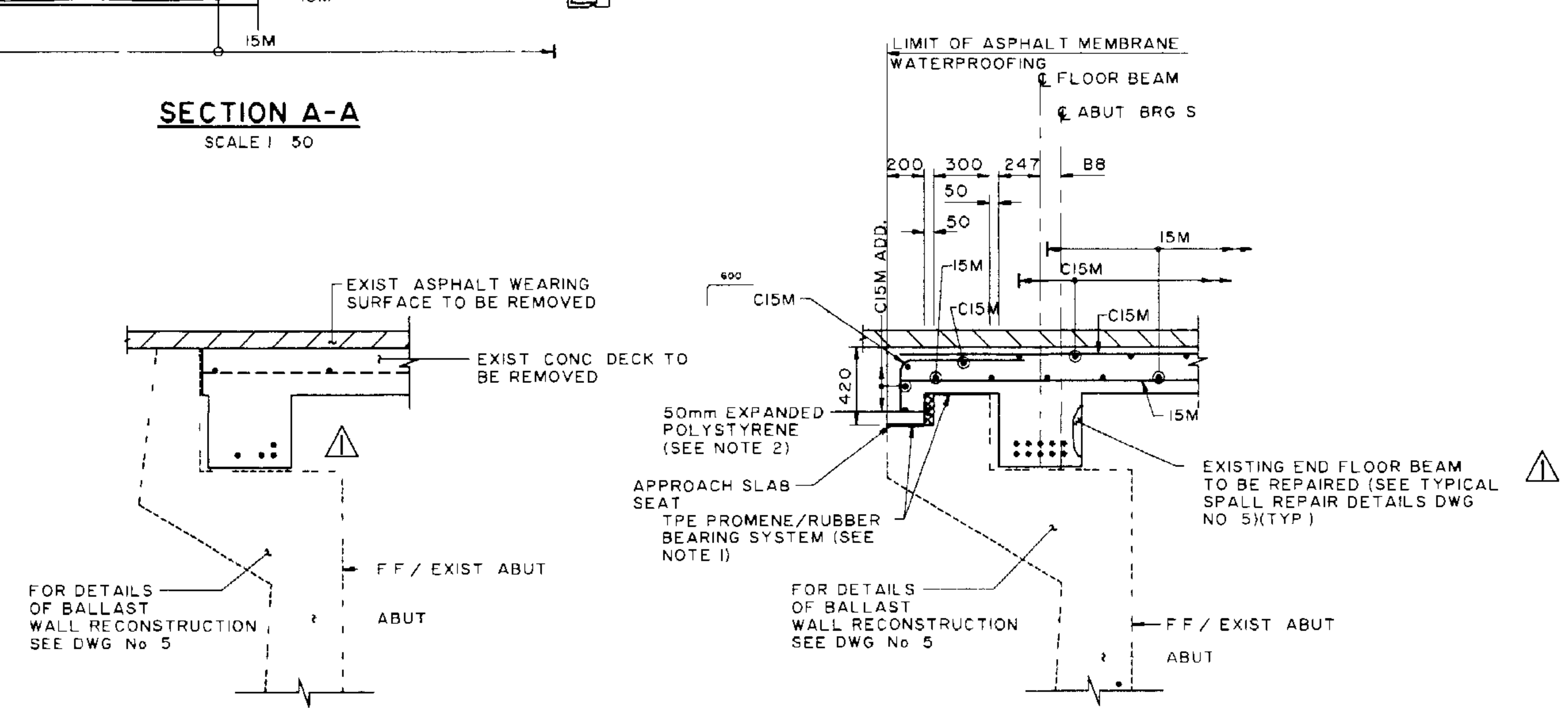


SECTION A-A
SCALE 1:50

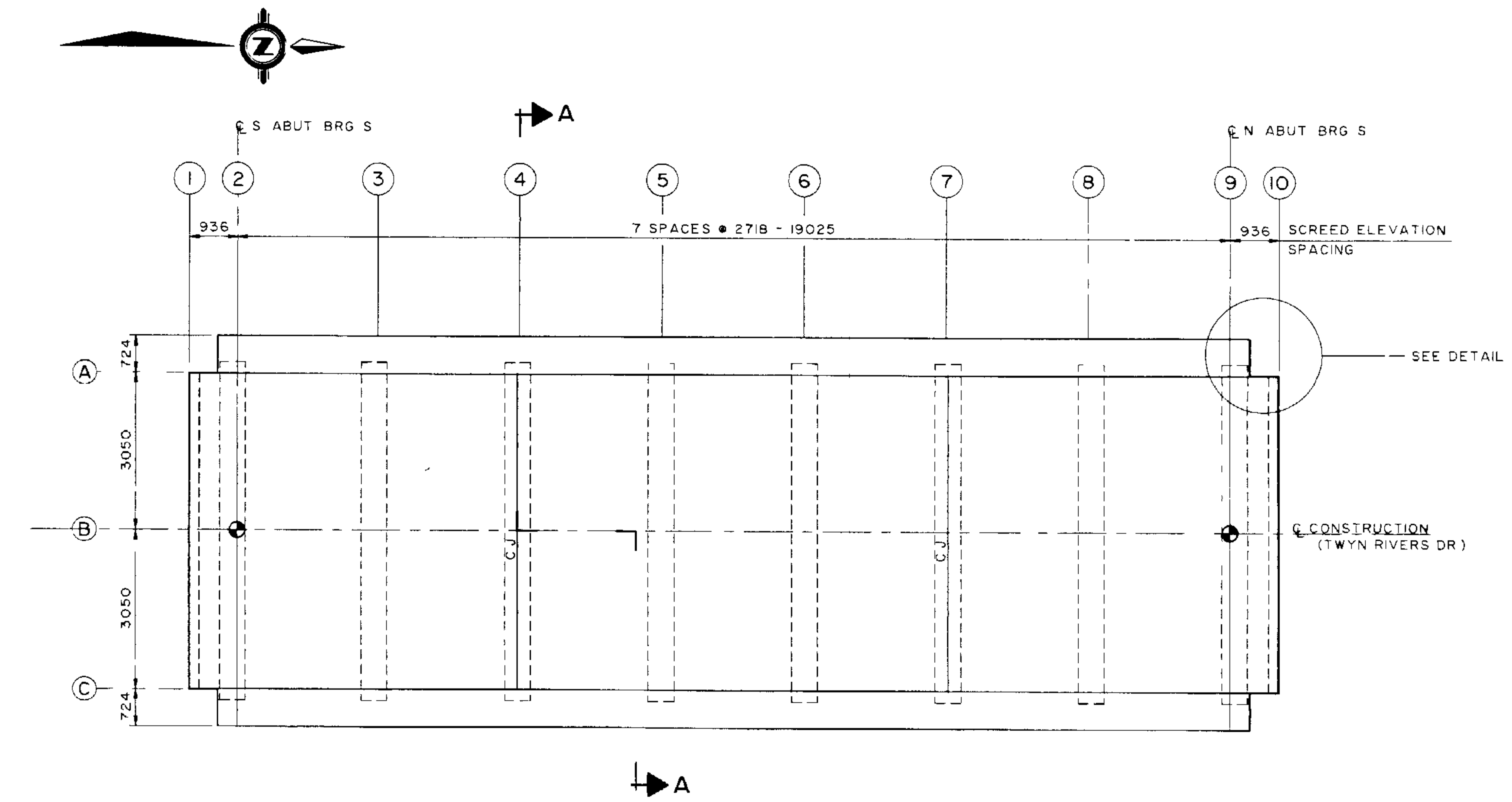
NOTE 1
TOP OF BALLAST WALL AND APPROACH SLAB SEAT TO BE TROWEL FINISHED PLACE TPE PROMENE/RUBBER BEARING SYSTEM MANUFACTURED BY GOODCO LIMITED MARKHAM ONTARIO OR APPROVED EQUAL ON THE BALLAST WALL AND APPROACH SLAB SEAT

NOTE 2
50mm EXPANDED POLYSTYRENE TO BE CONTINUOUS FOR FULL WIDTH OF DECK OVERHANG MATERIAL TO BE PLACED PRIOR TO DECK POUR AND LEFT IN PLACE

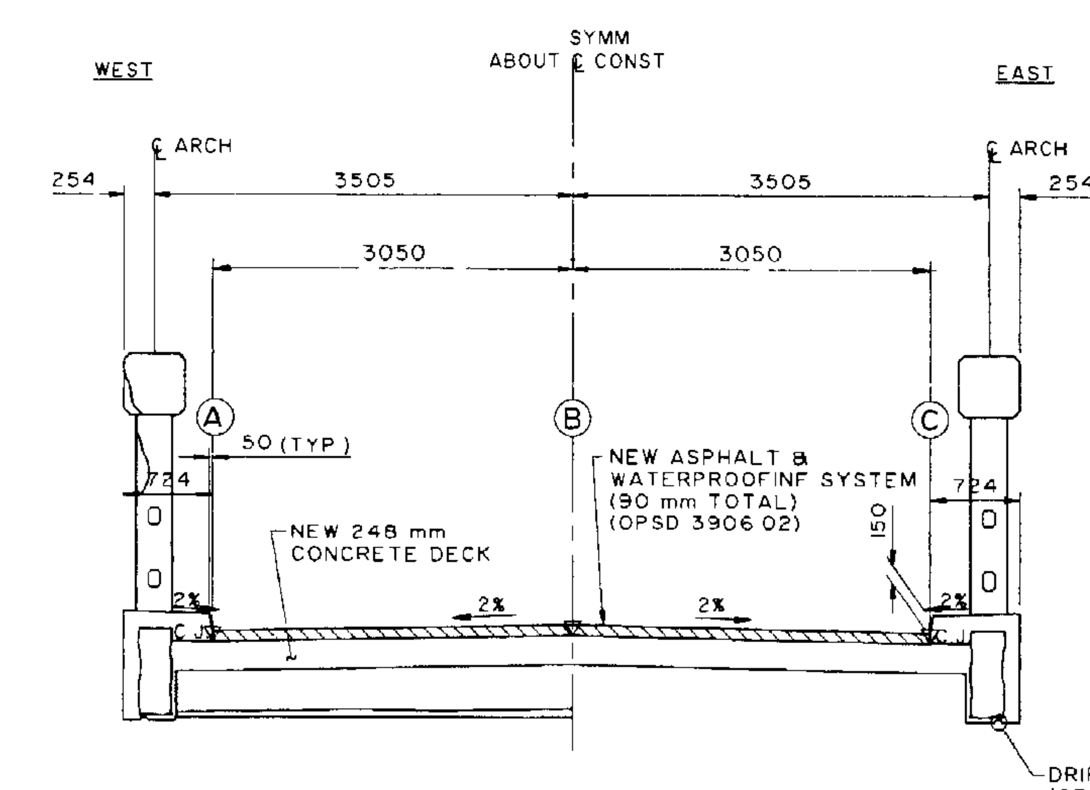
NOTE 3
PROVIDE EVAZOTE CLOSED CELL SEALANT OR APPROVED EQUAL FOR FULL JOINT DEPTH AT SPECIFIED LOCATIONS



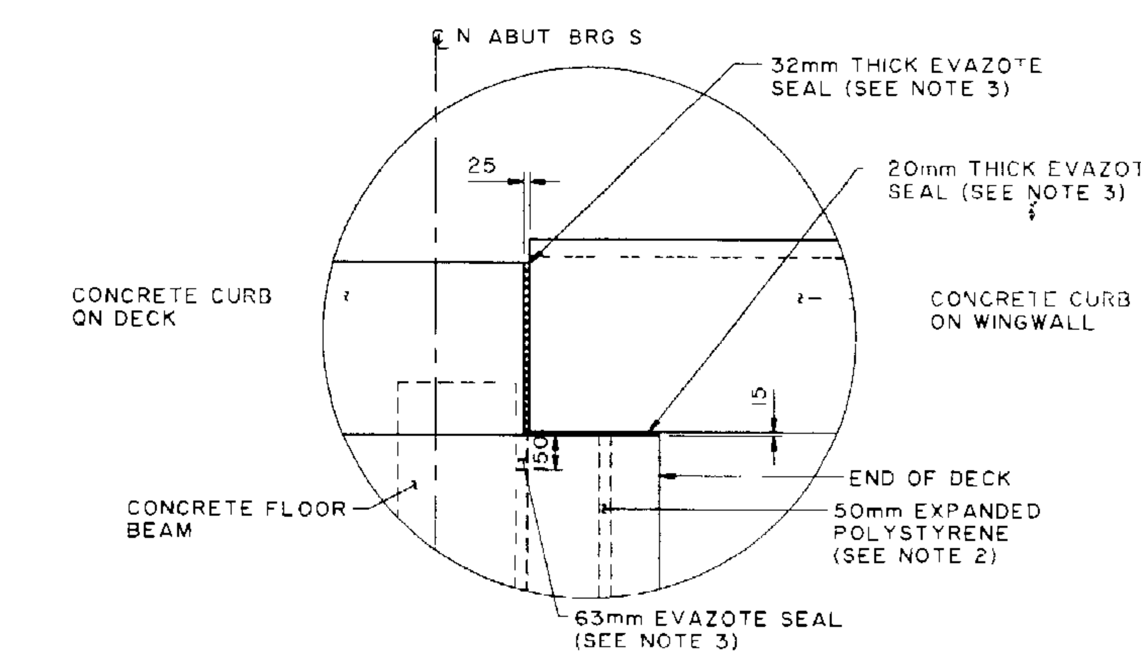
EXISTING **SECTION B-B** **NEW**
SCALE 1:25



PLAN
SCALE 1:75



SECTION A-A
SCALE 1:50



DETAIL '1'
SCALE 1:25

SCREED ELEVATIONS										
No	1	2	3	4	5	6	7	8	9	10
A	89 197	89 192	89 179	89 165	89 152	89 138	89 124	89 111	89 097	89 092
B	89 258	89 253	89 240	89 226	89 213	89 199	89 185	89 172	89 158	89 153
C	89 197	89 192	89 179	89 165	89 152	89 138	89 124	89 111	89 097	89 092

NOTES

- SCREED ELEVATIONS INCLUDE ALLOWANCES FOR GRADE AND DEAD LOAD DEFLECTION
- CONTRACTOR TO MAKE ALLOWANCES FOR FALSEWORK CREEP
- SCREED ELEVATIONS ARE GIVEN TO TOP OF CONCRETE

  CONCRETE IN CURB OVERLAY SHALL NOT BE PLACED UNTIL ALL CONCRETE IN DECK HAS REACHED A STRENGTH OF 20 MPa
- FOR METHOD OF OBTAINING SCREED ELEVATIONS SEE OPSD 3931 00

  FOR SUPPORTS FOR REINFORCING STEEL SEE OPSD 3923 00

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66 97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
1	JAN 98	AS CONSTRUCTED	DMG	DLB

C T SPRINGER
PROFESSIONAL ENGINEER PROVINCE OF ONTARIO

D L BAXTER
REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO
SEAL

5002-S-7

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

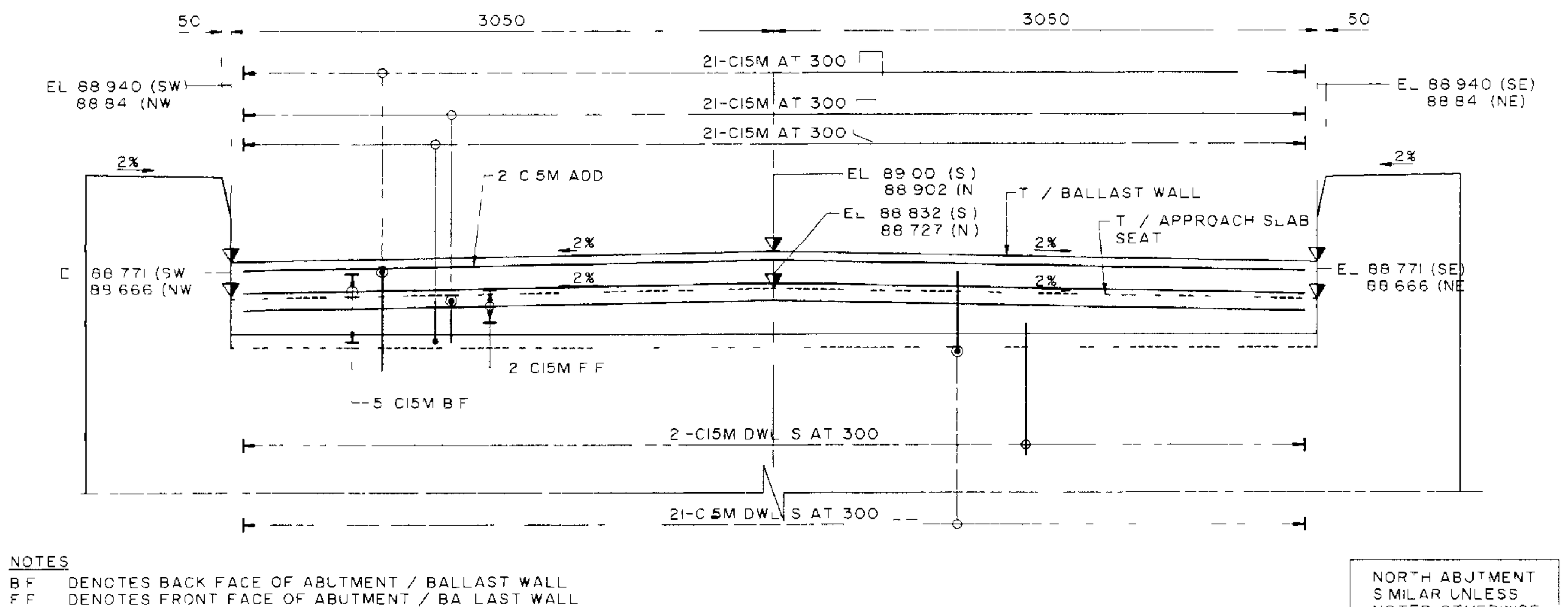
totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

STRUCTURAL REHABILITATION OF THE
MAXWELL S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

DECK DETAILS & REINFORCEMENT

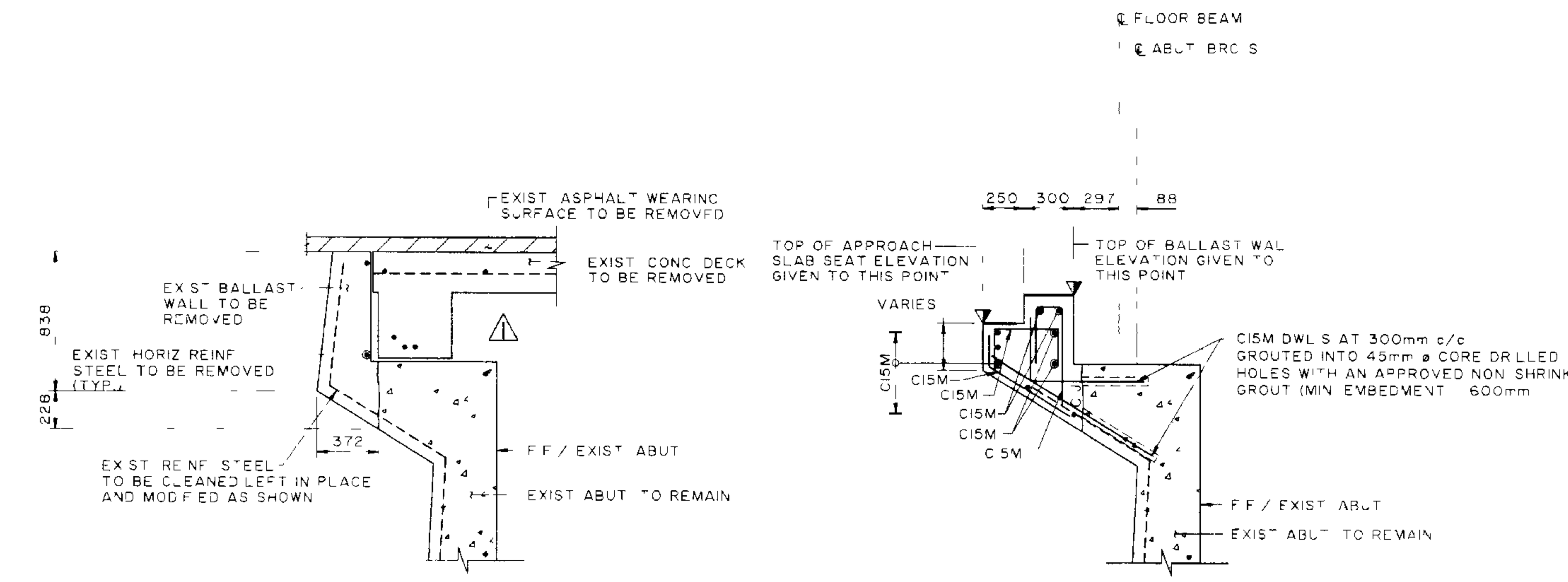
DESIGN	CTS	DRAWN	DMG	CHECKED	DLB	PROJECT	42-18696 03
SCALES	AS NOTED	ACAD FILE NAME	MAX 03	DRAWING NUMBER	4		
DATE	MAY 1997						

2363H



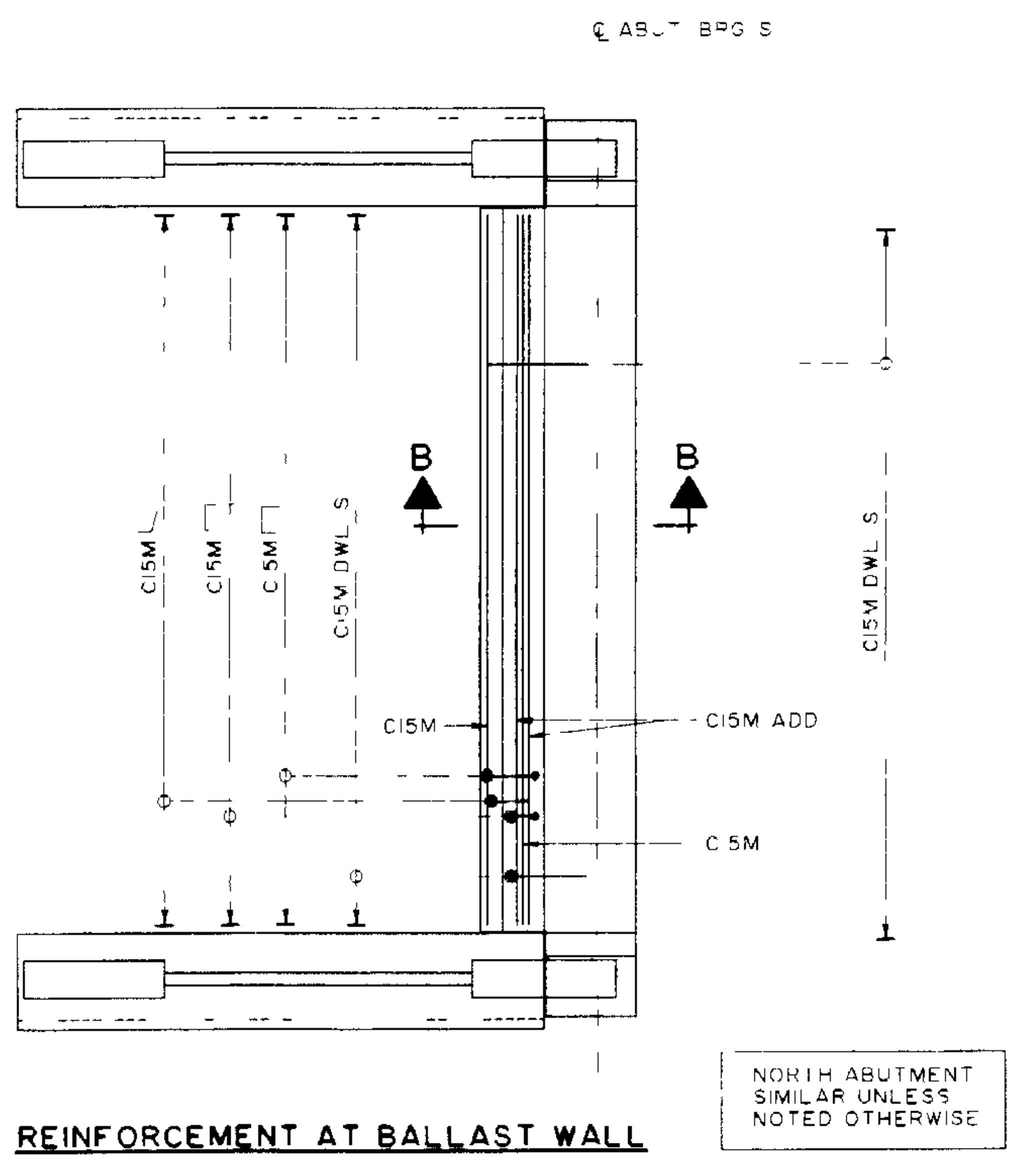
SOUTH ABUTMENT ELEVATION

SCALE 1:25



SECTION B-B

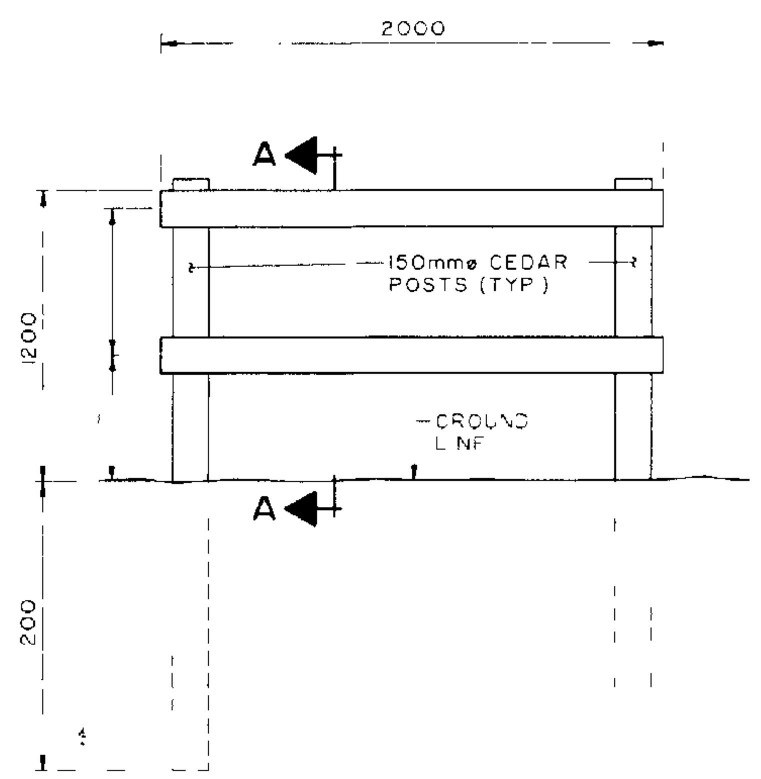
SCALE 1:25



REINFORCEMENT AT BALLAST WALL

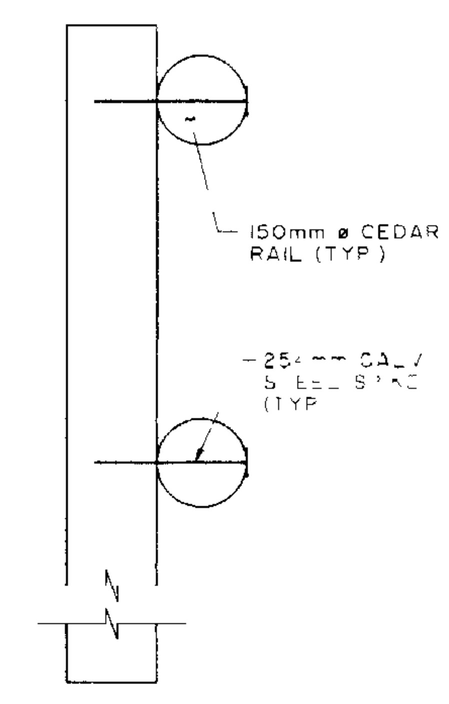
SOUTH PLAN

SCALE 1:50



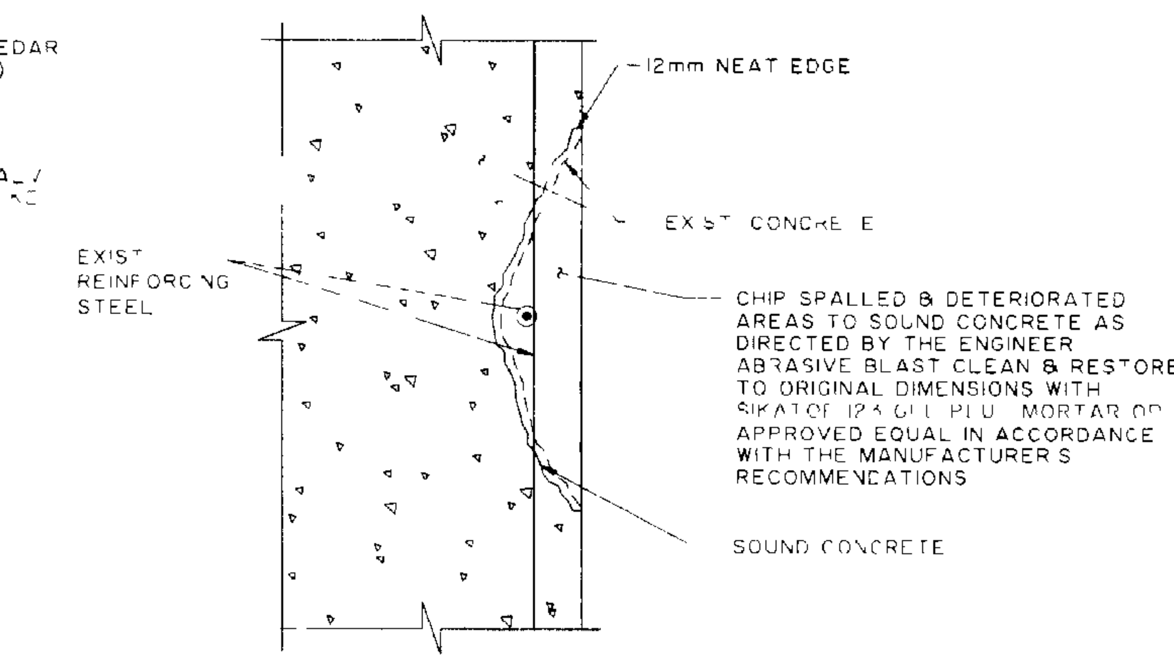
CEDAR RAIL FENCE

SCALE 1:25

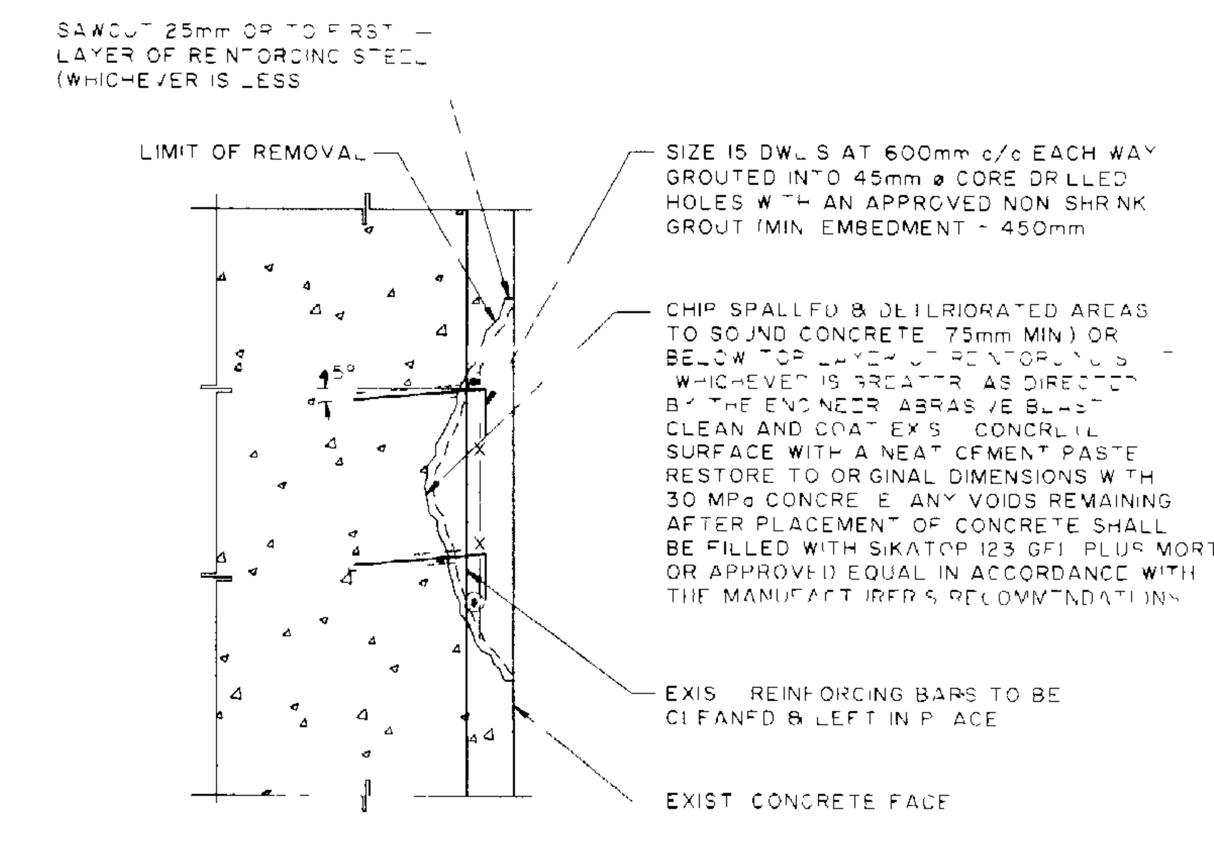


SECTION A-A

SCALE 1:10



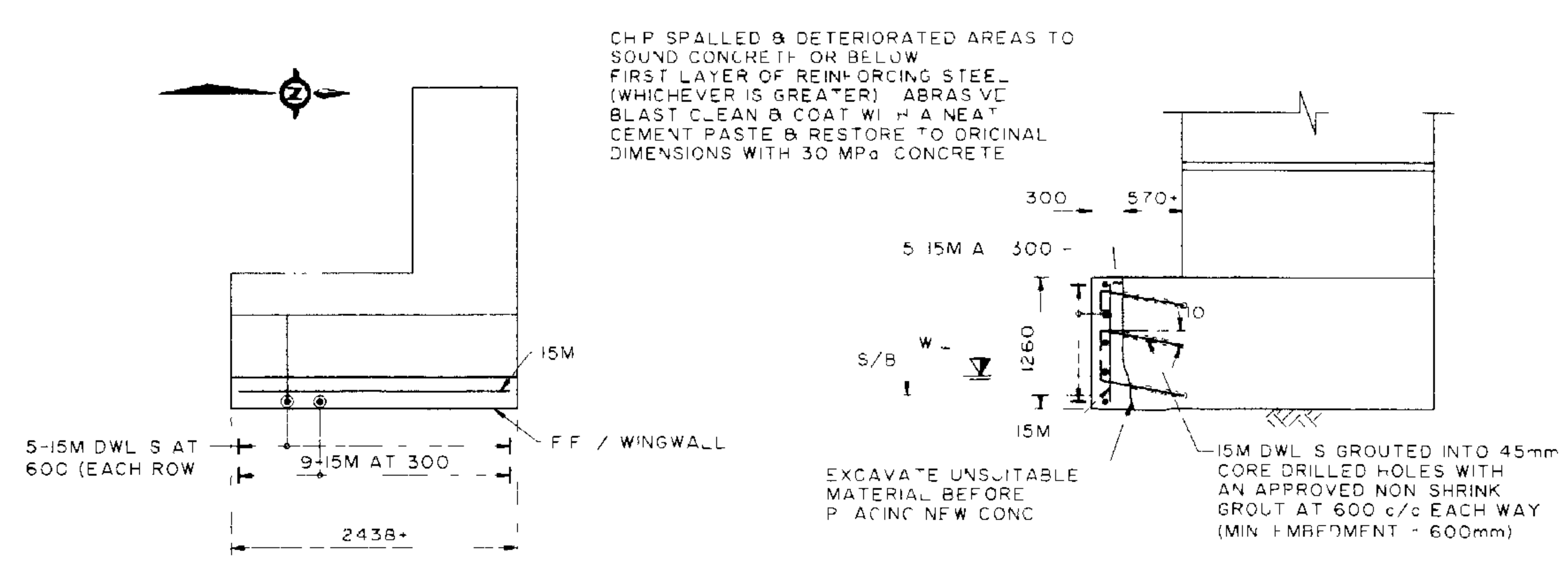
TYPE 'A'



TYPE 'B'

TYPICAL SPALL REPAIR DETAILS

N.T.S.

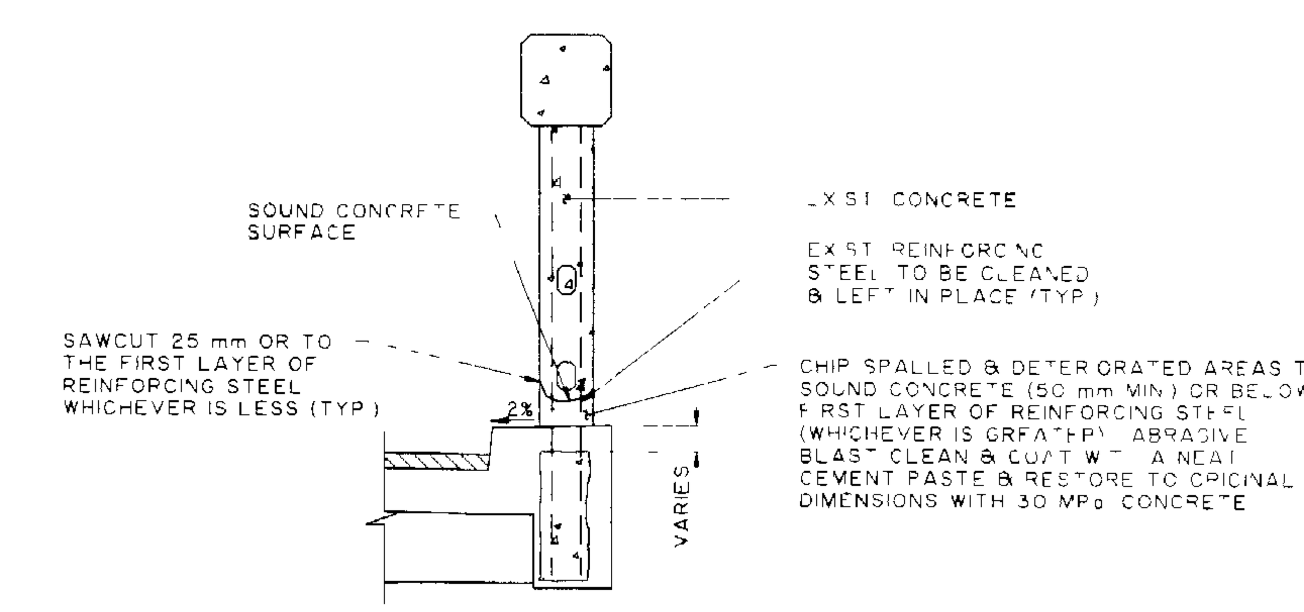


PLAN

N.T.S.

NE & SE ABUTMENT FOOTING REPAIR DETAIL

SCALE 1:50



SPALL REPAIR DETAIL - VERTICAL MEMBER

N.T.S.

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66-97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 4 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
⚠	JAN 98	AS CONSTRUCTED	DMG	DLB

SEAL

C. T. SPRINGER

D. L. BAXTER

5002-S-8

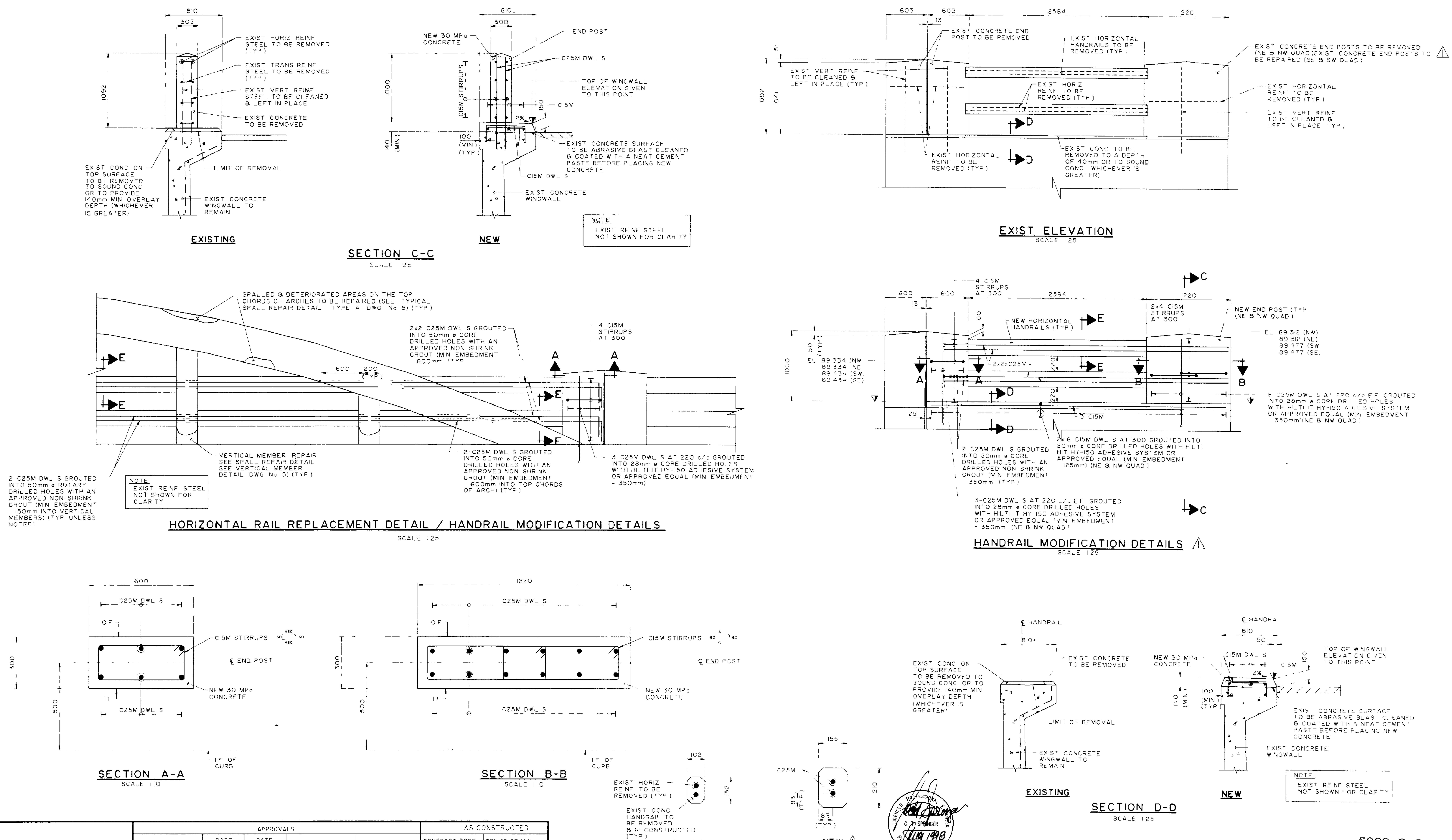
CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

STRUCTURAL REHABILITATION OF THE MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

MISCELLANEOUS REPAIR DETAILS

DESIGN	CTS	DRAWN	DMG	CHECKED	DLB	PROJECT	42 8696 03
SCALES	AS NOTED			ACAD FILE NAME	MAX 06	DRAWING NUMBER	5
DATE	MAY 1997						



5002-S-9

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 8/97	PERMIT	078/97/SCAR
MNR	APR 2_/97	JULY 29/97	PERMIT	YS 66 97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	DWG BY	DLB CHECKED
1	JAN 98	AS CONSTRUCTED		

SEAL

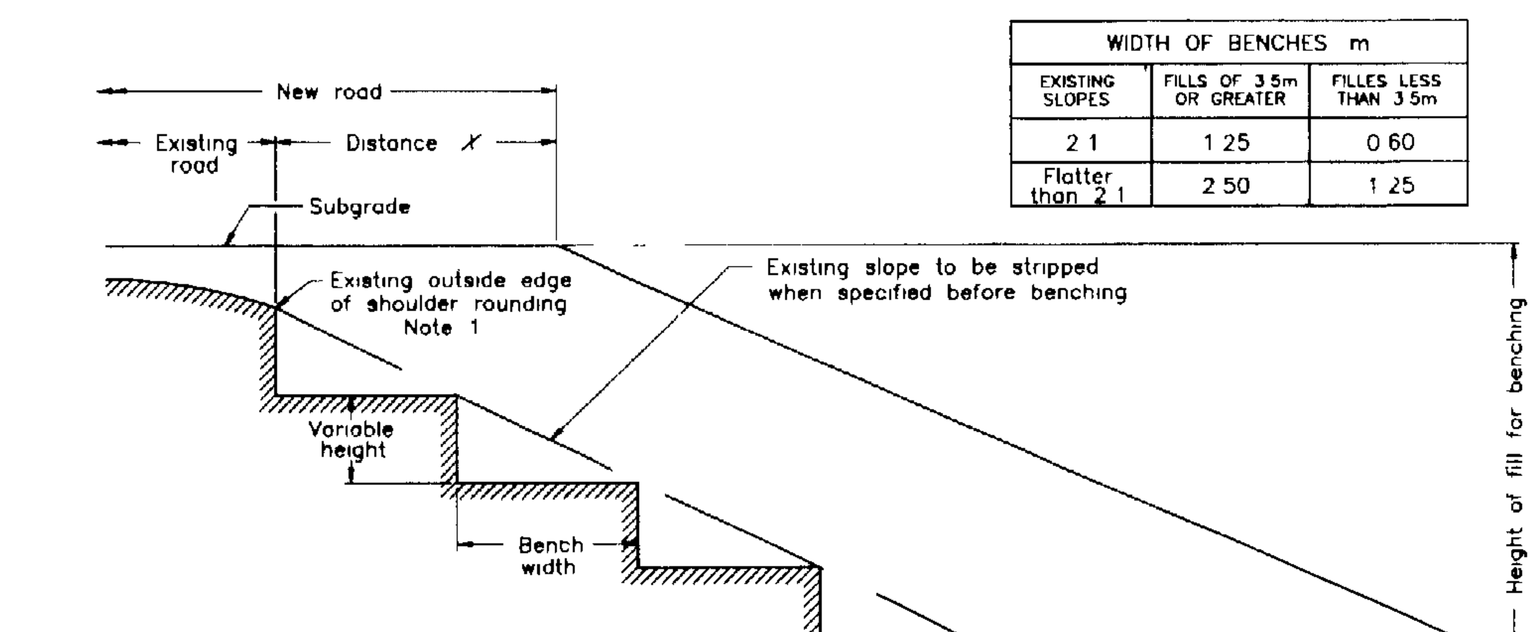
CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

STRUCTURAL REHABILITATION OF THE
MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

CONCRETE POST & RAIL REPAIRS

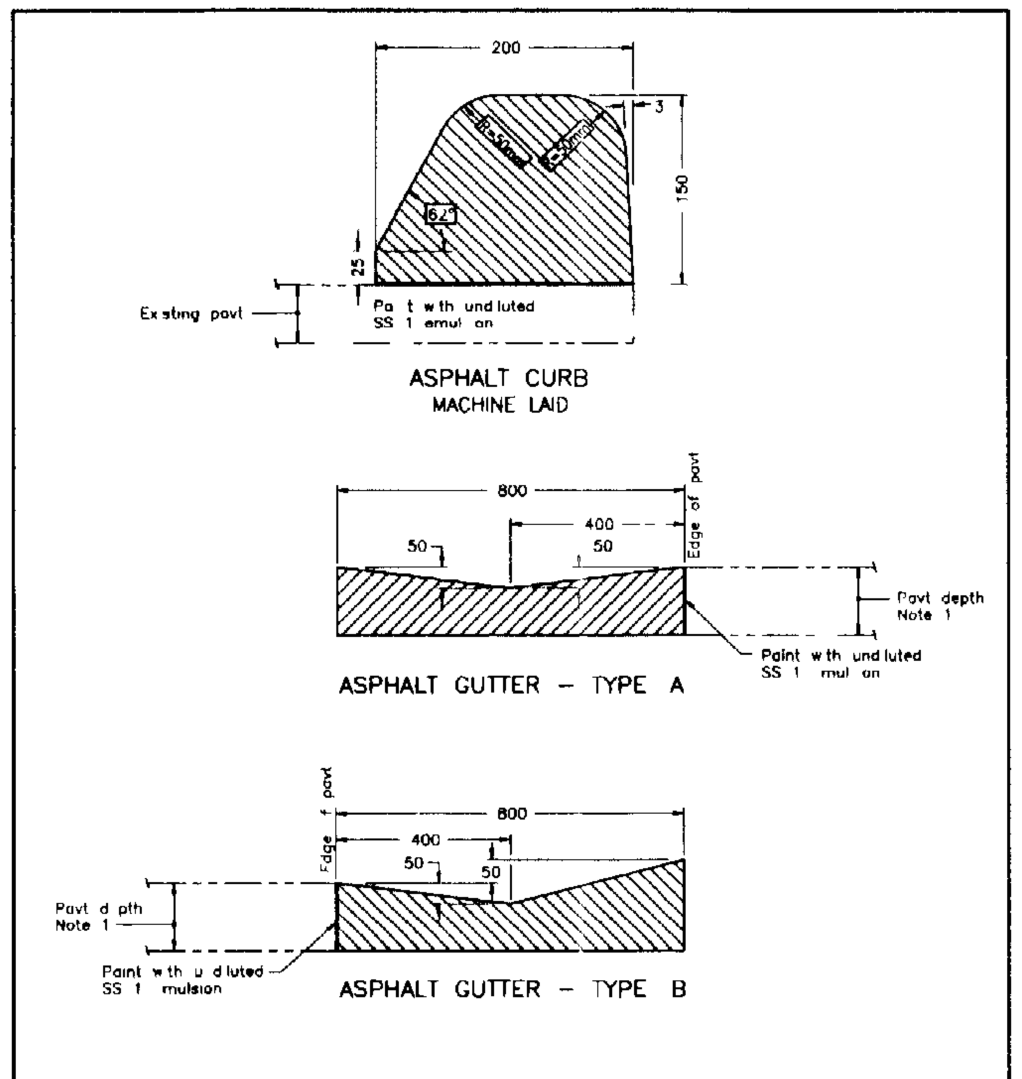
DESIGN	CTS	DRAWN	DMG	CHECKED	DLB	PROJECT	42 18696 03
SCALES	AS NOTED						
DATE	MAY 1997	ACAD FILE NAME	MAX-06	DRAWING NUMBER	6		



WIDTH OF BENCHES m		
EXISTING SLOPES	FILLS OF 3 5m OR GREATER	FILLES LESS THAN 3 5m
2 1	1 25	0 60
Flatter than 2 1	2 50	1 25

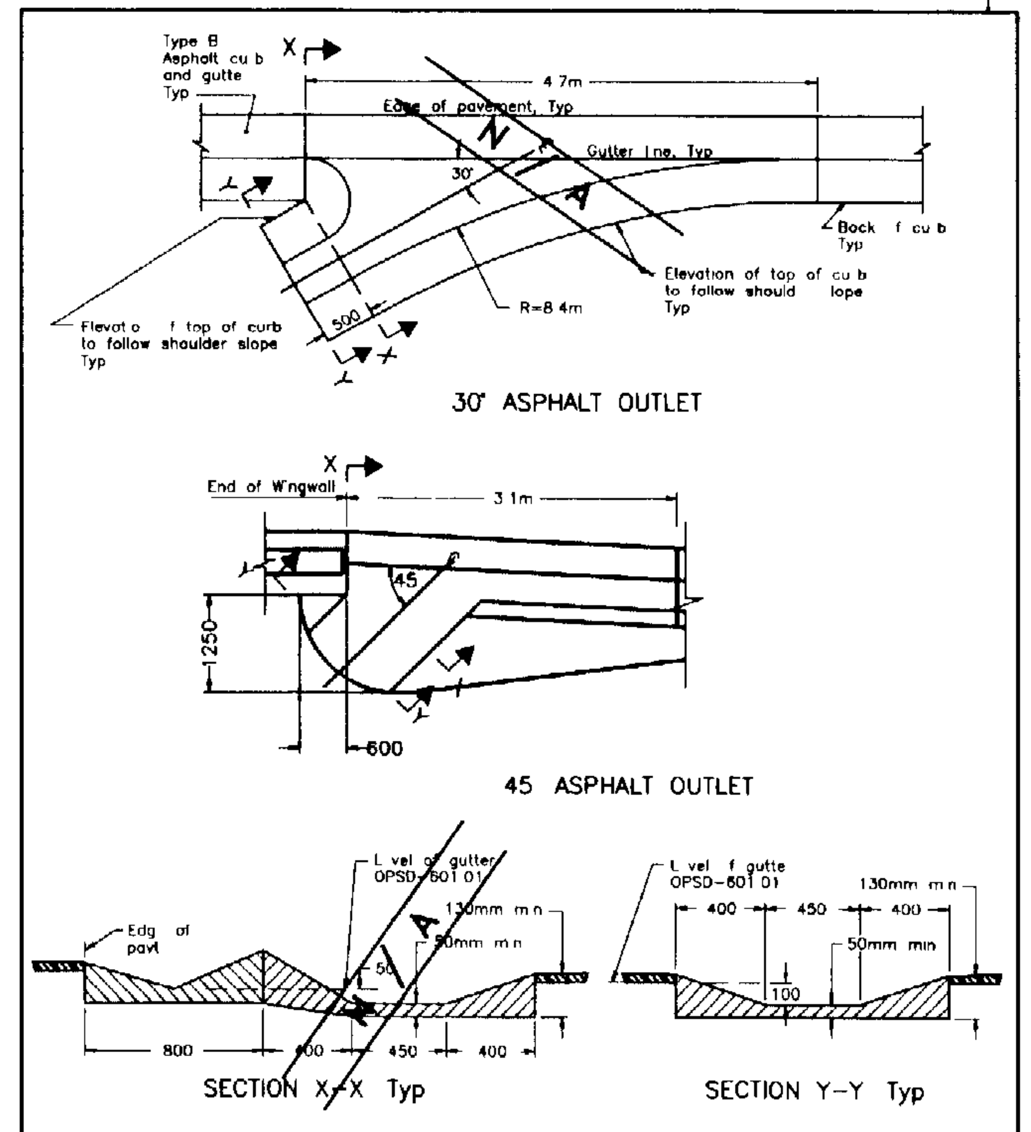
NOTES
1 When the subgrade is below the existing outside edge of shoulder rounding benching shall be carried out below the point where the subgrade intersects the existing slope
A This standard applies to widening of fills where the distance 'X' is 1 0m or more at new top of subgrade level
B Benching is not required on existing slopes flatter than 3 1 or where specified
C Benches are to be excavated one level at a time and the compacted fill brought up before the next benching level is excavated
D All dimensions are in millimetres or metres unless otherwise shown

ONTARIO PROVINCIAL STANDARD DRAWING | Date 1988 12 01 | Rev 1
BENCHING OF EARTH SLOPES
Date ______
OPSD – 208 01



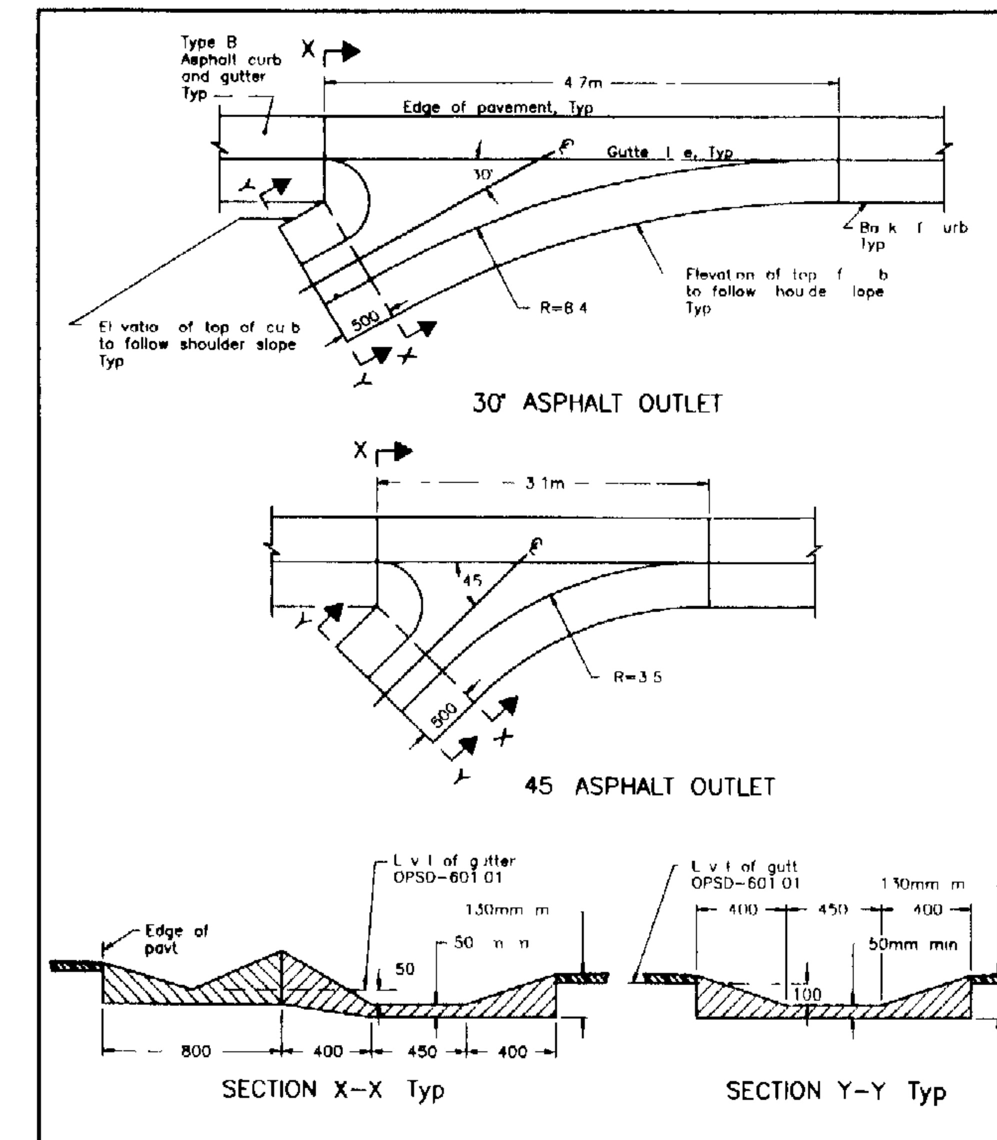
NOTES
1 Depth of gutter at pavement edge to equal depth of new pavement but in no case less than 130mm
A All dimensions are in millimetres unless otherwise shown

ONTARIO PROVINCIAL STANDARD DRAWING | Date 1990 09 14 | Rev 1
ASPHALT CURB AND ASPHALT GUTTER
Date ______
OPSD – 601 01



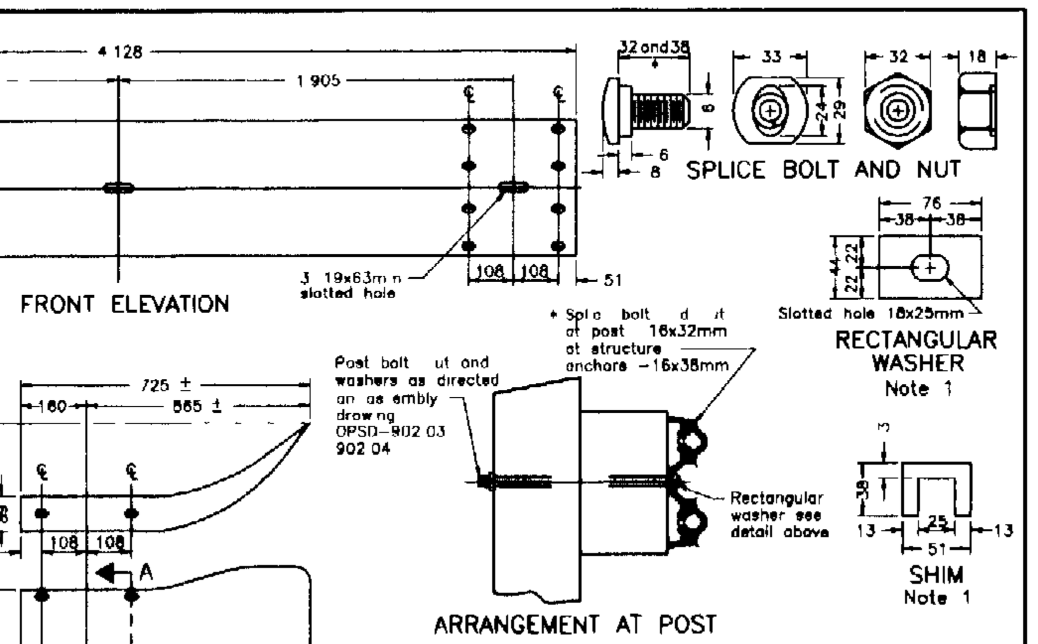
NOTES
~~A For asphalt spillway details refer to OPSD 605 04~~
B All dimensions are in millimetres unless otherwise shown

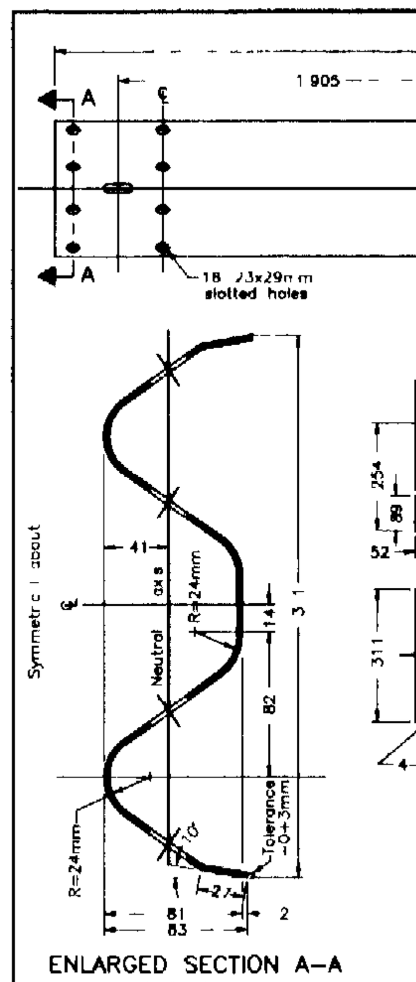
ONTARIO PROVINCIAL STANDARD DRAWING | Date 1991 12 16 | Rev 2
30° AND 45° ASPHALT OUTLET
FOR ASPHALT CURB AND GUTTER
Date ______
OPSD – 605 02 (MOD)



NOTES
A For asphalt spillway details refer to OPSD 605 04
B All dimensions are in millimetres unless otherwise shown

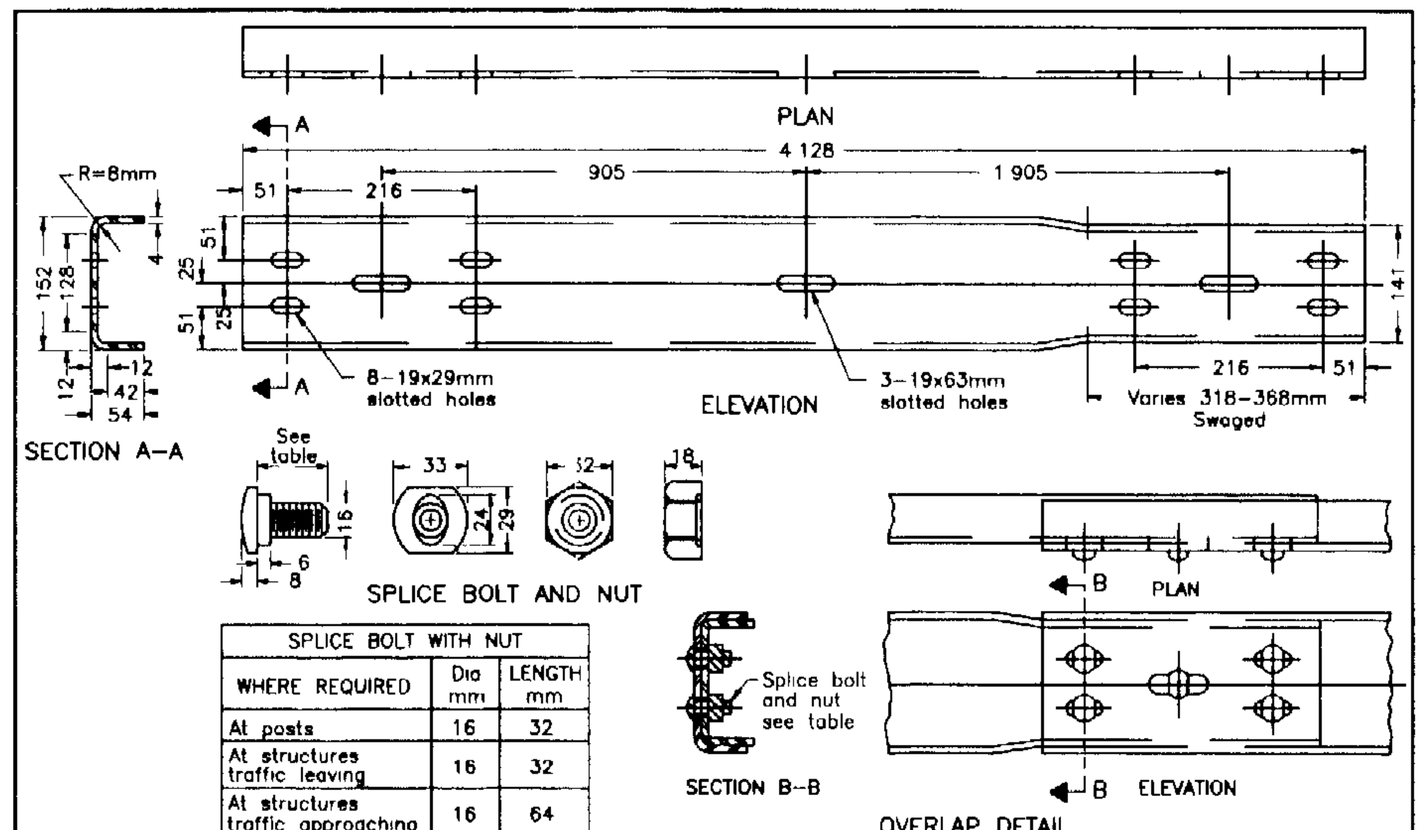
ONTARIO PROVINCIAL STANDARD DRAWING | Date 1991 12 16 | Rev 2
30° AND 45° ASPHALT OUTLET
FOR ASPHALT CURB AND GUTTER
Date ______
OPSD – 605 02





NOTES
1 Thickness of rail to be 2 5mm rectangular washer 4 0mm shim 2mm
A All dimensions subject to manufacturing tolerances unless otherwise indicated
B All dimensions are in millimetres or metres unless otherwise shown

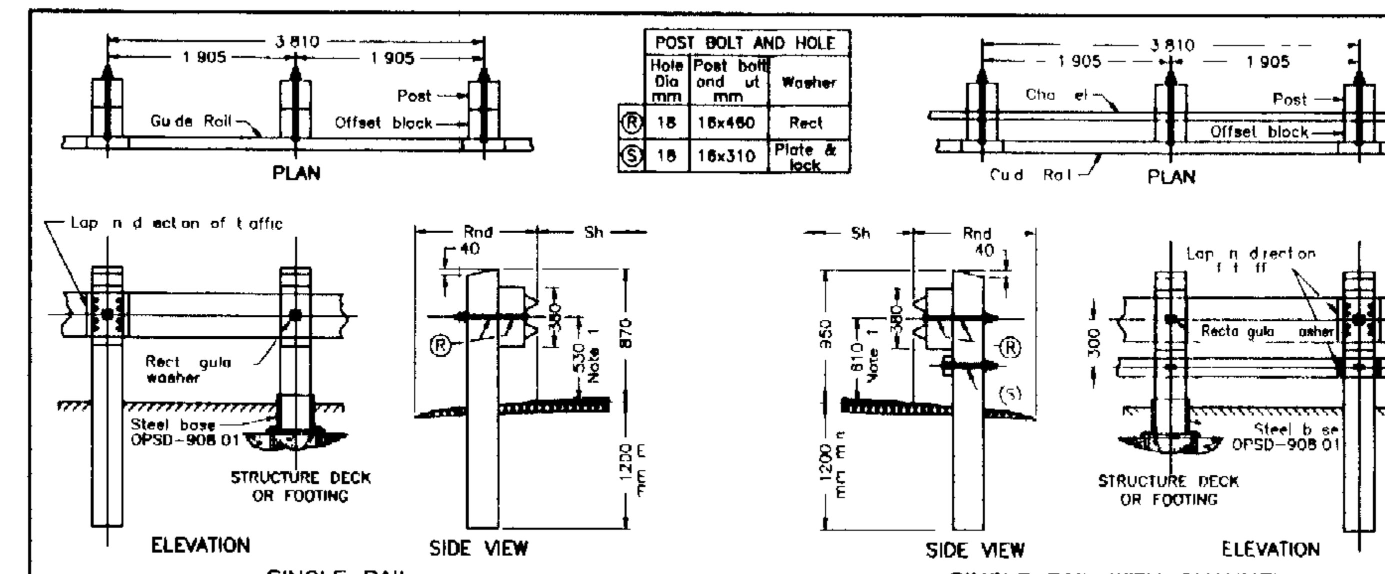
ONTARIO PROVINCIAL STANDARD DRAWING | Date 1986 04 07 | Rev 2
STEEL BEAM GUIDE RAIL
RAIL DETAIL
Date ______
OPSD – 902 01



SPLICE BOLT WITH NUT		
WHERE REQUIRED	Dia mm	LENGTH mm
At posts	16	32
At structures traffic leaving	16	32
At structures traffic approaching	16	64

NOTES
A All dimensions are in millimetres or metres unless otherwise shown

ONTARIO PROVINCIAL STANDARD DRAWING | Date 1986 04 07 | Rev 2
STEEL BEAM GUIDE RAIL
COLD ROLLED CHANNEL DETAIL
Date ______
OPSD – 902 02



NOTES
1 Where guide rail is adjacent to curb mounting height shall be measured
 a Vertically at face of guide rail when face of guide rail is more than 300mm beyond gutter line
 b Vertically at gutter line when face of guide rail is 300mm or less beyond gutter line
A Wooden posts and offset blocks
Size 200x200mm nominal 190x190mm ± 1 5mm dressed tops to have 25mm chamfer
B Wooden posts to be set by instrument for alignment and grade with tops parallel to pavement grade
C To produce an even alignment shim beam element where necessary
D This standard to be read in conjunction with OPSD–902 01 and 902 02
E All dimensions are in millimetres or metres unless otherwise shown

ONTARIO PROVINCIAL STANDARD DRAWING | Date 1990 11 15 | Rev 3
STEEL BEAM GUIDE RAIL
ASSEMBLY DETAIL
SINGLE RAIL WITH OR WITHOUT CHANNEL
Date ______
OPSD – 902 03

APPROVALS					
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66 97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON-ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
1	JAN 98	AS CONSTRUCTED	DMG	DLB

SEAL

5002–S–10

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

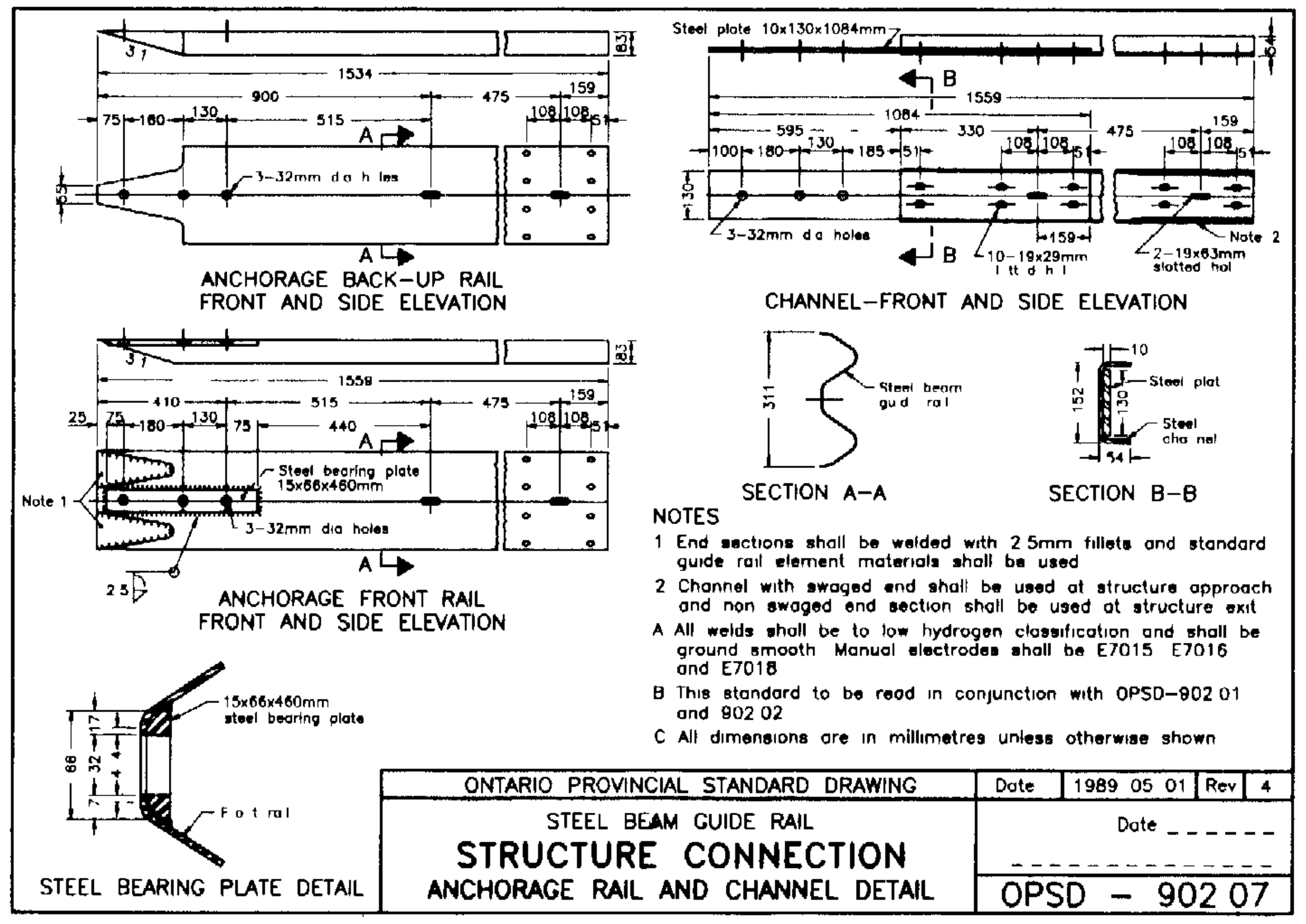
totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

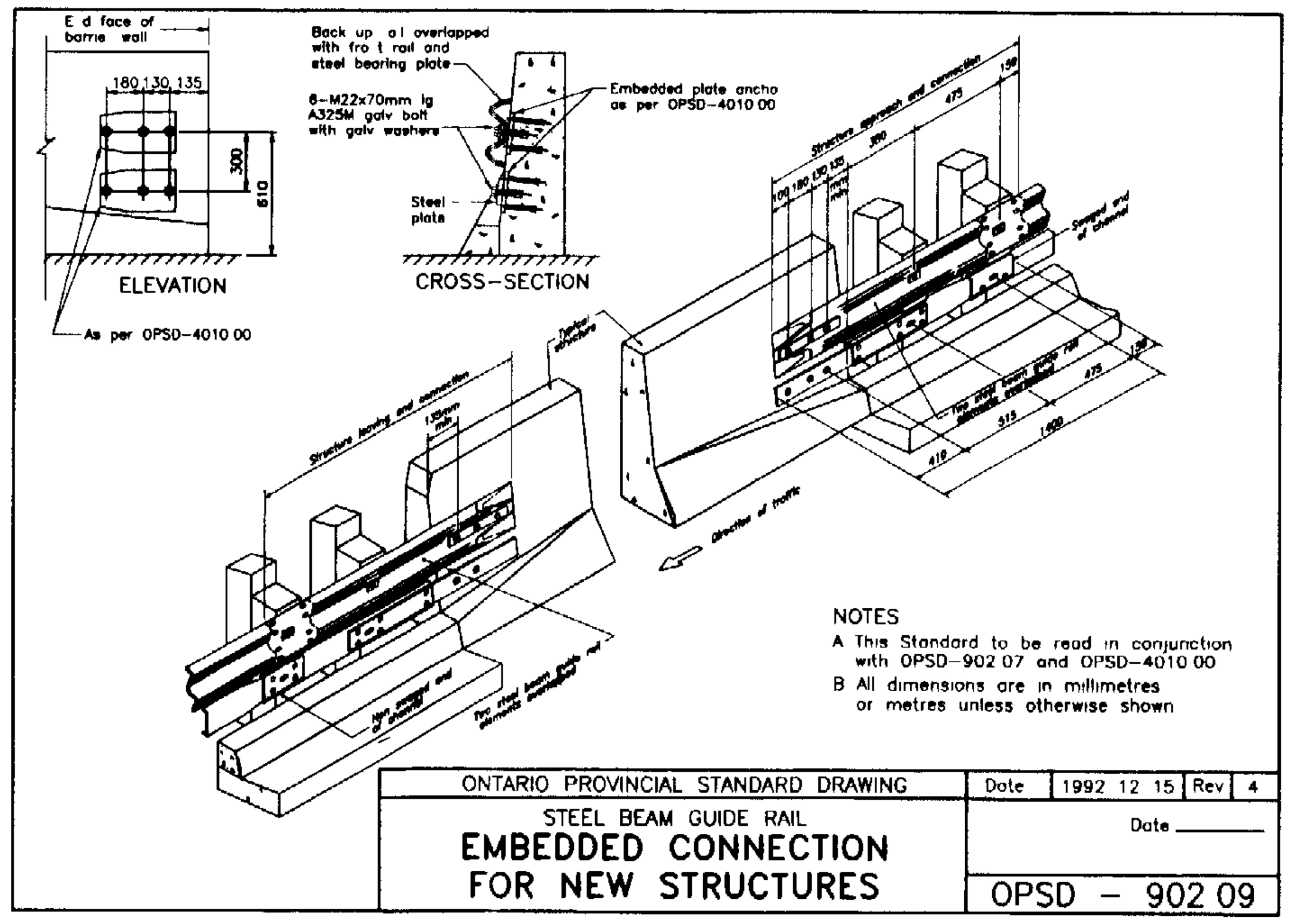
STRUCTURAL REHABILITATION OF THE
MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

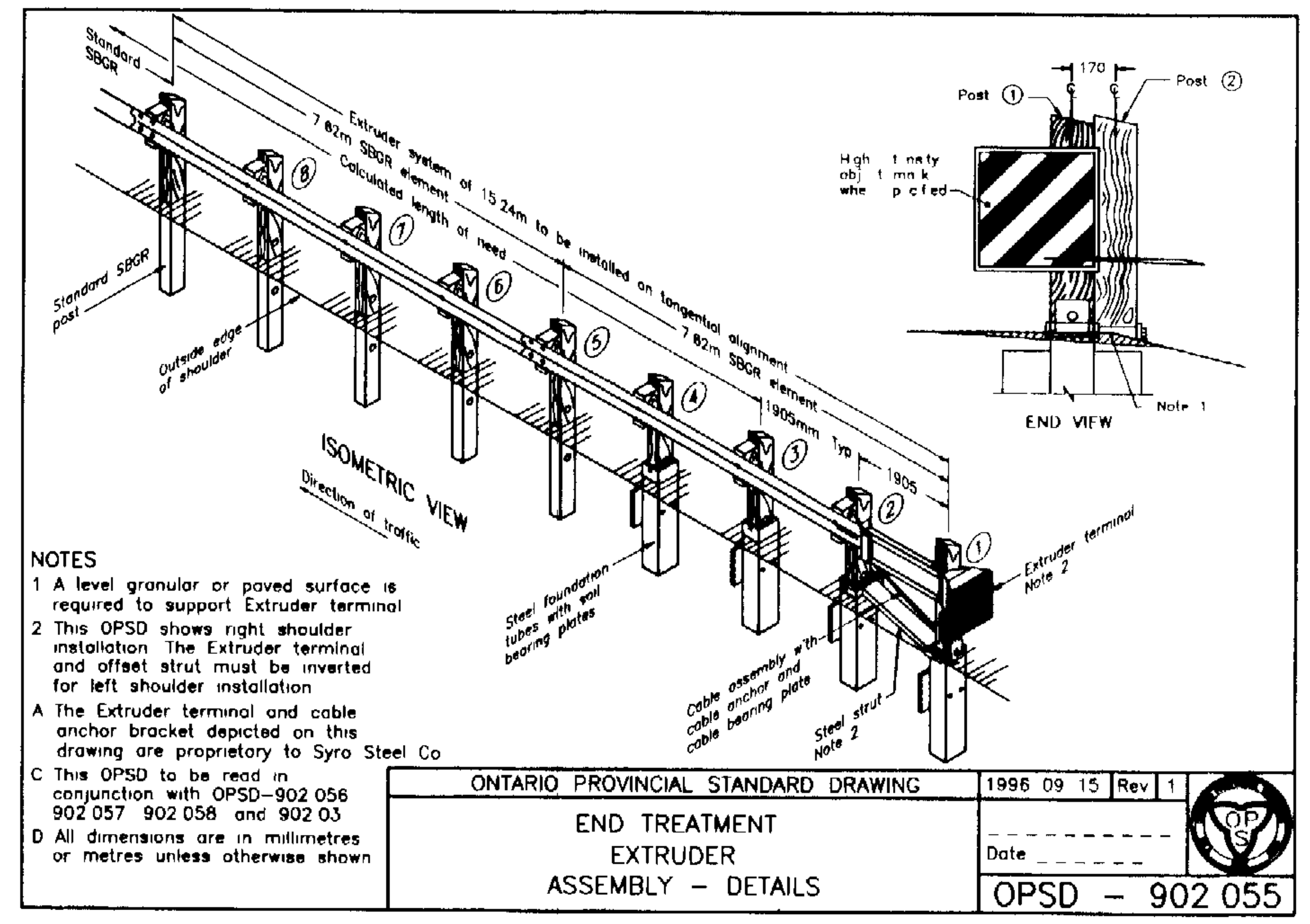
STANDARDS - I

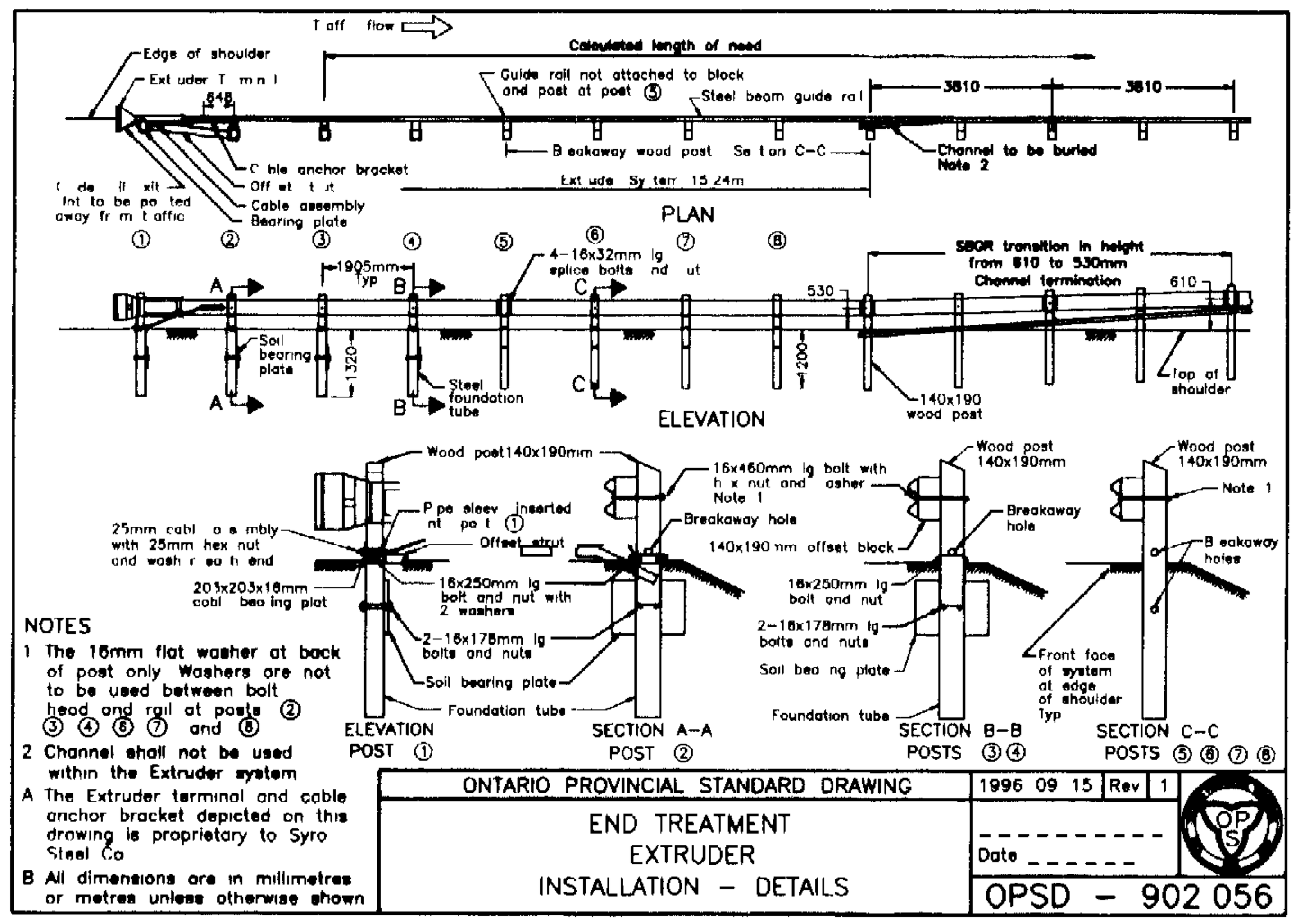
DESIGN	ADAPTED	DRAWN	DMG	CHECKED	DLB	PROJECT	42 18696 03
SCALES	NTS	ACAD FILE NAME	MAX STDI	DRAWING NUMBER	7		
DATE	MAY 1997						

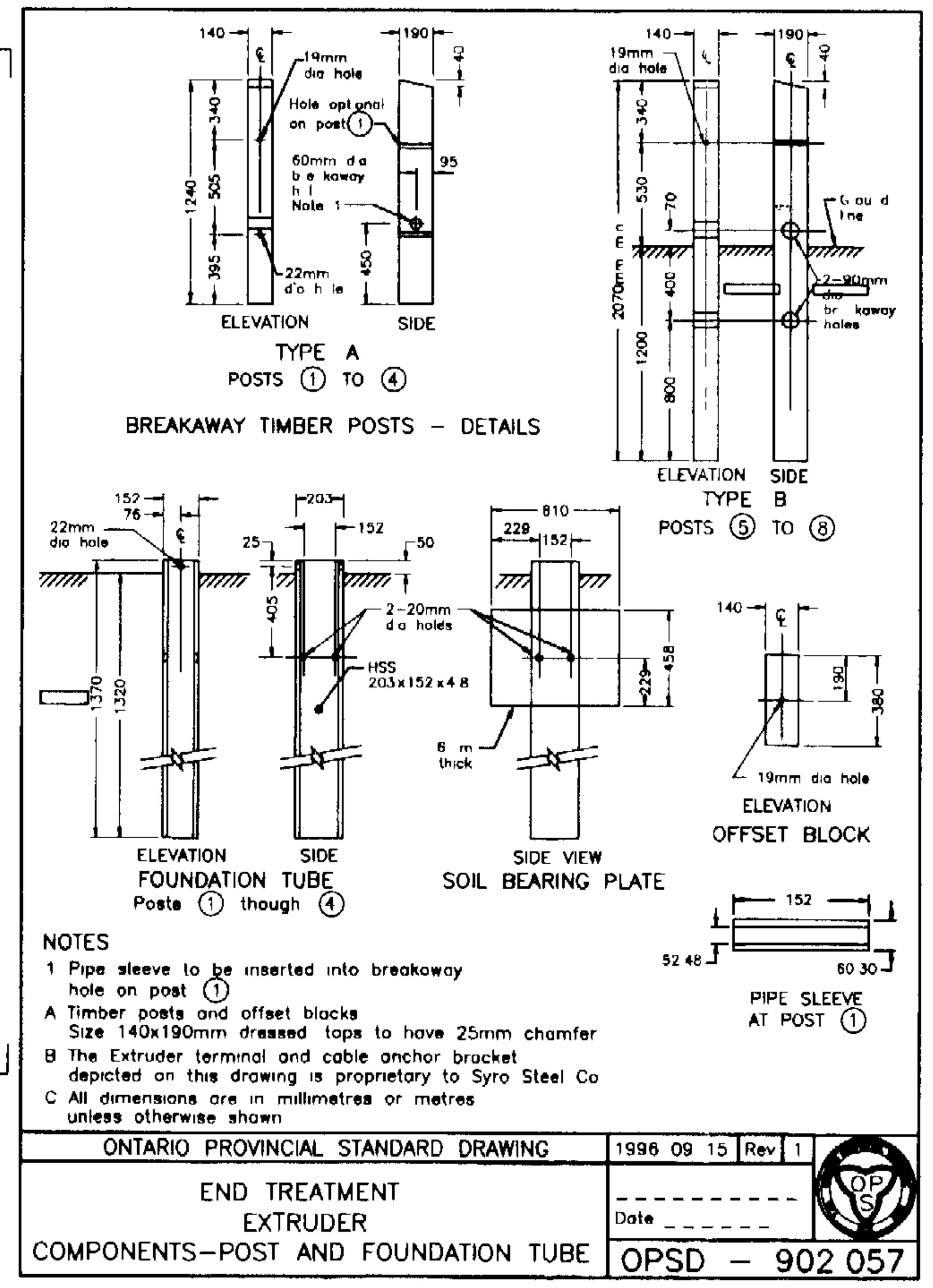
2363K

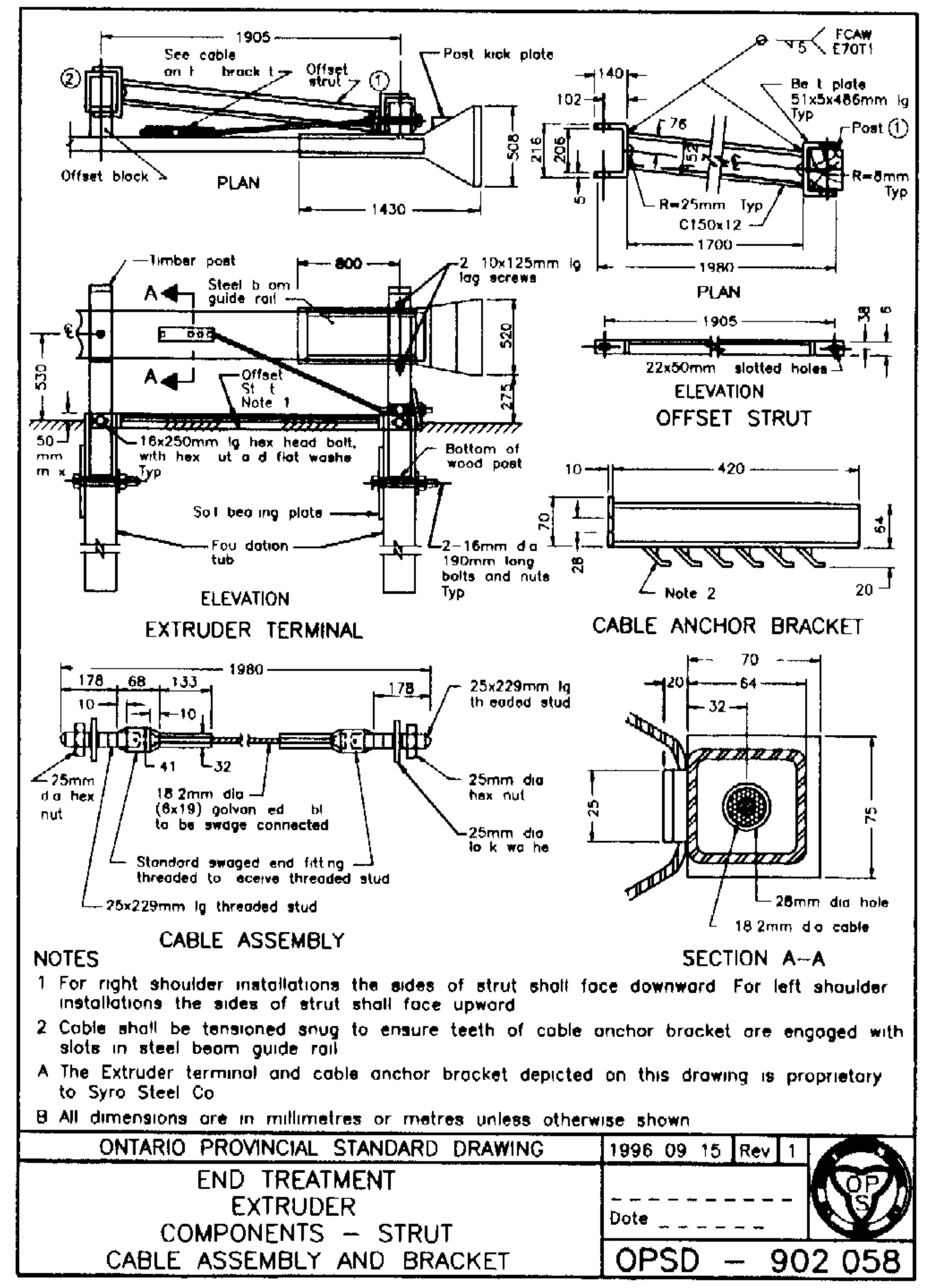


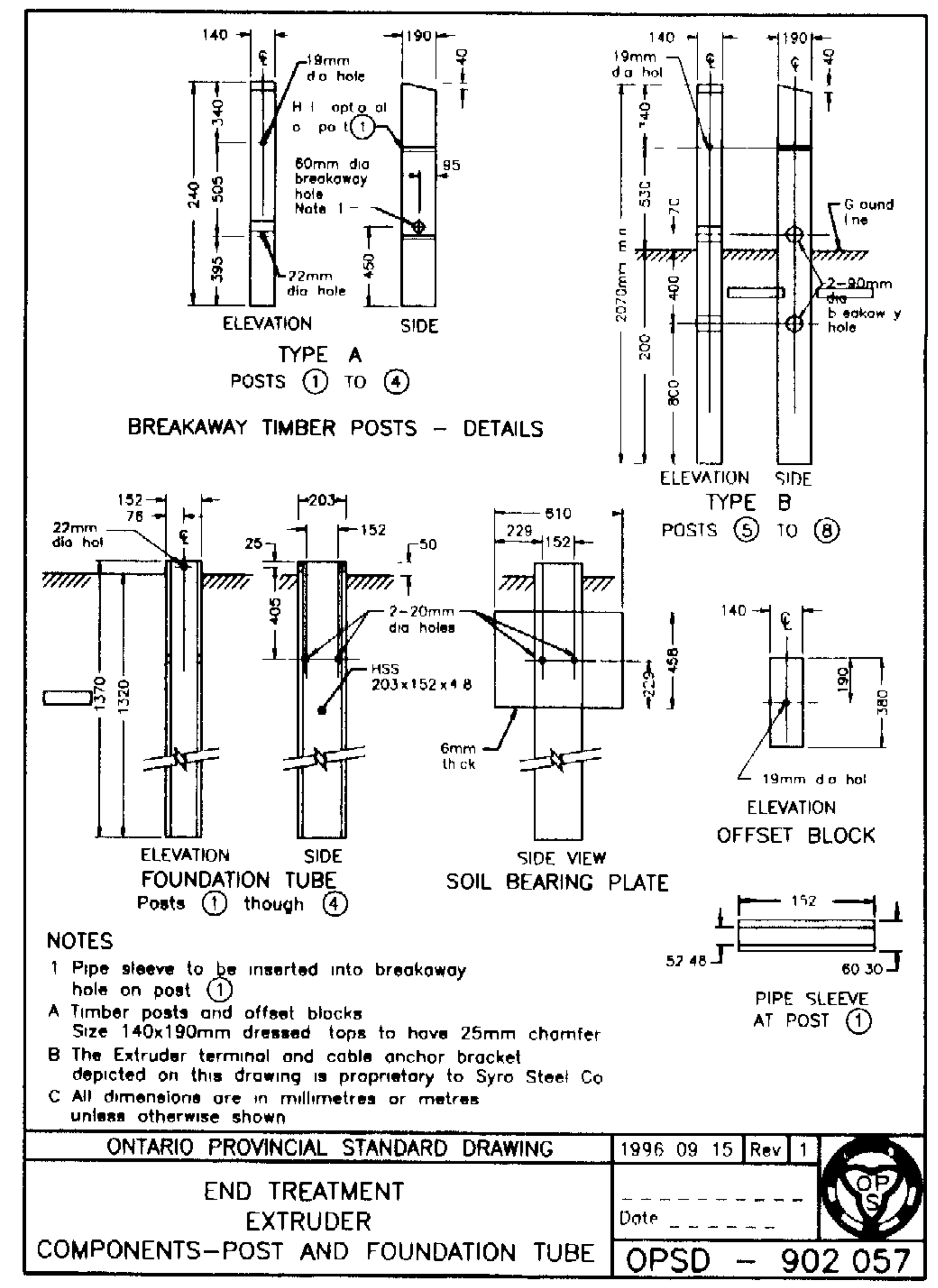












APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66-97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
1	JAN 98	AS CONSTRUCTED	DMG	DLB

C T SPRINGER
PROVINCE OF ONTARIO

D L BAXTER
PROVINCE OF ONTARIO
SEAL

5002-S-11

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

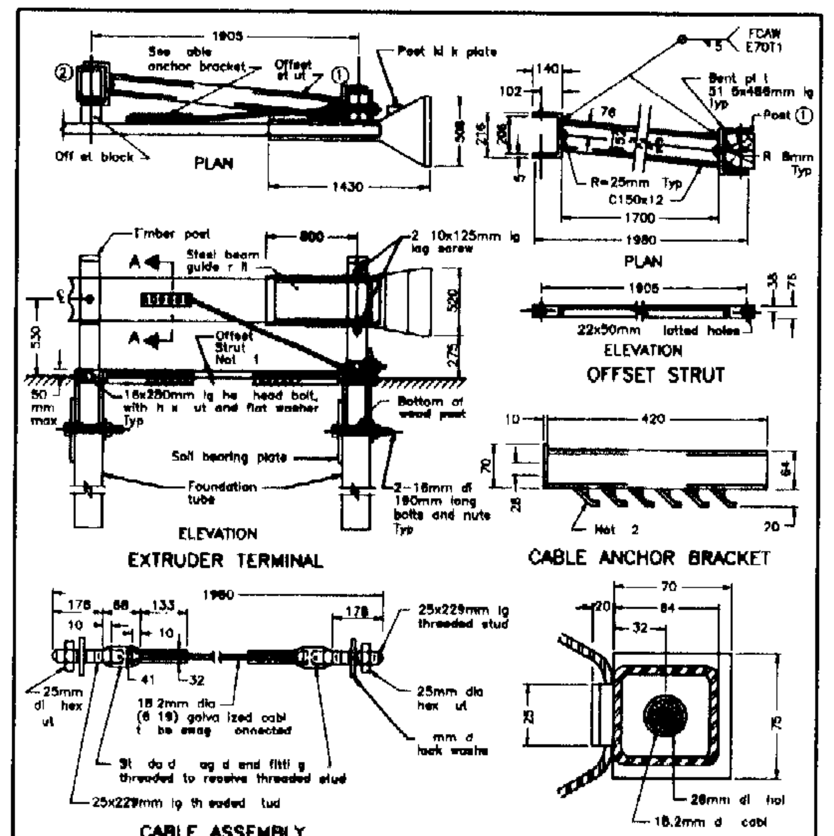
totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

STRUCTURAL REHABILITATION OF THE
MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

STANDARDS - 2

DESIGN	ADAPTED	DRAWN	DMG	CHECKED	DLB	PROJECT	42 18696 03
SCALES	NTS	ACAD FILE NAME	MAX-STD2	DRAWING NUMBER	8		
DATE	MAY 1997						

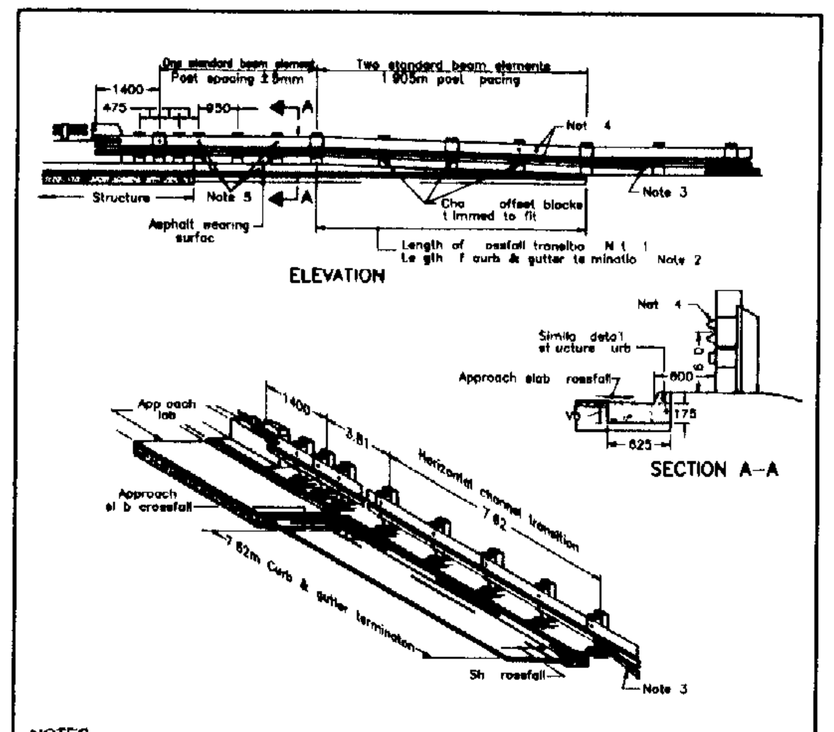
2816



ONTARIO PROVINCIAL STANDARD DRAWING | 1996 09 15 | Rev 1

END TREATMENT
EXTRUDER
COMPONENTS – STRUT
CABLE ASSEMBLY AND BRACKET

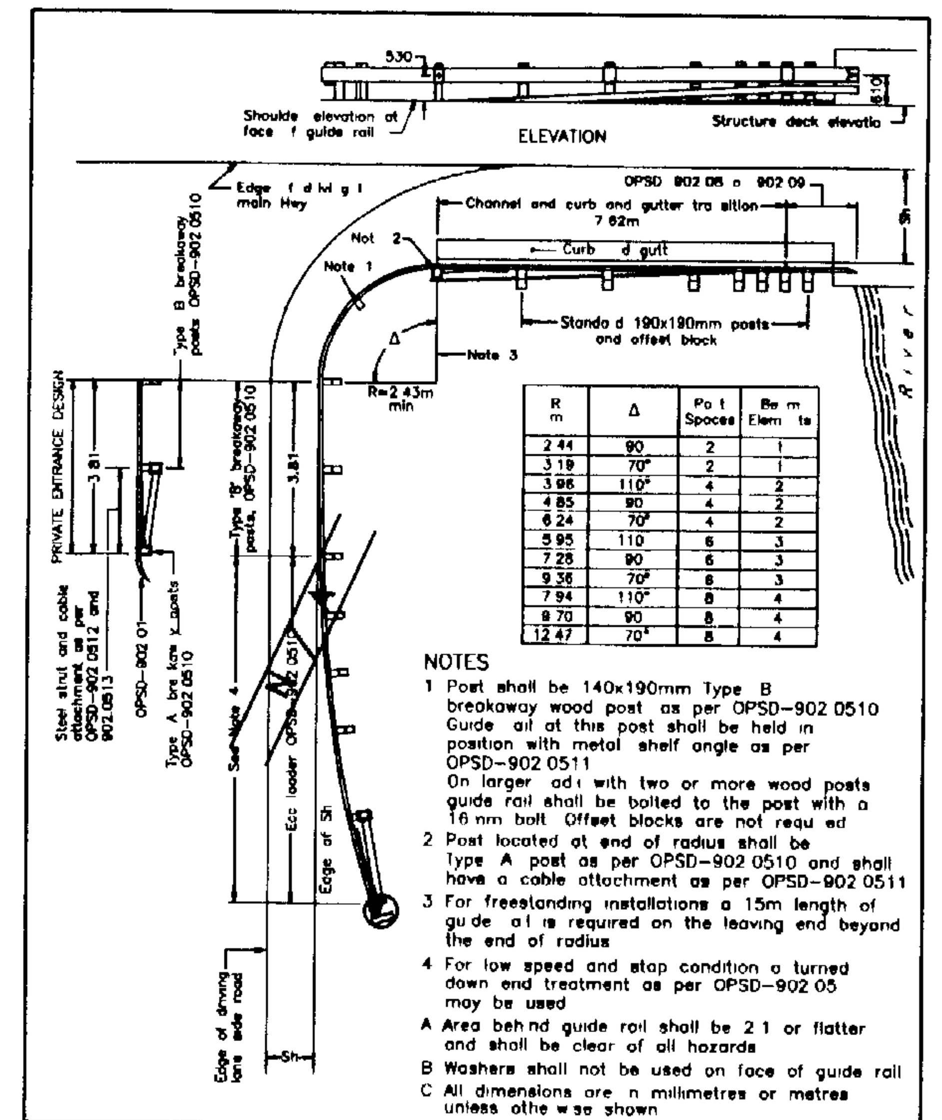
OPSD – 902 058



ONTARIO PROVINCIAL STANDARD DRAWING | 1986 10 03 | Rev 4

STEEL BEAM GUIDE RAIL
STRUCTURE CONNECTION
PARAPET WALL
CURB AND GUTTER TERMINATED

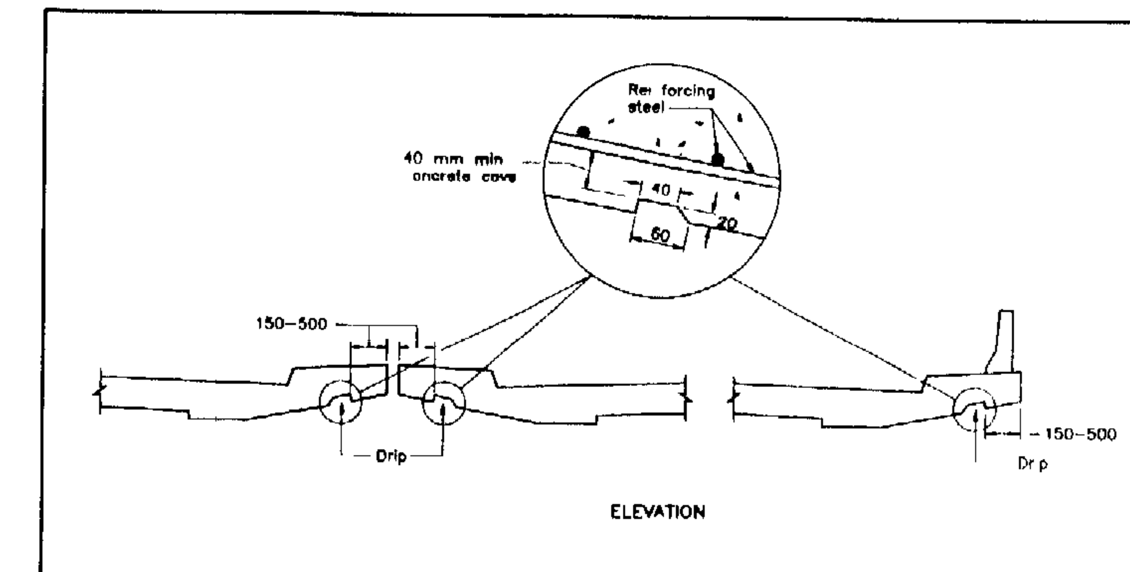
OPSD – 904 01



ONTARIO PROVINCIAL STANDARD DRAWING | 1993 09 07 | Rev

STEEL BEAM GUIDE RAIL
TREATMENT AT ENTRANCES
AND INTERSECTING ROADWAYS

OPSD – 909 020 (MOD)

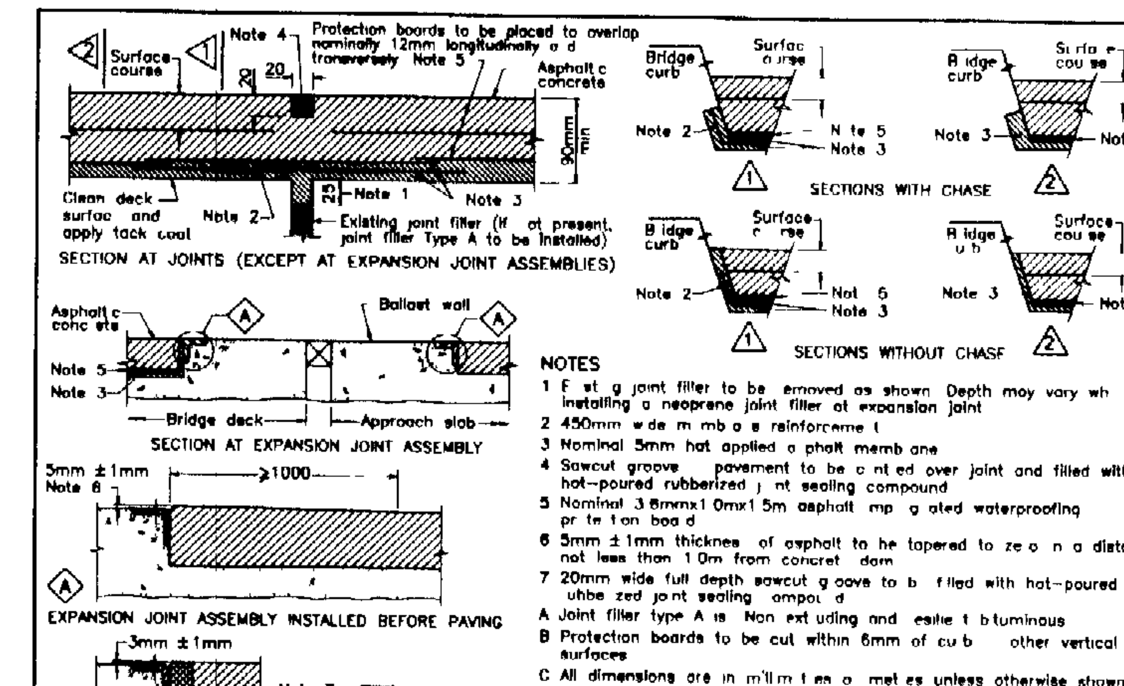


NOTES
A Drip detail applies to all types of concrete deck slabs.
B All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | 1991 07 15 | Rev

DRIP DETAIL

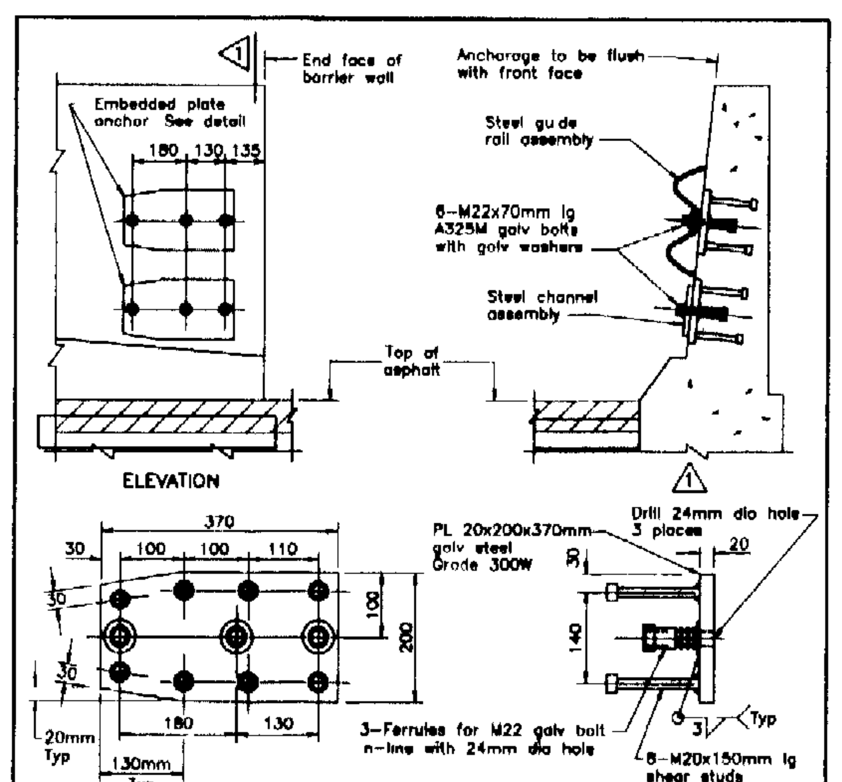
OPSD – 3904 04



ONTARIO PROVINCIAL STANDARD DRAWING | 1992 12 15 | Rev

BRIDGE DECK
WATERPROOFING
HOT APPLIED ASPHALT MEMBRANE
WITH ASPHALT IMPREGNATED PROTECTION BOARD

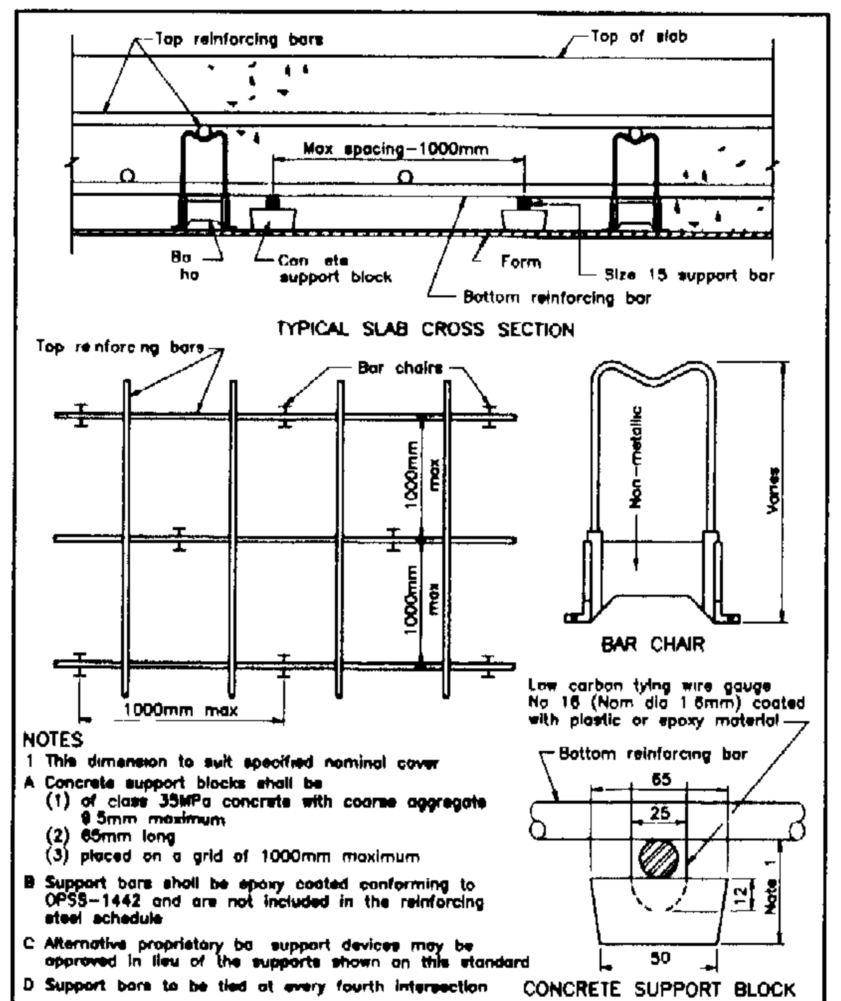
OPSD – 3906 02



ONTARIO PROVINCIAL STANDARD DRAWING | 1992 12 15 | Rev

GUIDE RAIL AND
CHANNEL ANCHORAGE

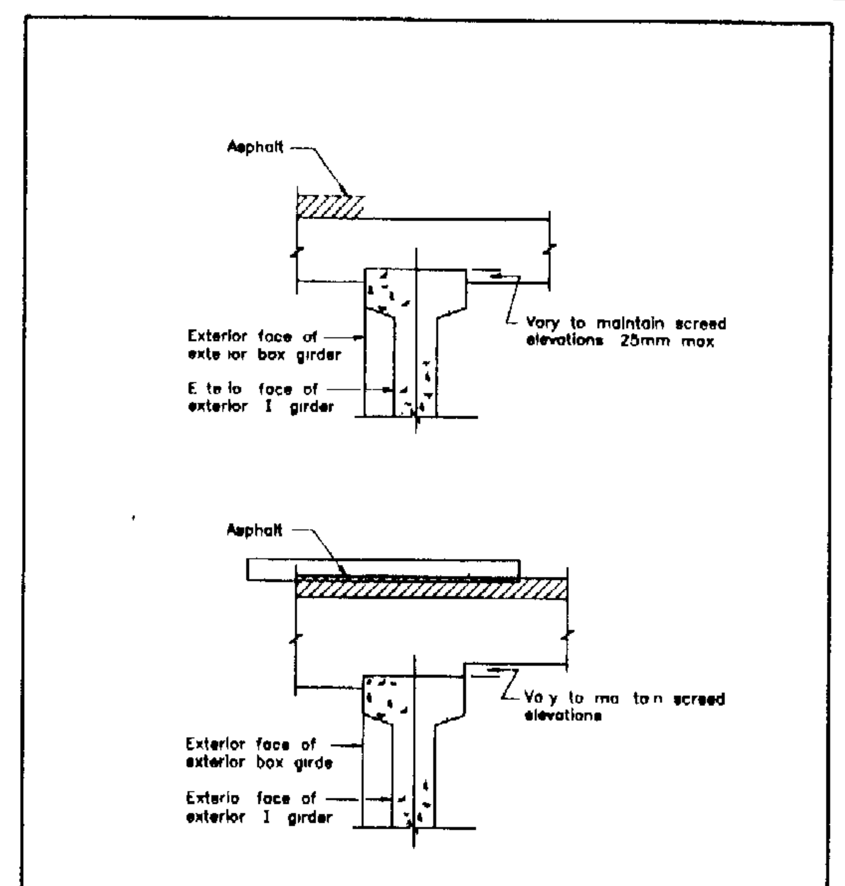
OPSD – 4010 00



ONTARIO PROVINCIAL STANDARD DRAWING | 1991 07 15 | Rev

SUPPORTS FOR
REINFORCING STEEL
FOR SLAB DEPTH 300 mm OR LESS

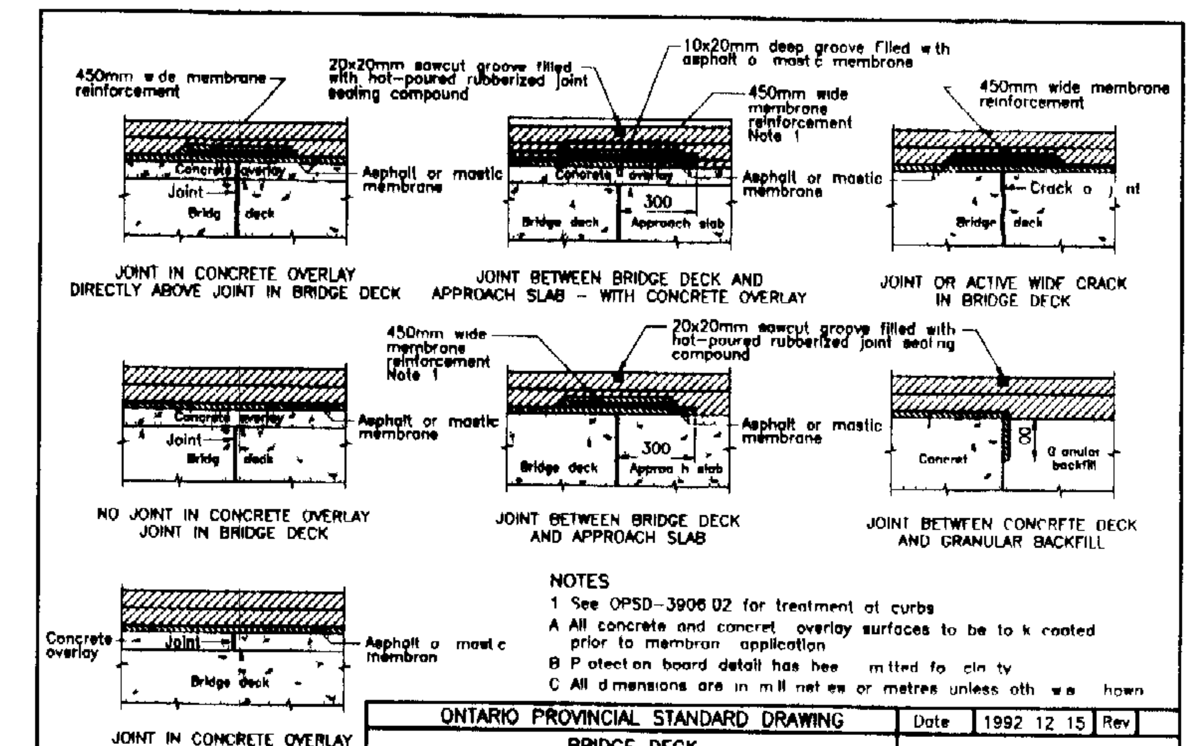
OPSD – 3923 00



ONTARIO PROVINCIAL STANDARD DRAWING | 1991 07 15 | Rev

METHOD OF OBTAINING SCREED
ELEVATIONS
FOR PRECAST CONCRETE GIRDERS

OPSD – 3931 00



ONTARIO PROVINCIAL STANDARD DRAWING | 1992 12 15 | Rev

BRIDGE DECK
WATERPROOFING DETAILS
AT ACTIVE WIDE CRACKS (GREATER THAN 2 mm)
AND CONSTRUCTION JOINTS

OPSD – 3906 03

5002-S-12

APPROVALS				
SOURCE NAME	DATE SENT	DATE RECEIVED	APPROVAL TYPE	APPROVAL NUMBER
MTRCA	APR 25/97	JUNE 18/97	PERMIT	078/97/SCAR
MNR	APR 25/97	JULY 29/97	PERMIT	YS 66-97/98

AS CONSTRUCTED	
CONTRACT TYPE	BRIDGE REHAB
FILE NO	8354
CONTRACT NO	8534
CONTRACTOR	McPHERSON ANDREWS CONTRACTING LTD
STARTED	JULY 14 1997
COMPLETED	MAY 29 1998
LAYOUT BY	N/A
PROJ ENG	B WOLF
INSPECTOR	R GUPTA BHAYA
FINAL SURVEY BY	N/A
FINALIZED BY	CONSULTANT
DATE	JUNE 1998
REVIEWED BY	B WOLF
DATE	JUNE 1998
CONSULTANT	TOTTEN SIMS HUBICKI ASSOC

NO	DATE	REVISIONS	BY	CHECKED
1	JAN 98	AS CONSTRUCTED	DMG	DLB

LICENSED PROFESSIONAL ENGINEER C T SPRINGER PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER D L BAXTER PROVINCE OF ONTARIO

SEAL

CITY OF SCARBOROUGH
WORKS AND ENVIRONMENT DEPARTMENT

totten sims hubicki associates
ENGINEERS ARCHITECTS AND PLANNERS

STRUCTURAL REHABILITATION OF THE
MAXWELL'S BRIDGE
ON TWYN RIVERS DRIVE
CITY OF SCARBOROUGH
LITTLE ROUGE RIVER

STANDARDS - 3

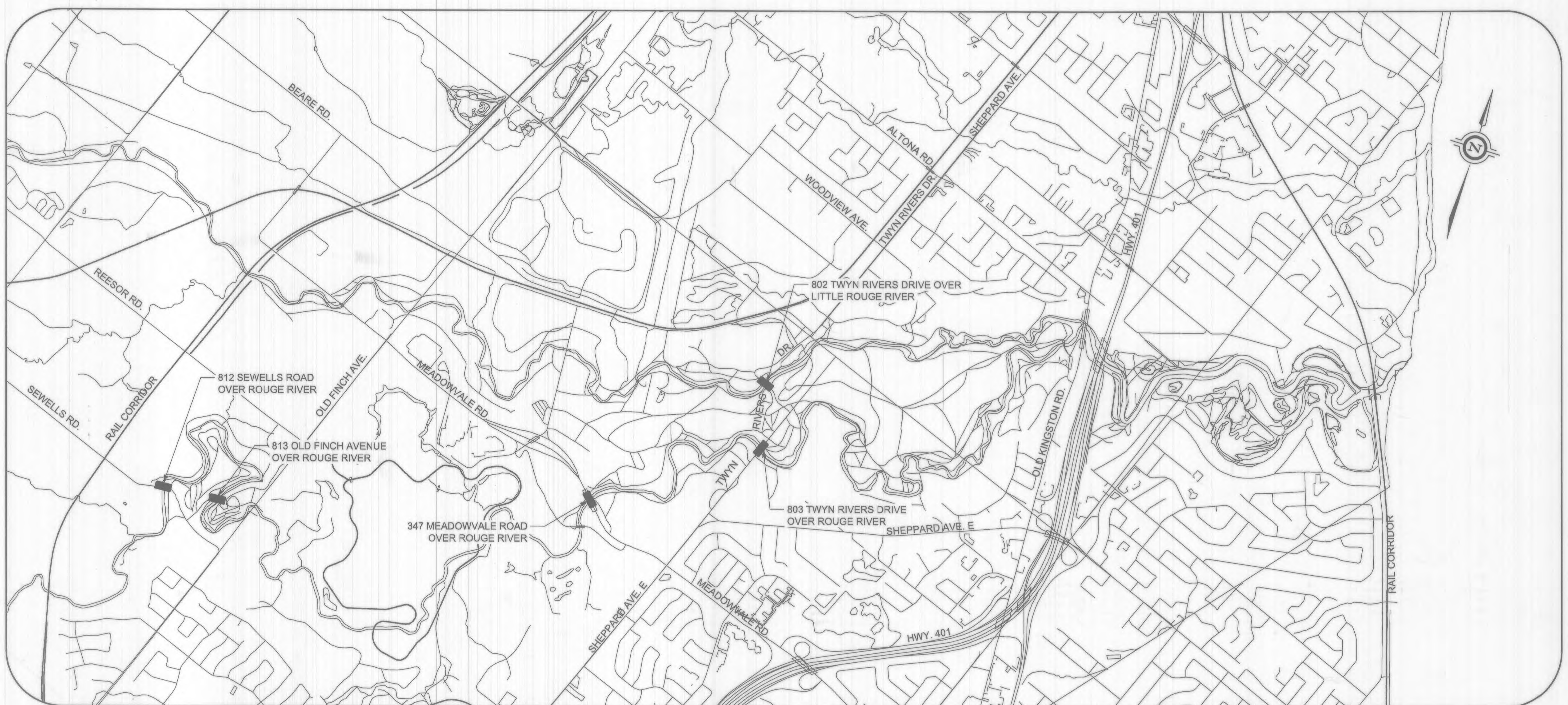
DESIGN	ADAPTED	DRAWN	DMG	CHECKED	DLB	PROJECT	42-18696 03
SCALES	NTS			ACAD FILE NAME	MAX STD3	DRAWING NUMBER	9
DATE	MAY 1997						

23634


332,400 E
332,450 E
332,350 E
332,400 E
4,852,400 N
4,852,550 N
4,852,500 N
4,852,450 N
N
STREET LINE
EDGE OF ROAD
GUARD RAIL
SECTION
C.C IN FIELD STONE
SIB
IB
HYDRO POLE
GUY WIRE
SEC. 14 m E.
SEC. 9 m E.
SECTION 4 m E.
SEC. 4 m W.
SEC. 9 m W.
SEC. 14 m W
EDGE OF RIVER
EDGE ABUTMENT
REINFORCED CONCRETE BRIDGE
CONC. ARCHES
0+00
0+15 m N.
0+30 m N.
0+45 m N.
0+60 m N.
0+75 m N.
0+15 m S
0+30 m S.
0+45 m S
0+60 m S
0+75 m S
20" PINE
20" CEDAR
12" CEDAR
16" CEDAR
4-10" CEDARS
6" MAPLE
2" MAPLE
4" ELM
8" ELM
16" APPLE TREE
10" MAPLE TREE
8" HEMLOCK
2" BEECH
6" BIRCH
12" BIRCH
14" ASH
WILLOWS
SCALE = 1:200
95.00 m
94.00
93.00
92.00
91.00
90.00 m
89.00
88.00
87.00
86.00
85.00 m
V. SCALE = 1:50
SCALE = 1:50
M.T.R.C.A. REGIONAL STORM FLOOD LINE
℄ OF ROAD
REINF. CONC. BRIDGE
BRIDGE ABUTMENTS 16.8 m
℄ RIVER
0+75 N − 88.342
0+60 N 88.255
0+45 N − 88.438
0+30 N 88.678
0+15 N − 89.118
0+00 89.103
0+15 S − 89.324
0+30 S 89.840
0+45 S − 90.666
0+60 S 92.007
0+75 S − 93.917
H. SCALE = 1:200
07004 V01
[redacted]
TWIN RIVERS DR
MAXWELL'S BRIDGE
(MOST EASTERLY BRIDGE)
EXISTING CONDITIONS
MARCH 1990
DRN. BY: J.S.
DRG. Nº 2363
S-5002-13

TORONTO

Engineering and Construction Services



SCALE 1 : 2000

LIST OF DRAWINGS

347 Meadowvale Road Over Rouge River

802 Twyn Rivers Drive Over Little Rouge River

802-S5002-14	Cover Sheet
802-S5002-15	General Arrangement
802-S5002-16	Details

803 Twyn Rivers Drive Over Rouge River

803-S5003-11	General Arrangement
803-S5003-12	Details
803-S5003-13	Details

812 Sewells Road Over Rouge River

812-S5012-7	General Arrangement
812-S5012-8	Details

813 Old Finch Avenue Over Rouge River

813-S5013-5	General Arrangement
813-S5013-6	Details
813-S5013-7	Access Road and Tree Removal Plan
813-S5013-8	Tree Reinstatement Plan

REVISED DRAWINGS -

-

-

MULTIPLE BRIDGE REPAIRS

SOUTH EAST SCARBOROUGH

CONTRACT No. 12SE-10S

TONY PAGNANELLI, P. ENG. - (ACTING) EXECUTIVE DIRECTOR, ENGINEERING AND CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG. - (ACTING) DIRECTOR, CAPITAL WORKS DELIVERY

ISSUED FOR TENDER

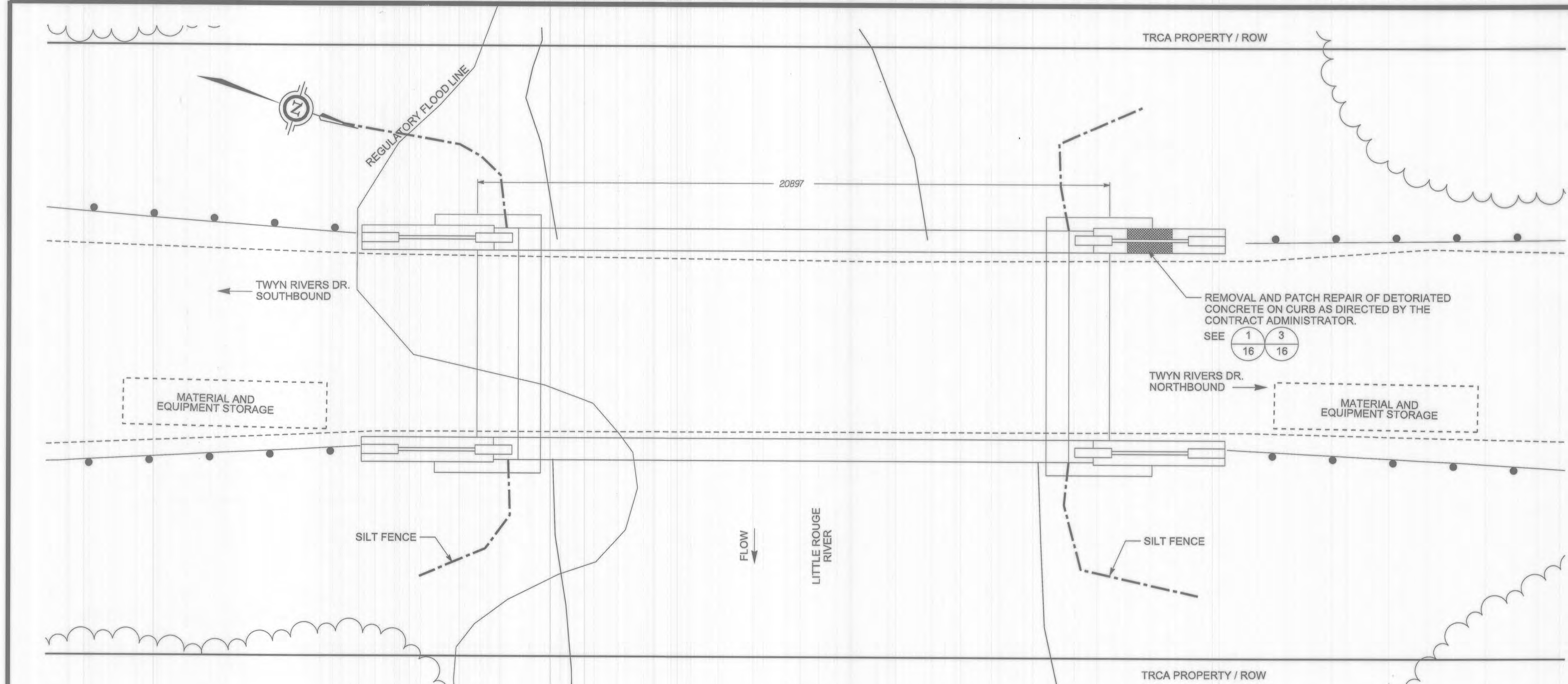
DATE: JULY 3, 2013

DRAWING NUMBER: 802-S5002-14

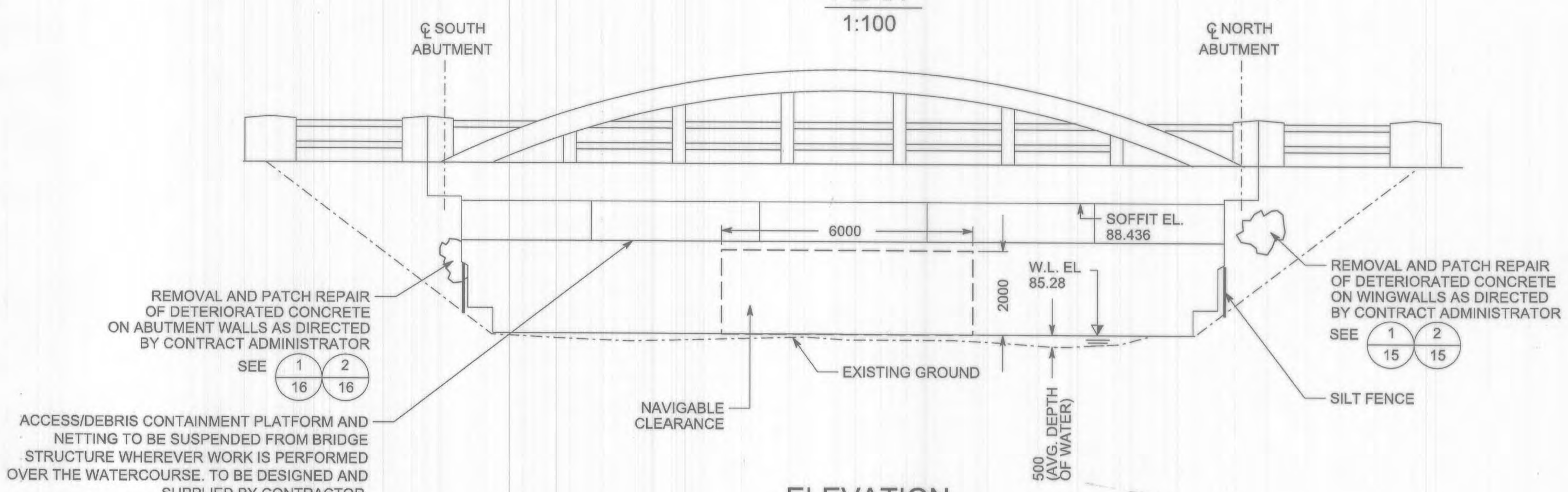
REVISED:

CONTRACT No. 12SE-10S ISSUED FOR TENDER

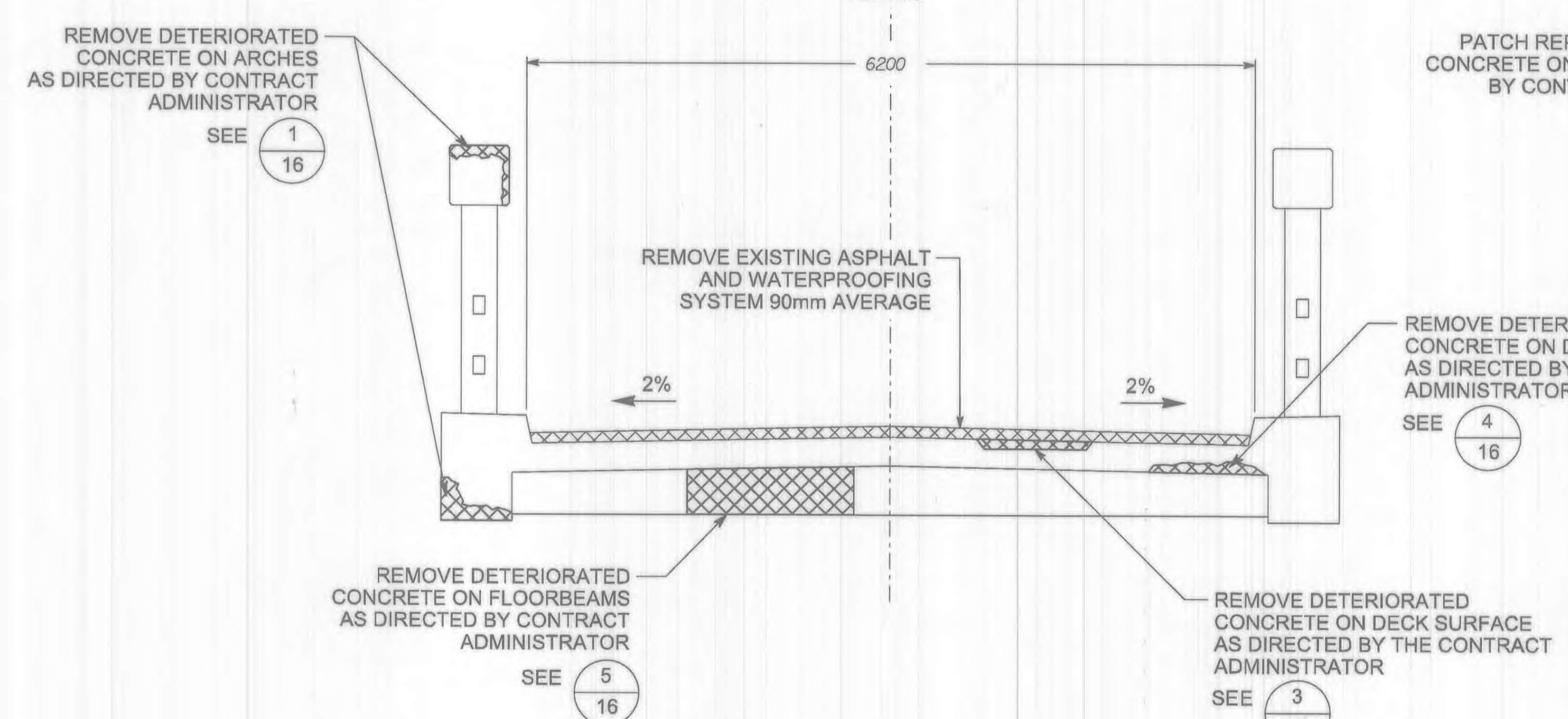
Mo.Day.Yr $$FILE$$



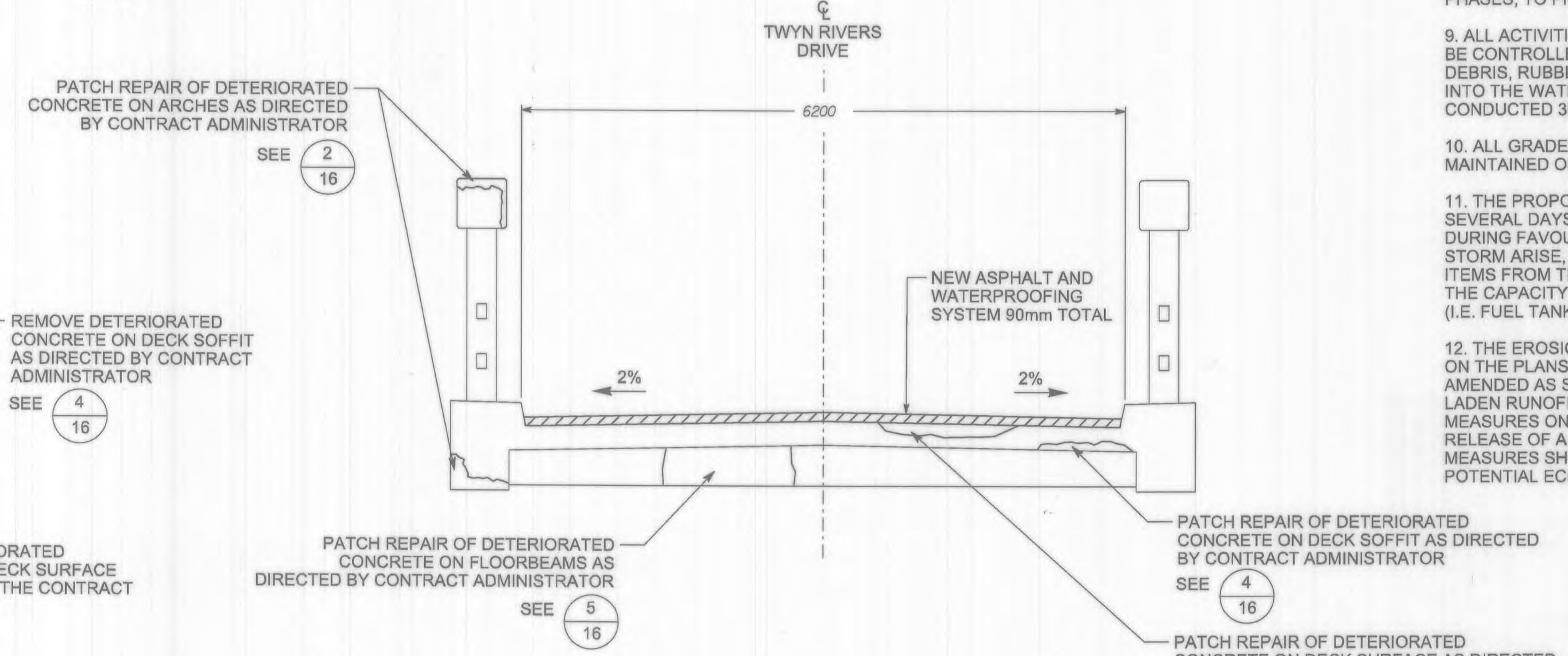
PLAN
1:100



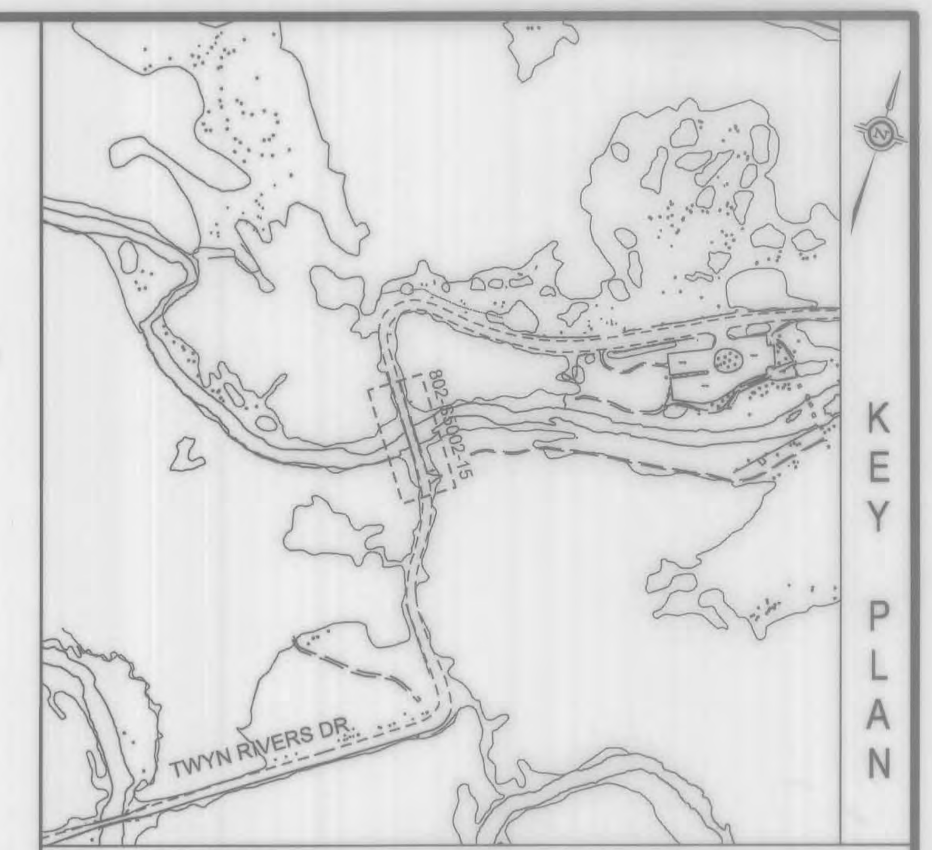
ELEVATION
1:100



EXISTING SECTION
1:50



REHAB SECTION
1:50



RELATED DRAWINGS: NOT TO SCALE

GENERAL NOTES:

DESIGN CODE

1. THE STRUCTURE REHABILITATION IS DESIGNED IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN/CSA-S6-06 (CHBDC).

2. ALL WORK SHALL CONFORM TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS.

3. ASSOCIATED ENGINEERING LTD. DOES NOT ASSUME ANY RESPONSIBILITY FOR LOSSES, DAMAGES, OR COSTS ARISING FROM THE USE OR REUSE OF THESE DRAWINGS BY PERSONS, FIRMS, OR CORPORATIONS WITHOUT PRIOR WRITTEN CONSENT.

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.

2. UNLESS OTHERWISE SHOWN, SAWCUT AT THE LIMITS OF CONCRETE REMOVALS SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.

3. DRAWINGS ARE NOT TO BE SCALED.

4. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.

5. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE CITY.

6. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM REMOVAL WORK FALL ON RIVER AND OTHER AREAS BELOW THE BRIDGE.

7. ALL IN-WATER AND NEAR WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS IN ACCORDANCE WITH THE TRCA EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION (2006).

8. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING, THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.

9. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED 30 METRES FROM THE WATER.

10. ALL GRADES WITHIN THE REGIONAL STORM FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.

11. THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE PROPONENT/ CONTRACTOR SHALL REMOVE ALL ITEMS FROM THE REGIONALSTORM FLOOD PLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (I.E. FUEL TANKS, UNFIXED EQUIPMENT, ETC.).

12. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/ AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, THEN ALTERNATIVE MEASURES SHOULD BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS.

GENERAL NOTES CONT'D:

13. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, NURSERY AND MIGRATORY PERIODS, IN- AND NEAR-WATER ACTIVITIES MAY ONLY OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 TO MARCH 31.

14. TO AVOID INTERFERENCE WITH THE EGGS, NESTS OR YOUNG OF BIRDS PROTECTED UNDER THE FEDERAL MIGRATORY BIRDS CONVENTION ACT, REMOVALS SHOULD NOT OCCUR FROM MAY 1 TO AUGUST 1 OF ANY GIVEN YEAR. IDEALLY, REMOVALS SHOULD OCCUR FROM AUGUST THROUGH DECEMBER TO AVOID INTERFERENCE WITH ALL NESTING BIRDS. SHOULD REMOVALS BE REQUIRED WITHIN THE MAY 1 TO AUGUST 1 BREEDING PERIOD, A QUALIFIED AVIAN BIOLOGIST SHOULD CONDUCT A THOROUGH SURVEY IMMEDIATELY PRIOR TO THE DESIRED TREE REMOVAL DATE TO CONFIRM PRESENCE OR ABSENCE OF PROTECTED SPECIES. IF PROTECTED SPECIES ARE PRESENT, REMOVALS CANNOT OCCUR WITHOUT A PERMIT FROM THE CANADIAN WILDLIFE SERVICE.

17. IF ANY DEBRIS IS TO BYPASS THE CONTAINMENT AREA AND ENTER THE WATERCOURSE, THE CONTRACTOR SHALL COLLECT IT BY HAND.

18. SITE RESTORATION OF ALL DISTURBED AREA SHALL BE IN ACCORDANCE WITH TRCA POST-CONSTRUCTION RESTORATION GUIDELINES (2004).

19. VEHICULAR ACCESS BELOW THE BRIDGE STRUCTURE WILL NOT BE PERMITTED.

20. NO VEGETATION IS TO BE REMOVED.

APPLICABLE STANDARD DRAWINGS

OPSD 3370.100 DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD DETAILS
OPSD 3370.101 DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS
OPSD 3950.100 JOINTS CONCRETE EXPANSION AND CONSTRUCTION ON STRUCTURE

SCOPE OF REHABILITATION WORK

THE GENERAL SCOPE OF THE BRIDGE REPAIR WORK OF THE CONTRACT SHALL INCLUDE THE FOLLOWING:

1. REMOVE EXISTING ASPHALT AND WATERPROOFING FROM DECK AND DECK SOFFIT.

2. REMOVE DELAMINATED AND DETERIORATED CONCRETE FROM DECK TOP, DECK SOFFIT, FLOOR BEAMS, ABUTMENTS, WINGWALLS, CURBS, ARCHES, AND PATCH REPAIR AREAS WHERE CONCRETE WAS REMOVED AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

3. WATERPROOF AND PAVE THE DECK SLABS.

CLASS OF CONCRETE

MINUMUM STRENGTH	AT 7 DAYS 25 MPa AT 28 DAYS 35 MPa	
CLEAR COVER TO REINFORCING STEEL	ABUTMENTS, WINGWALLS	70±20
	DECK SOFFIT	50±10
	FLOOR BEAMS	70±20
	CURB	70±20
	ARCHES	70±10

CONSULTANTS

Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13116pd.dgn, y13116pf.dgn, y13116det.dgn
UTILITY	y13116ugs.dgn
MAPPING	y13116top.dgn, y13116top_2.dgn
STREETLINE	y13116psl.dgn

DIGITAL INFORMATION

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A. M. LAWS 100183187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 July 3/13 PROVINCE OF ONTARIO

TONY PAGNANELLI, P.ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

802 TWYN RIVERS DR. OVER LITTLE ROUGE RIVER

GENERAL ARRANGEMENT

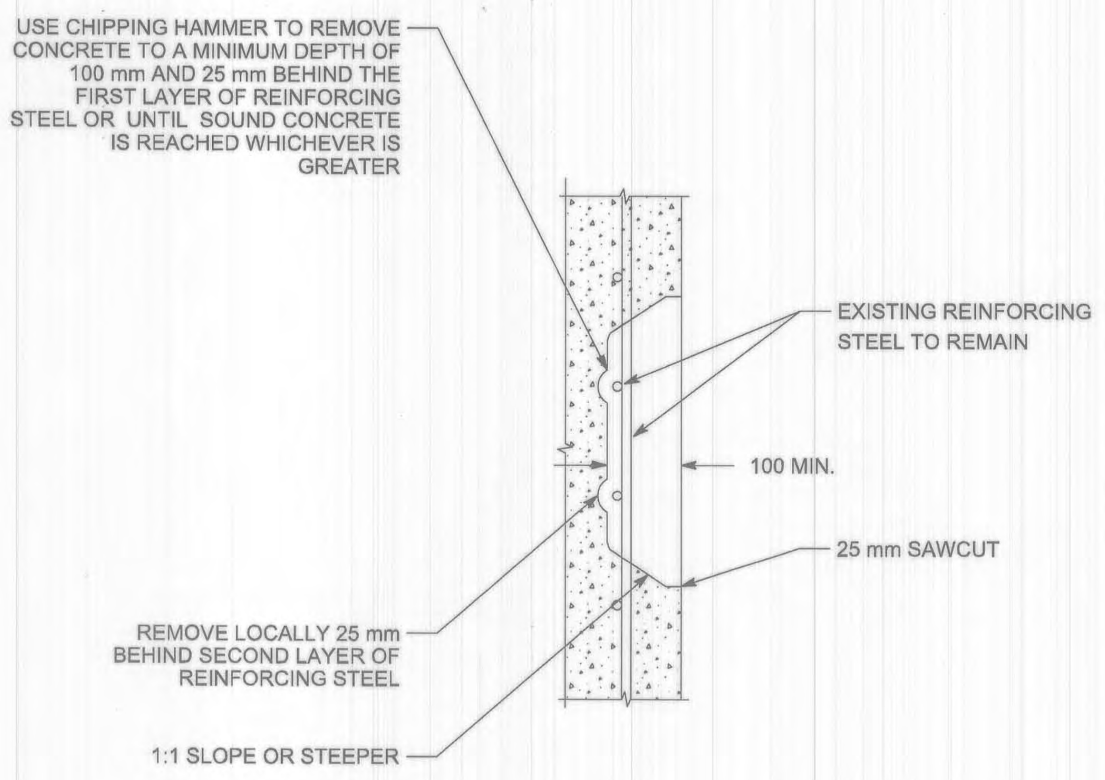
BRIDGE REPAIRS

DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No.
SCALE:	AS SHOWN			DRAWING NUMBER	802-S5002-15	SHEET S2
DATE:	JULY 3, 2013					

5.10.2013 802-S5002-15.dgn

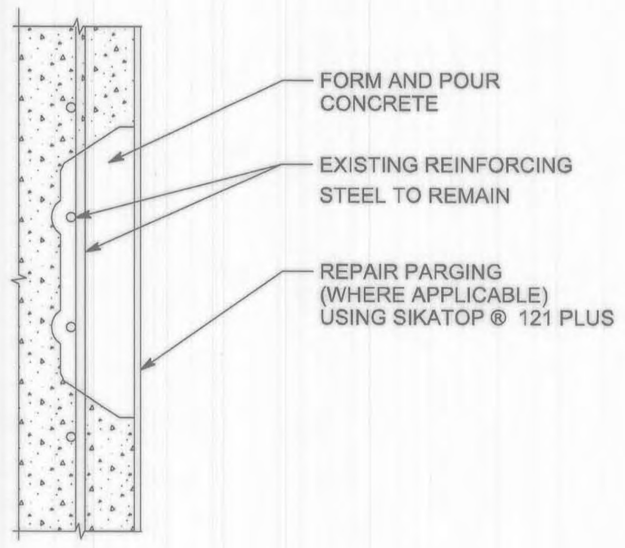
NOTES:

1. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED BY CONTRACTOR IN THE FIELD PRIOR TO UNDERTAKING WORK



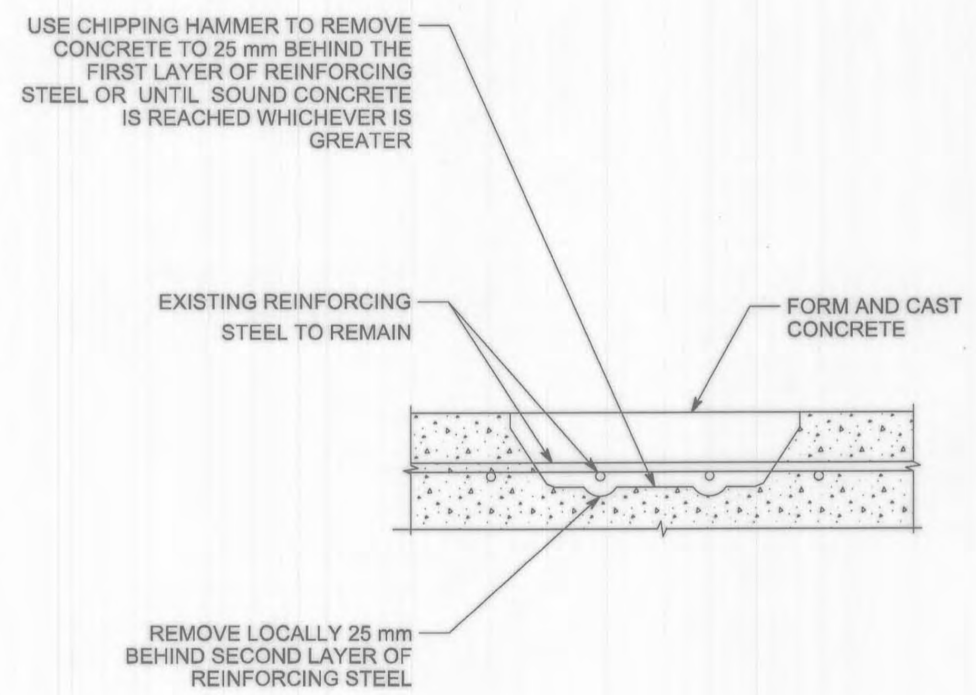
VERTICAL

1 REMOVAL SECTION
1:10



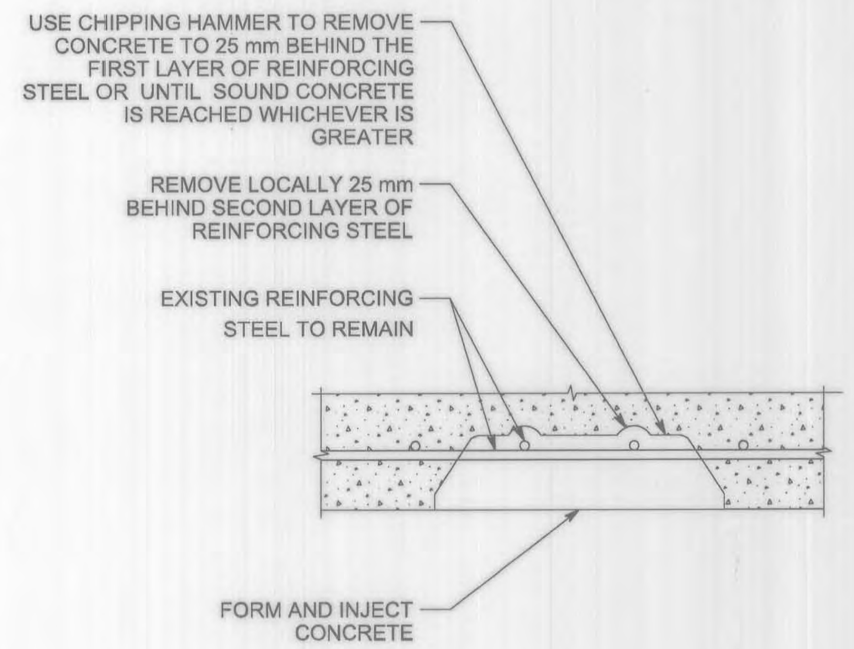
VERTICAL

2 REFACING SECTION
1:10



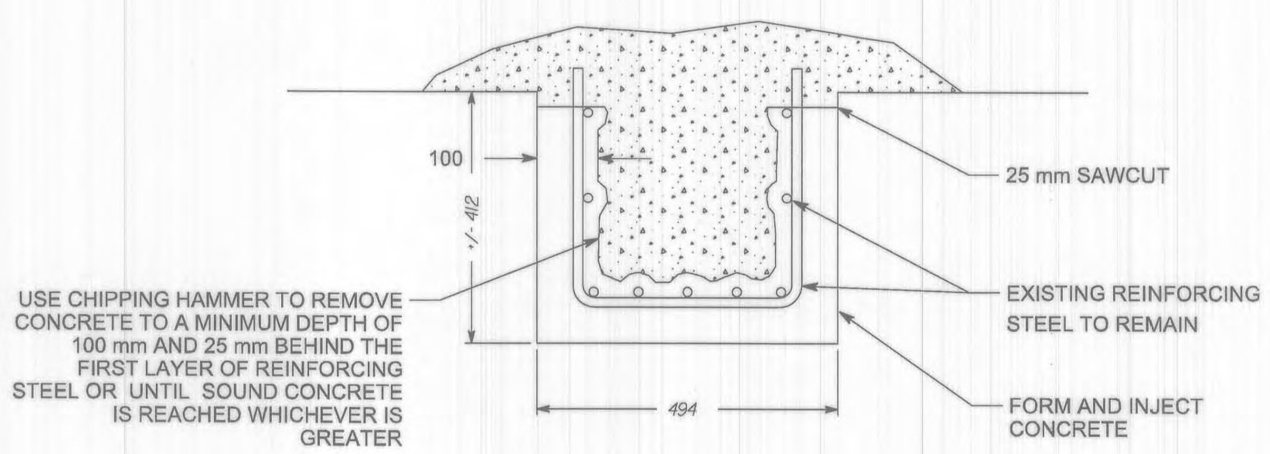
HORIZONTAL

3 REMOVAL/REFACING SECTION
1:10



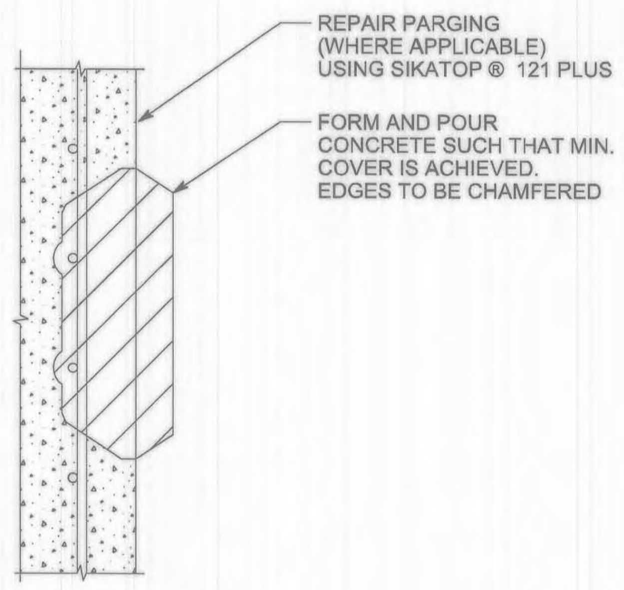
U/S HORIZONTAL

4 REMOVAL/REFACING SECTION
1:10



FLOOR BEAM

5 REMOVAL/REFACING SECTION
1:10



NOTES:

1. WHERE MINIMUM COVER TO EXISTING REINFORCING IS NOT OBTAINED, PATCH IS TO BE FORMED SUCH THAT COVER WILL BE ACHIEVED.
2. MINIMUM COVER:

ABUTMENT, WINGWALL	< 50 mm
ARCHES	< 60 mm
DECK SOFFIT	< 40 mm

HORIZONTAL / VERTICAL

6 REFACING SECTION
1:10

CONSULTANTS

Associated Engineering

DIGITAL INFORMATION	
SURVEY(Year)	N/A
DESIGN	y13116det.dgn
UTILITY	N/A
MAPPING	N/A
STREETLINE	N/A

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A. M. LAWS 100183187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 July 3/13 PROVINCE OF ONTARIO

TONY PAGNANELLI, P.ENG. ACTING EXECUTIVE DIRECTOR ENGINEERING AND CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG. ACTING DIRECTOR CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG. ACTING MANAGER PROJECT DELIVERY LINEAR AND STRUCTURES

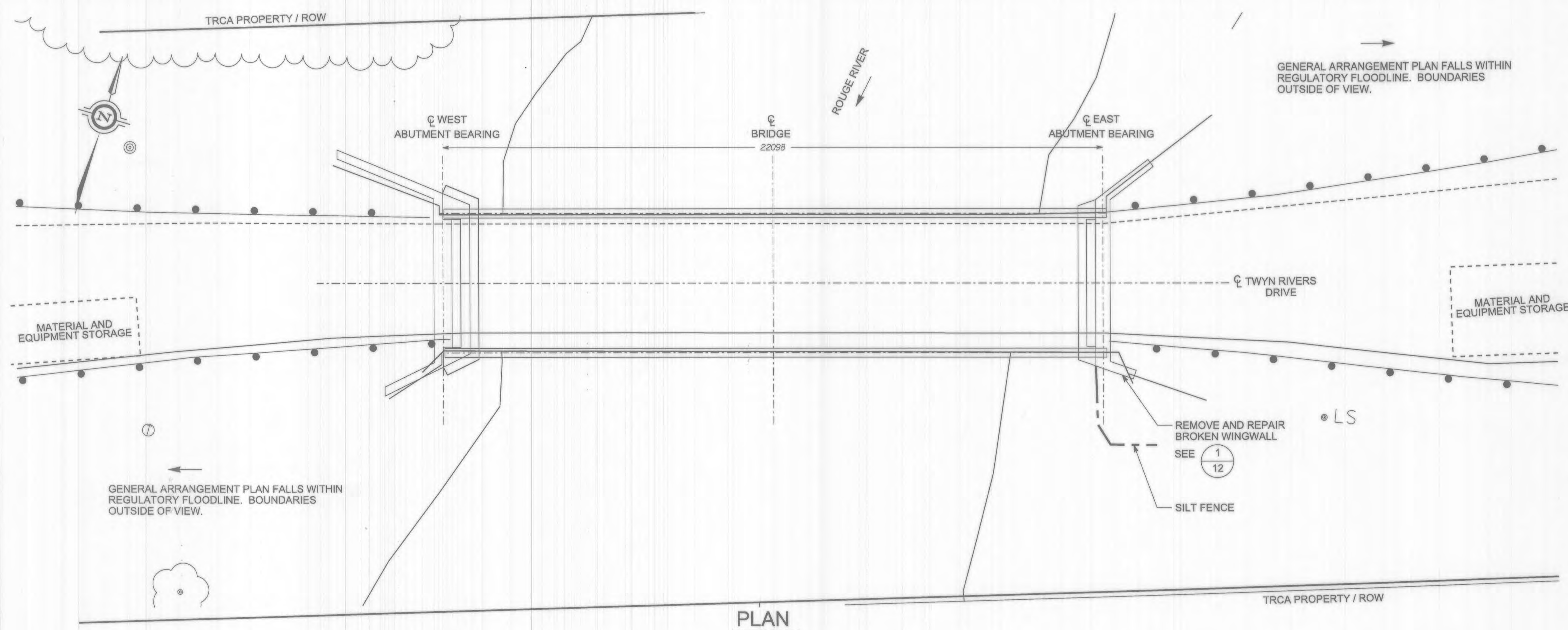
802 TWYN RIVERS DR. OVER LITTLE ROUGE RIVER

DETAILS

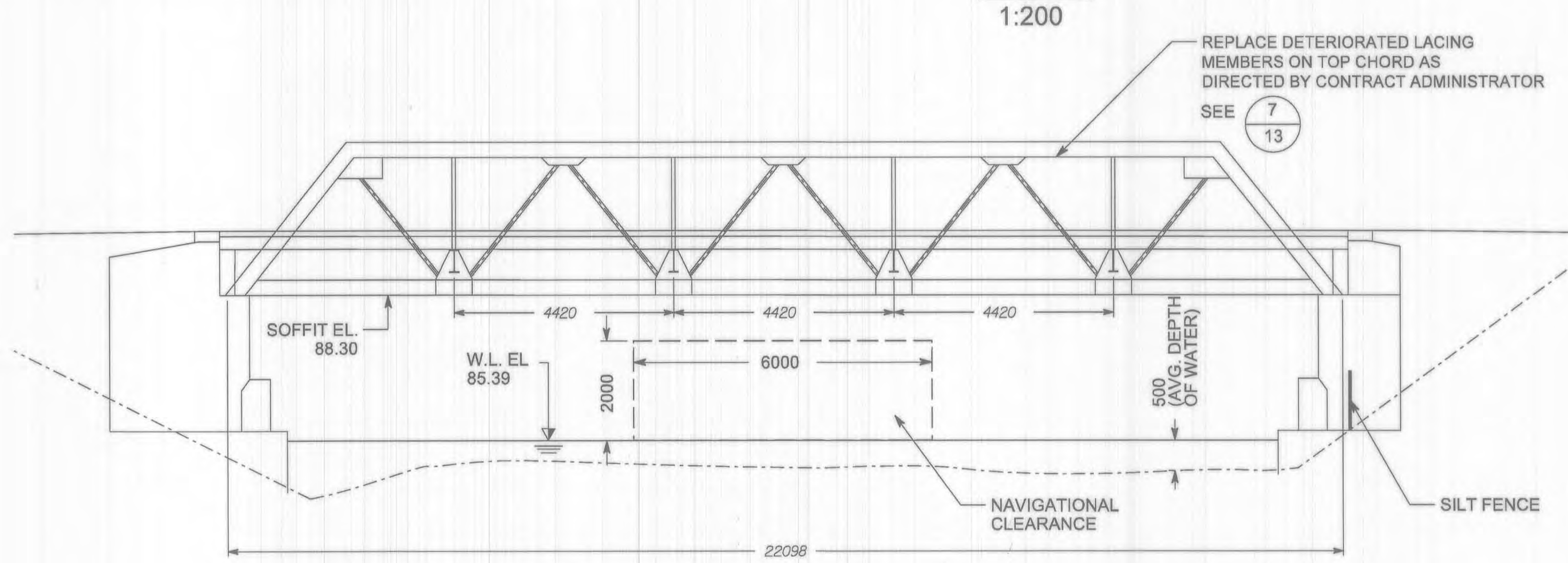
BRIDGE REPAIRS

DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS NOTED			DRAWING NUMBER	802-S5002-16	SHEET S3
DATE:	JULY 3, 2013					

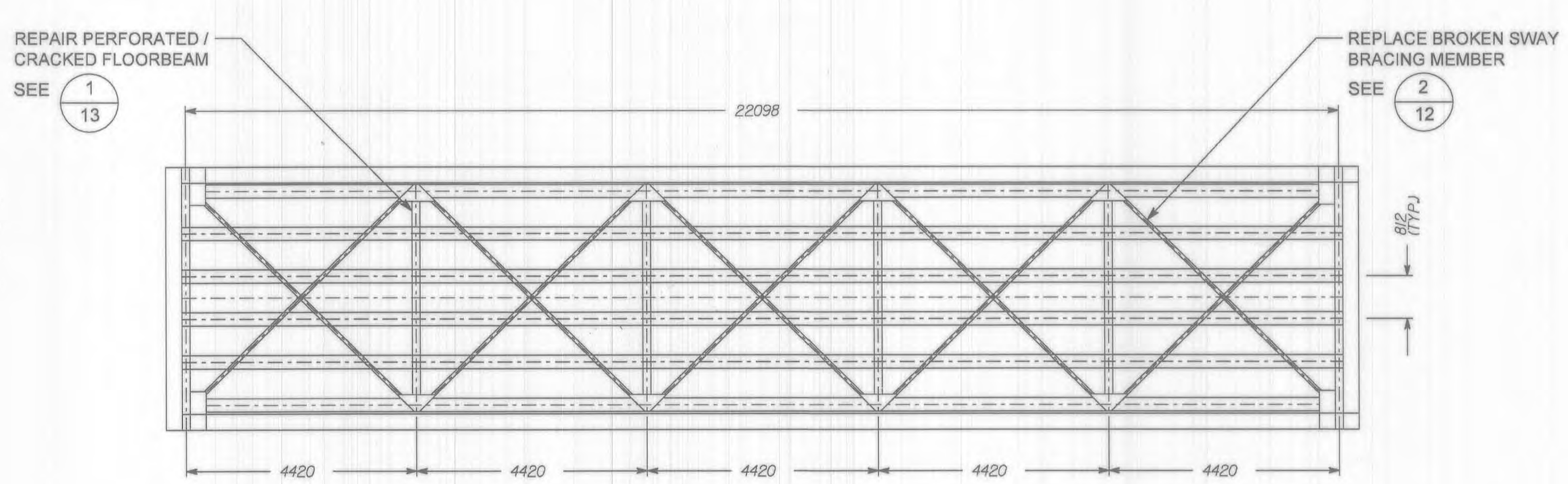
4.29.2013 802-S5002-16.dgn



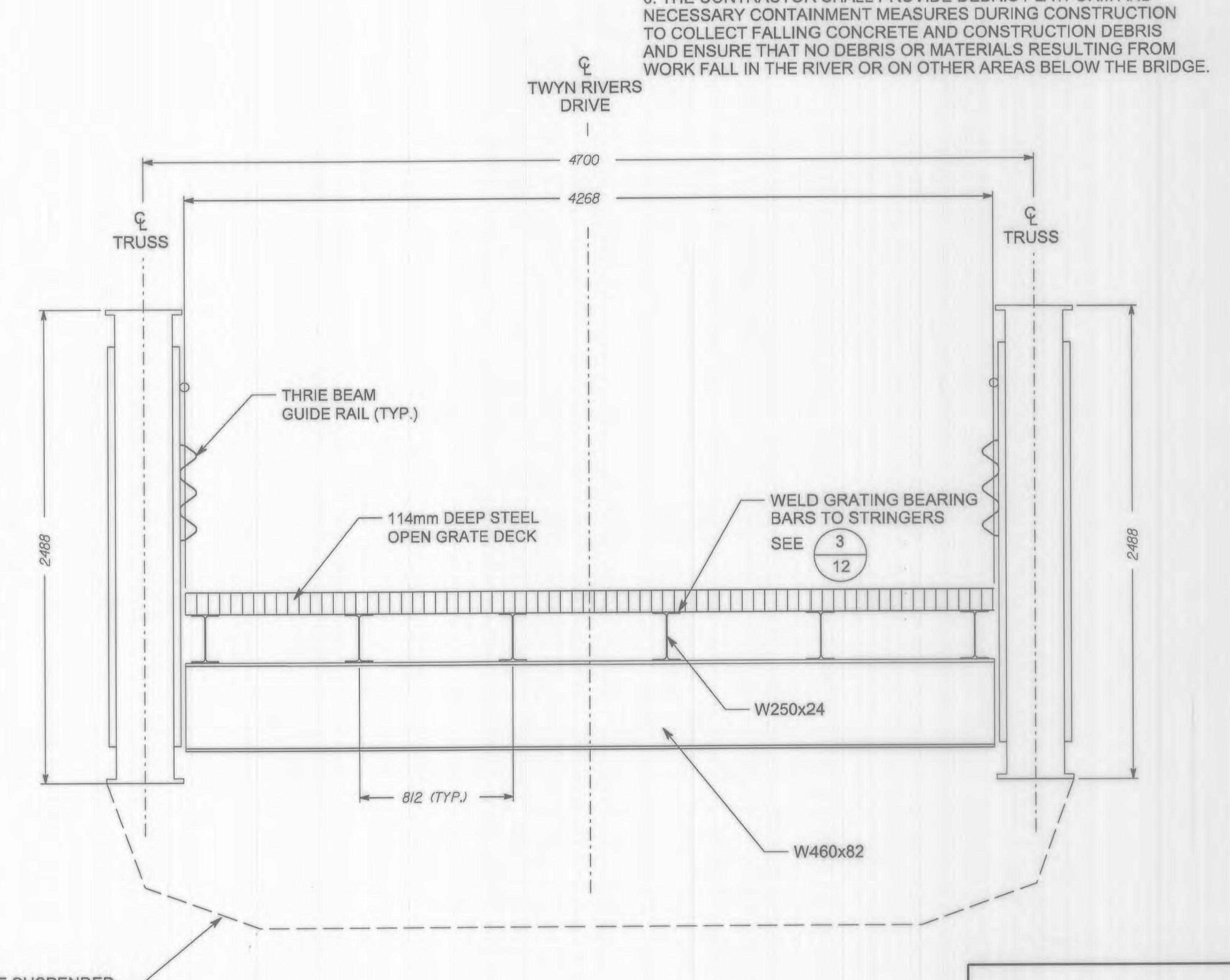
PLAN
1:200



ELEVATION
1:100



BOTTOM VIEW
1:100



EXISTING BRIDGE SECTION
1:25

STRUCTURAL NOTES

CLASS OF CONCRETE

MINUMUM STRENGTH — AT 7 DAYS 25 MPa; AT 28 DAYS 35 MPa

CLEAR COVER TO REINFORCING STEEL — WING WALL 70±20

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.

2. UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES FOR BLACK REINFORCING STEEL BARS SHALL BE CLASS B.

STRUCTURAL STEEL

1. ALL STEEL WORK SHALL BE IN ACCORDANCE WITH OPSS 906, CAN/CSA S6-06, AND CAN/CSA G 40.21.

2. STRUCTURAL STEEL TO BE CAN/CSA G 40.21 GRADE 350 WT.

3. HIGH STRENGTH BOLTS, NUTS, AND WASHERS TO ASTM A325, INSTALL SNUG TIGHT.

4. WELDING ELECTRODES TO CSA W48 SERIES.

GENERAL NOTES:

DESIGN CODE

1. THE STRUCTURE REHABILITATION IS DESIGNED IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN/CSA-S6-06 (CHBDC).

2. ALL WORK SHALL CONFORM TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS.

3. ASSOCIATED ENGINEERING LTD. DOES NOT ASSUME ANY RESPONSIBILITY FOR LOSSES, DAMAGES, OR COSTS ARISING FROM THE USE OR REUSE OF THESE DRAWINGS BY PERSONS, FIRMS, OR CORPORATIONS WITHOUT PRIOR WRITTEN CONSENT.

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.

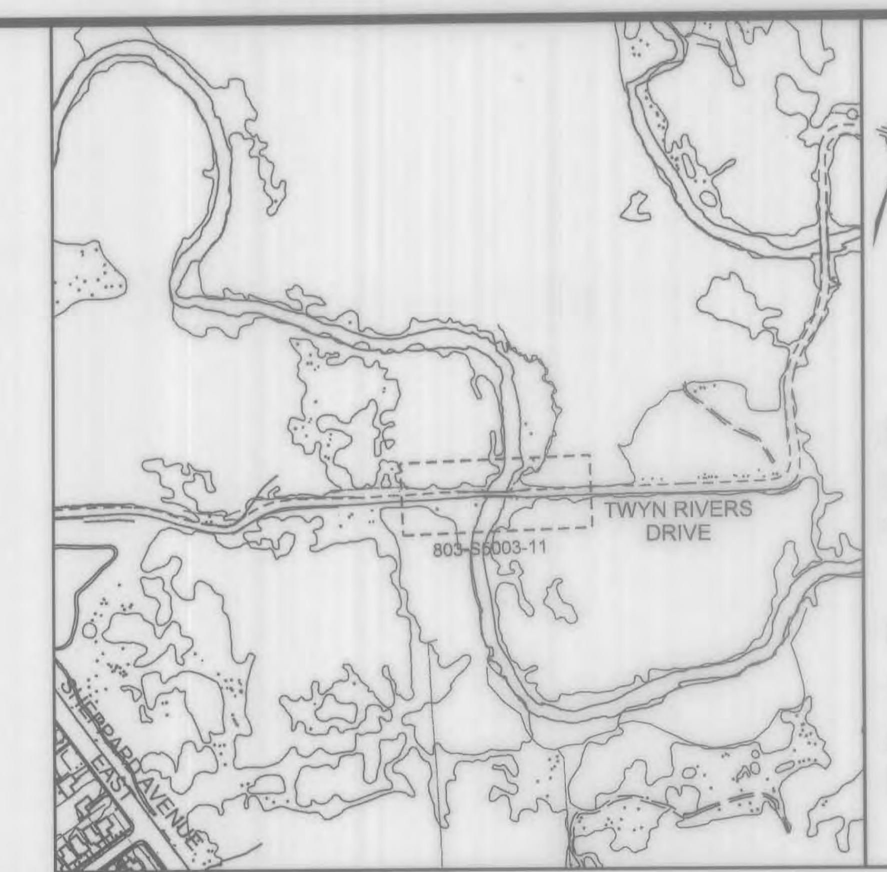
2. UNLESS OTHERWISE SHOWN, SAWCUT AT THE LIMITS OF CONCRETE REMOVALS SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.

3. DRAWINGS ARE NOT TO BE SCALED.

4. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.

5. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE CITY.

6. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM WORK FALL IN THE RIVER OR ON OTHER AREAS BELOW THE BRIDGE.



RELATED DRAWINGS: P-/U- NOT TO SCALE

GENERAL NOTES CONT'D:

7. BRIDGE WILL BE CLOSED TO ALL THROUGH TRAFFIC DURING CONSTRUCTION.

8. ALL IN-WATER AND NEAR WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS IN ACCORDANCE WITH THE TRCA EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION (2006).

9. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING, THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.

10. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED 30 METRES FROM THE WATER.

11. ALL GRADES WITHIN THE REGIONAL STORM FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.

12. THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE PROPONENT/ CONTRACTOR SHALL REMOVE ALL ITEMS FROM THE REGIONAL STORM FLOOD PLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (I.E. FUEL TANKS, UNFIXED EQUIPMENT, ETC.).

13. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/ AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, THEN ALTERNATIVE MEASURES SHOULD BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS.

14. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, NURSERY AND MIGRATORY PERIODS, IN- AND NEAR-WATER ACTIVITIES MAY ONLY OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 TO MARCH 31.

15. TO AVOID INTERFERENCE WITH THE EGGS, NESTS OR YOUNG OF BIRDS PROTECTED UNDER THE FEDERAL MIGRATORY BIRDS CONVENTION ACT, REMOVALS SHOULD NOT OCCUR FROM MAY 1 TO AUGUST 1 OF ANY GIVEN YEAR. IDEALLY, REMOVALS SHOULD OCCUR FROM AUGUST THROUGH DECEMBER TO AVOID INTERFERENCE WITH ALL NESTING BIRDS. SHOULD REMOVALS BE REQUIRED WITHIN THE MAY 1 TO AUGUST 1 BREEDING PERIOD, A QUALIFIED AVIAN BIOLOGIST SHOULD CONDUCT A THOROUGH SURVEY IMMEDIATELY PRIOR TO THE DESIRED TREE REMOVAL DATE TO CONFIRM PRESENCE OR ABSENCE OF PROTECTED SPECIES. IF PROTECTED SPECIES ARE PRESENT, REMOVALS CANNOT OCCUR WITHOUT A PERMIT FROM THE CANADIAN WILDLIFE SERVICE.

16. IF ANY DEBRIS IS TO BYPASS THE CONTAINMENT AREA AND ENTER THE WATERCOURSE, THE CONTRACTOR SHALL COLLECT IT BY HAND.

17. SITE RESTORATION OF ALL DISTURBED AREA SHALL BE IN ACCORDANCE WITH TRCA POST-CONSTRUCTION RESTORATION GUIDELINES (2004).

18. VEHICULAR ACCESS BELOW THE BRIDGE STRUCTURE WILL NOT BE PERMITTED.

19. NO VEGETATION IS TO BE REMOVED.

SCOPE OF REHABILITATION WORK

THE GENERAL SCOPE OF THE BRIDGE REPAIR WORK SHALL INCLUDE THE FOLLOWING:

1. REPAIR DETERIORATED FLOORBEAM.

2. REPLACE BROKEN SWAY BRACING.

3. REPLACE DETERIORATED LACING MEMBERS.

4. WELD DECK PANELS TO STRINGERS.

5. PATCH REPAIR SE WINGWALL.

CONSULTANTS

Associated Engineering

DIGITAL INFORMATION		No.	DATE	REVISIONS	INITIAL	SIGNED
SURVEY(Year)	N/A					
DESIGN	y13117det.dgn, y13117pd.dgn, y13117pf.dgn					
UTILITY	y13117ugs.dgn					
MAPPING	y13117top.dgn					
STREETLINE	y13117psl.dgn		07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A. M. LAWS 100183167 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127742 PROVINCE OF ONTARIO

JOHN P KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

TONY PAGNANELLI, P.ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

803 TWYN RIVERS DRIVE OVER ROUGE RIVER

GENERAL ARRANGEMENT

BRIDGE REPAIRS

DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS NOTED			DRAWING NUMBER	803-S5003-11	SHEET S1
DATE:	JULY 3, 2013					

Mo.Day.Yr $$FILE$$

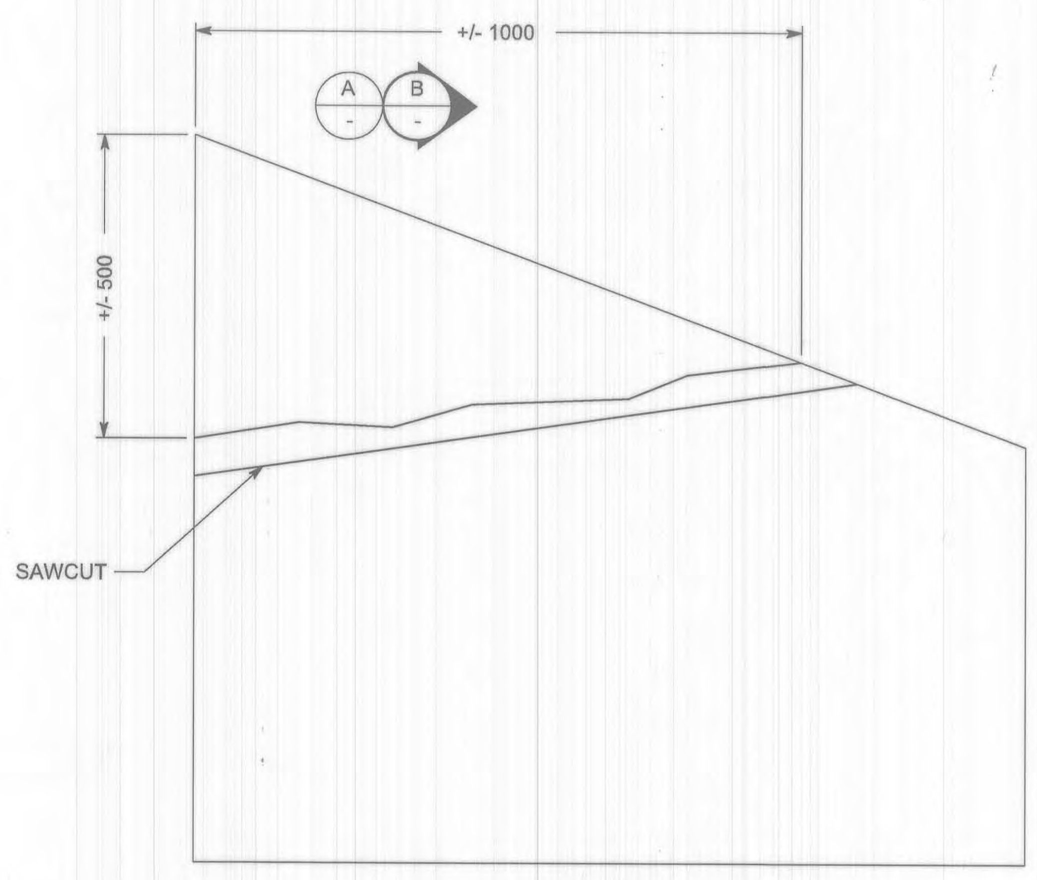
NOTES:

1. FOR GENERAL NOTES SEE DRAWING 803-S5003-11

2. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED BY CONTRACTOR IN THE FIELD PRIOR TO UNDERTAKING WORK

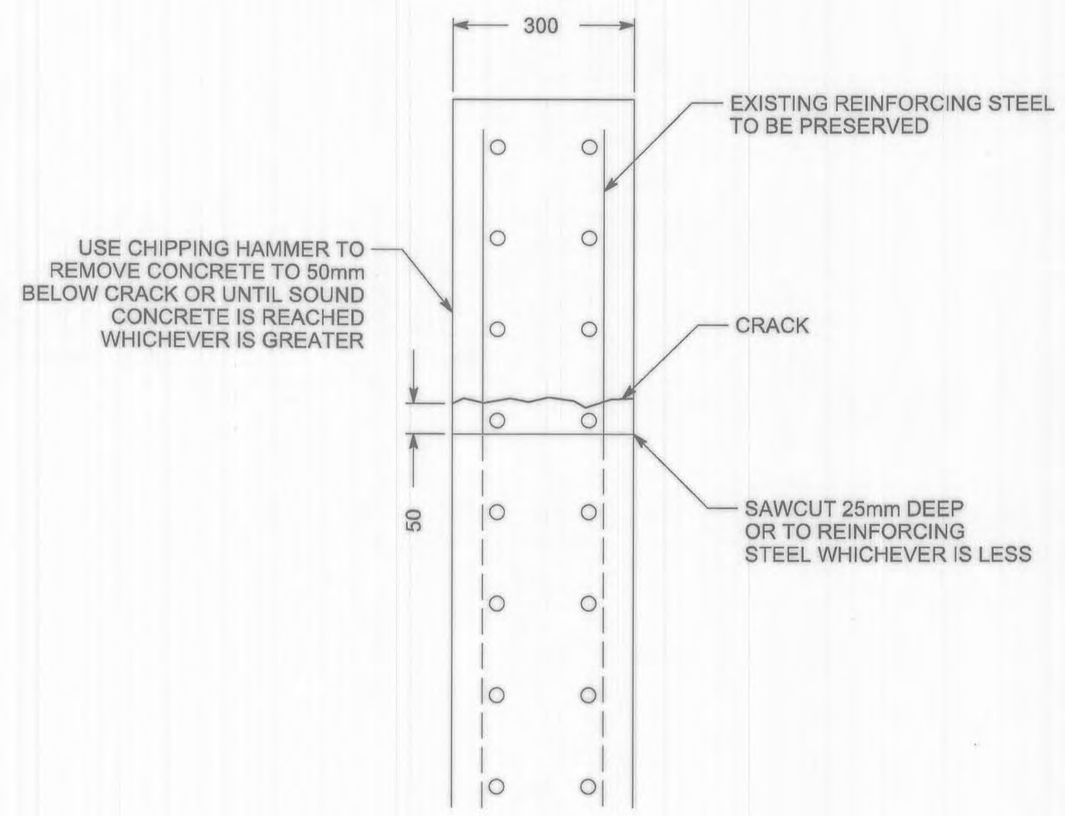
3. EVERY OTHER BEARING BAR TO BE WELDED AT EACH STRINGER. GRATING IS TO BE CLAMPED DOWN TO STRINGER TO ENSURE BEARING DURING WELDING, AND IS NOT TO BE UNCLAMPED UNTIL WELD HAS COOLED.

FOLLOWING WELDING, TOP FLANGE, WELD, AND AREAS OF GRATING WITH DAMAGED GALVANIZING ARE TO BE COATED WITH TWO COATS ZINC RICH SPRAY IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS.

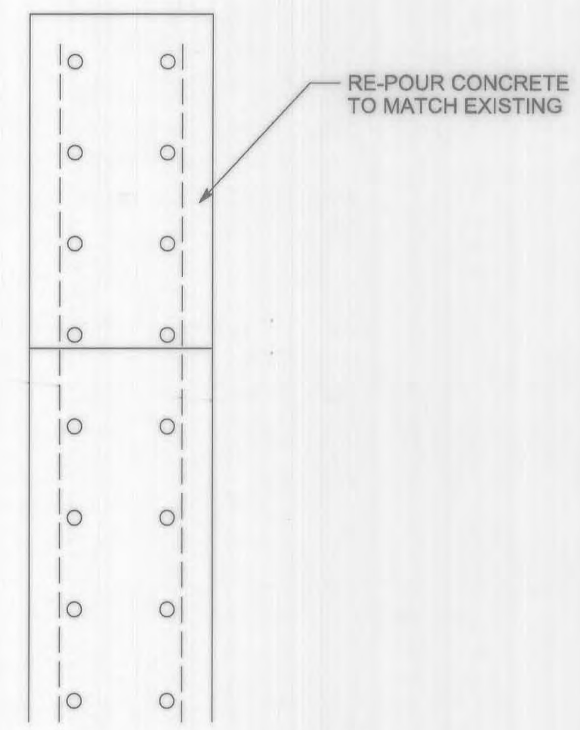


ELEVATION

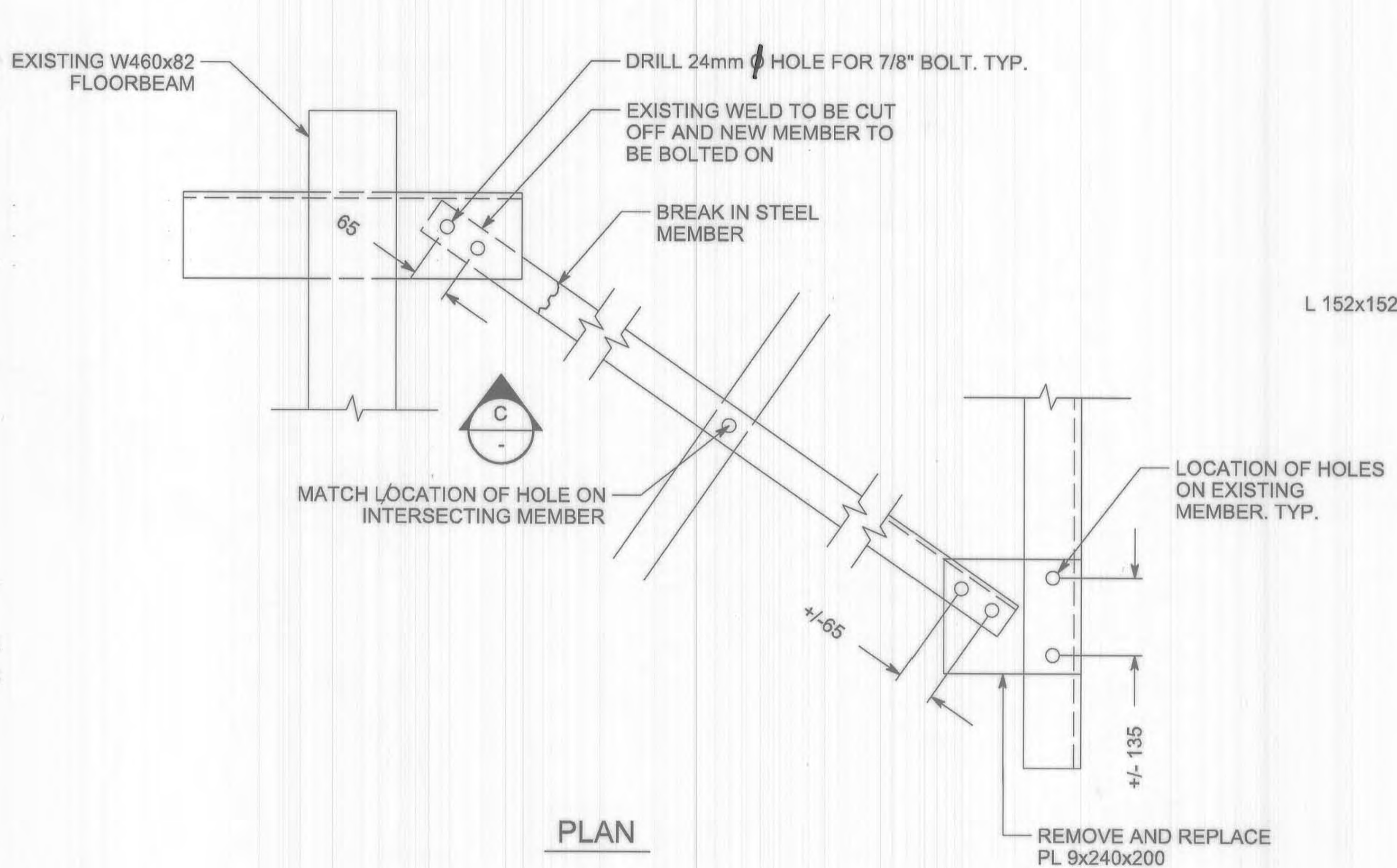
1/11 SOUTHEAST WINGWALL REPAIR
1:20



A REMOVAL SECTION
1:20

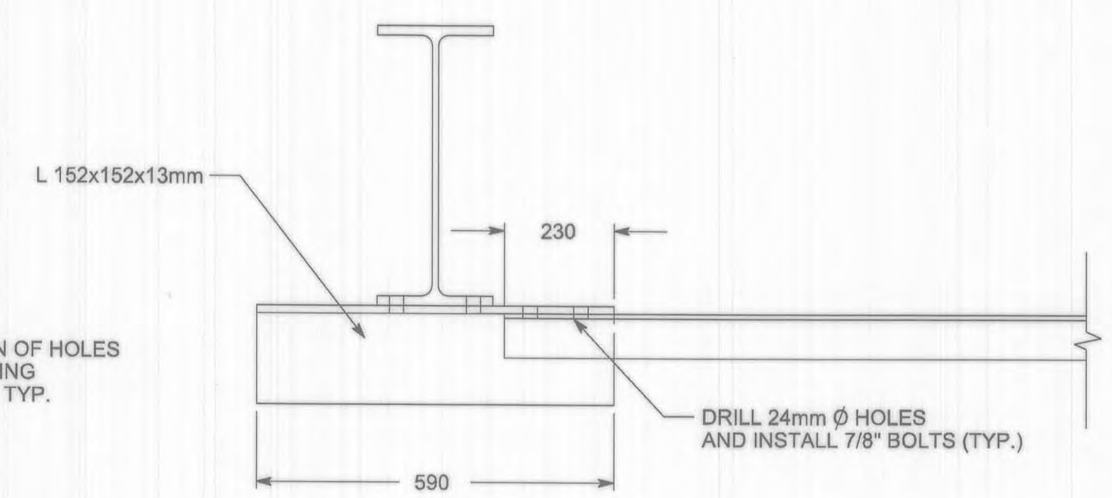


B REPAIR SECTION
1:20



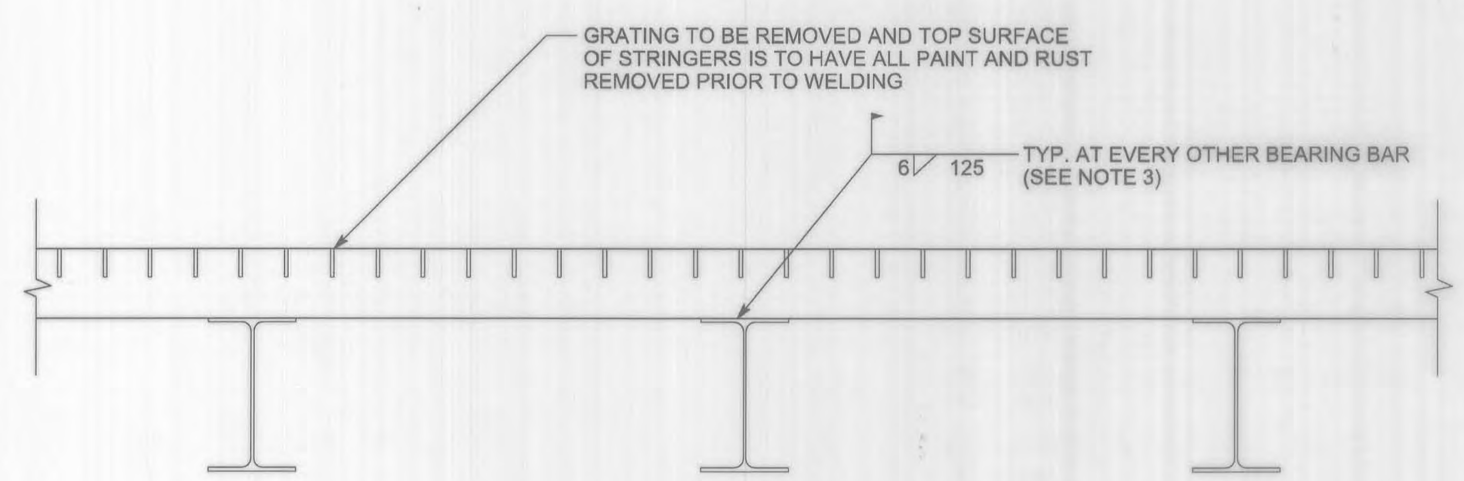
PLAN

2/11 SWAY-BRACE CONNECTION
1:20



ELEVATION

C SWAY-BRACE CONNECTION
1:20



3/11 DECK GRATING TO STRINGER WELD CONNECTION
1:20

CONSULTANTS

Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13117det.dgn
UTILITY	N/A
MAPPING	N/A
STREETLINE	N/A
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A.M. LAWS 100183187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.S. MONKMAN 100127743 July 3/13 PROVINCE OF ONTARIO

TONY PAGNANELLI, P.ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

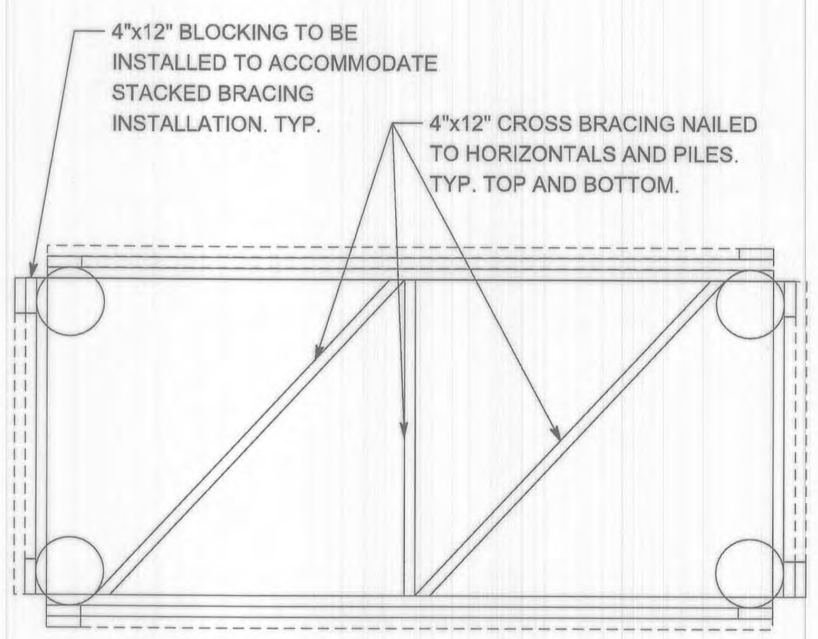
803 TWYN RIVERS DRIVE OVER ROUGE RIVER

DETAILS

BRIDGE REPAIRS

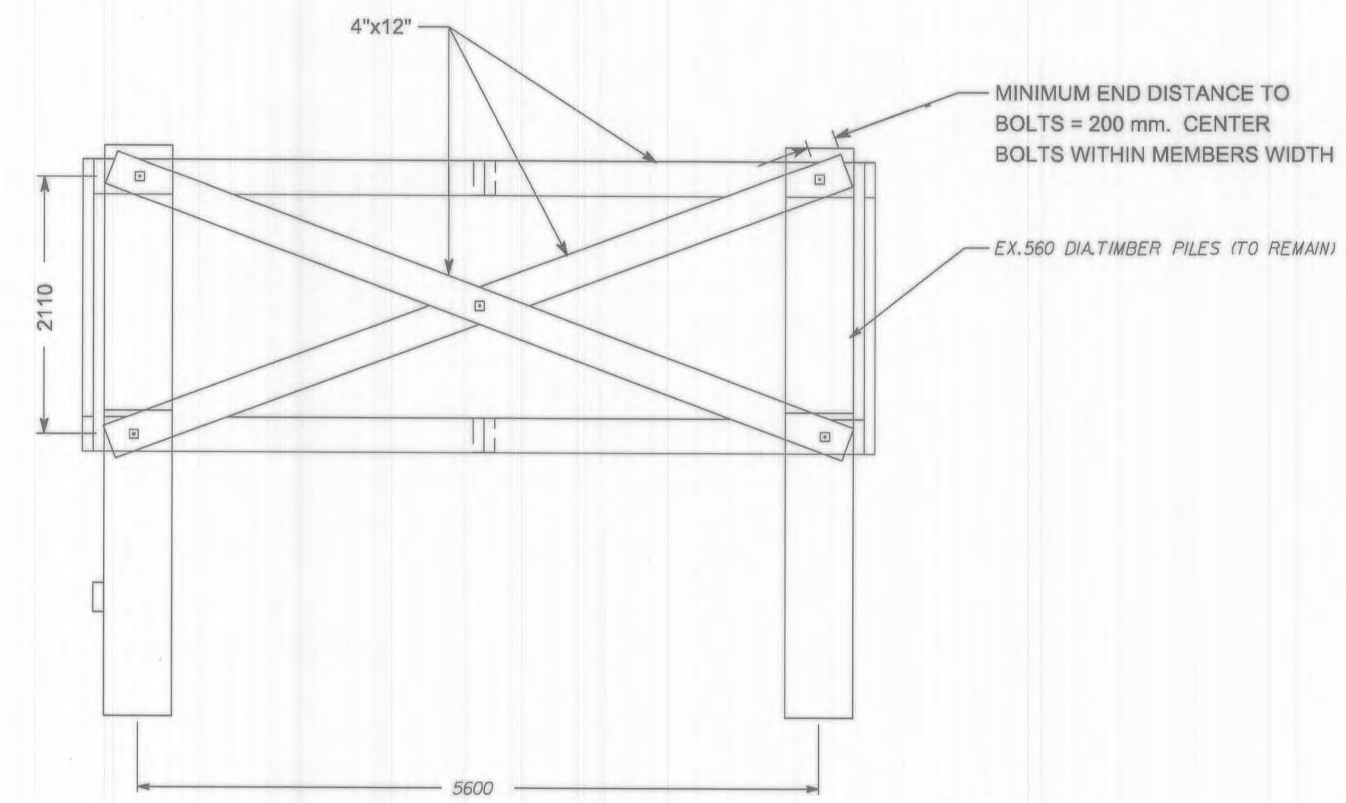
DESIGN	A.L.	DRAWN	J.W.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS NOTED			DRAWING NUMBER	803-S5003-12	SHEET S2
DATE:	JULY 3, 2013					

Mo.Day.Yr $$FILE$$



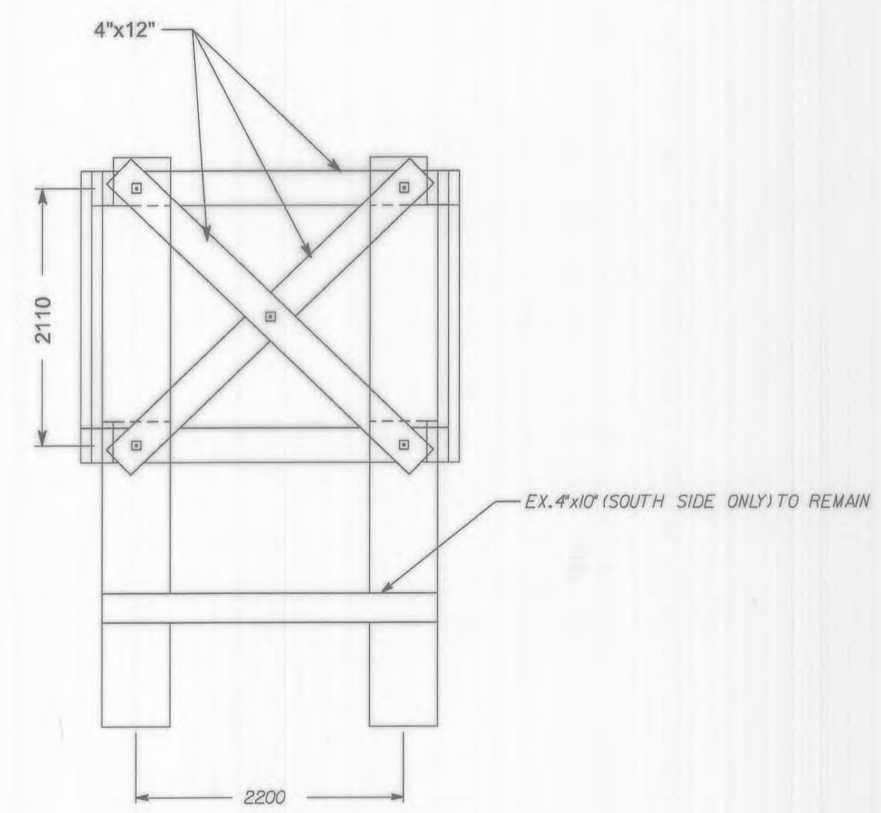
NOTE:
TIMBERS ARE TO BE SIZED TO PERMIT EVEN BEARING AND COMPENSATE FOR VARIATIONS IN TIMBER DEPTHS AT SUPPORTS

1 PLAN - PIER
1:50



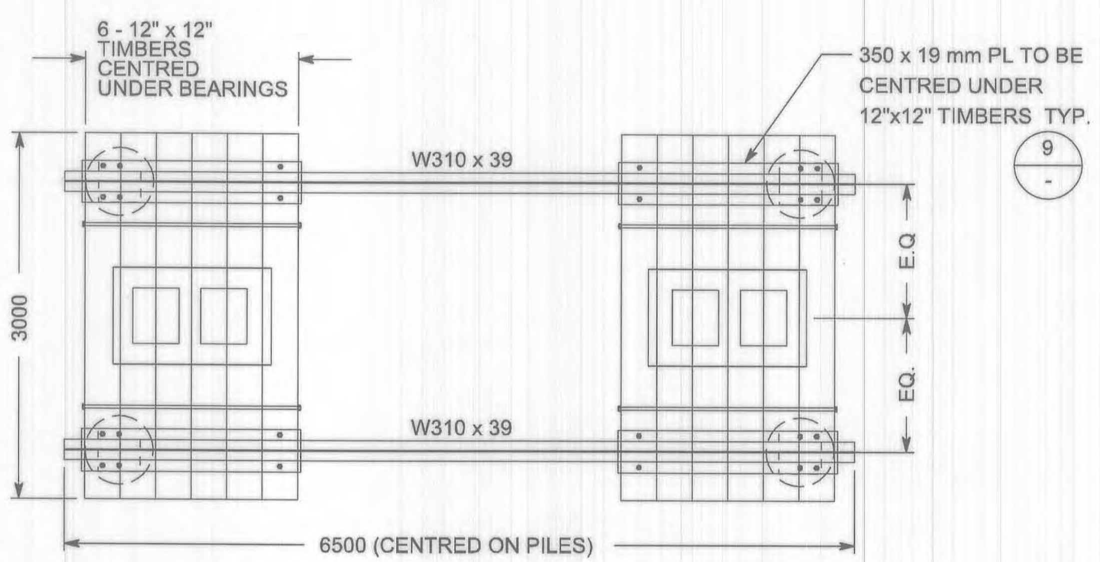
EAST, WEST (SIMILAR)

2 ELEVATION - PIER
1:50



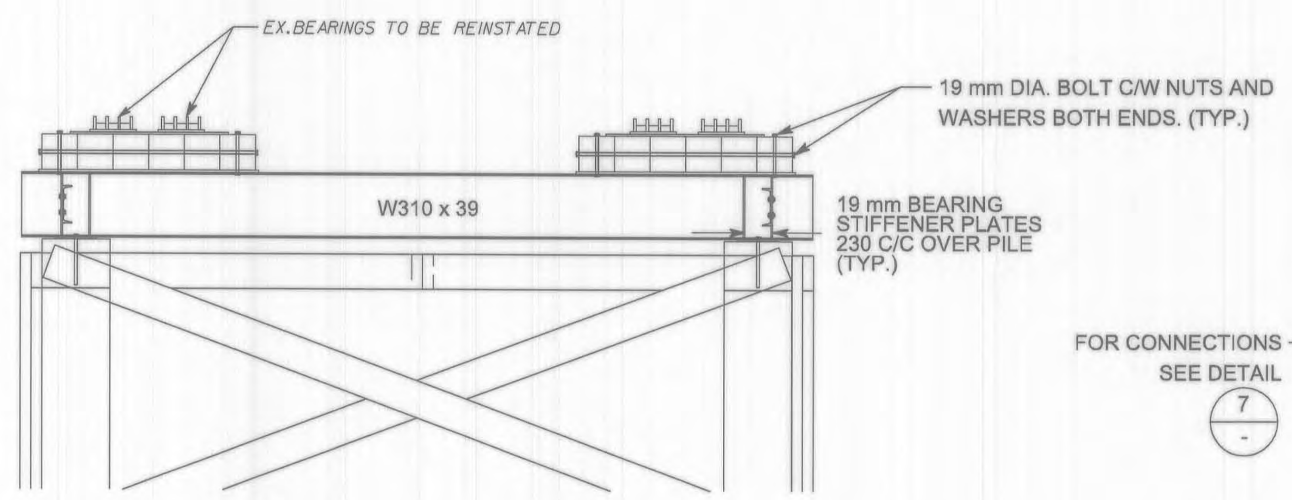
NORTH, SOUTH (SIMILAR)

3 ELEVATION - PIER
1:50



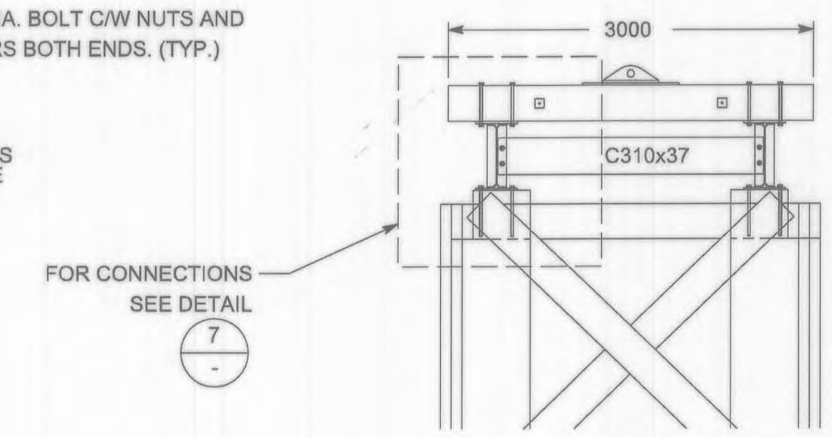
NOTE: TIMBERS ARE TO BE SIZED TO PERMIT EVEN BEARING AND COMPENSATE FOR VARIATIONS IN TIMBER DEPTHS AT SUPPORTS

4 PLAN - PIER CAP
1:50



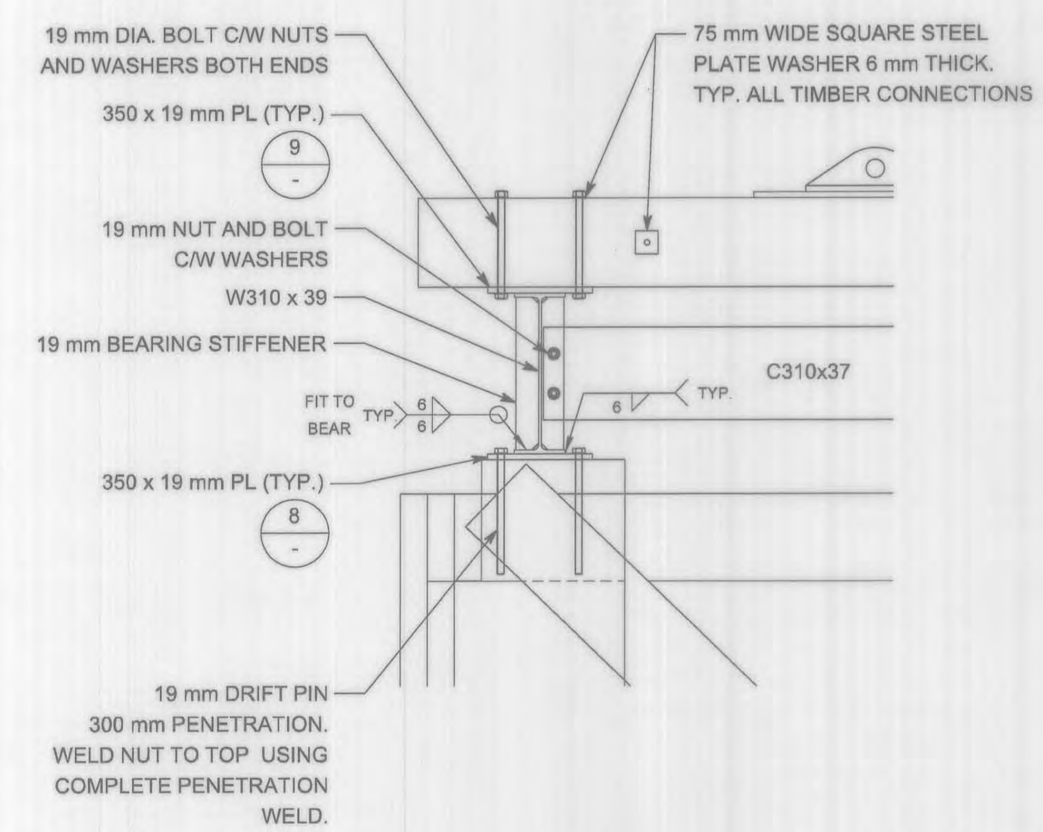
EAST, WEST

5 ELEVATION -PIER CAP
1:50

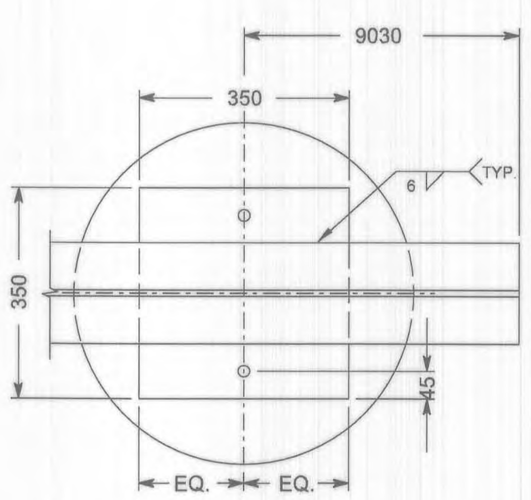


NORTH, SOUTH

6 ELEVATION - PIER CAP
1:50

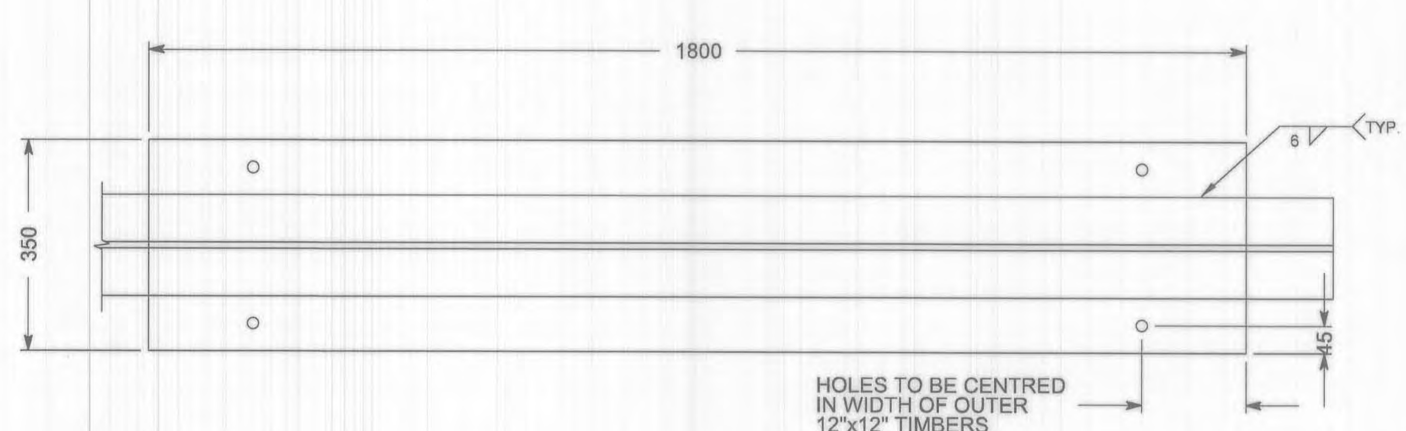


7 DETAIL
1:20



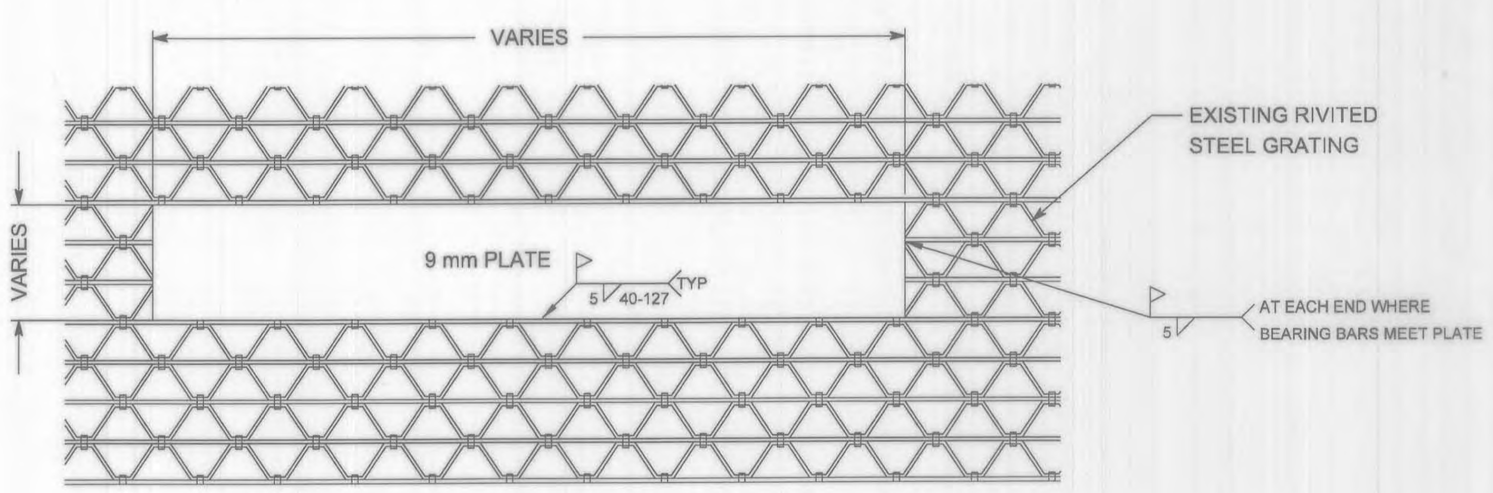
PILE CAP ANCHOR PLATE

8 DETAIL
1:10



PILE CAP ANCHOR PLATE

9 DETAIL
1:10



10 DETAIL
1:10

CONSULTANTS
Associated Engineering

SURVEY(Year)	N/A
DESIGN	Y13113det.dgn
UTILITY	N/A
MAPPING	N/A
STREETLINE	N/A
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A.M. LAW 100183107 PROVINCE OF ONTARIO Jul 3, 13

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 PROVINCE OF ONTARIO July 3/13

TONY PAGNANELLI, P. ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND CONSTRUCTION SERVICES

JOHN P. KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

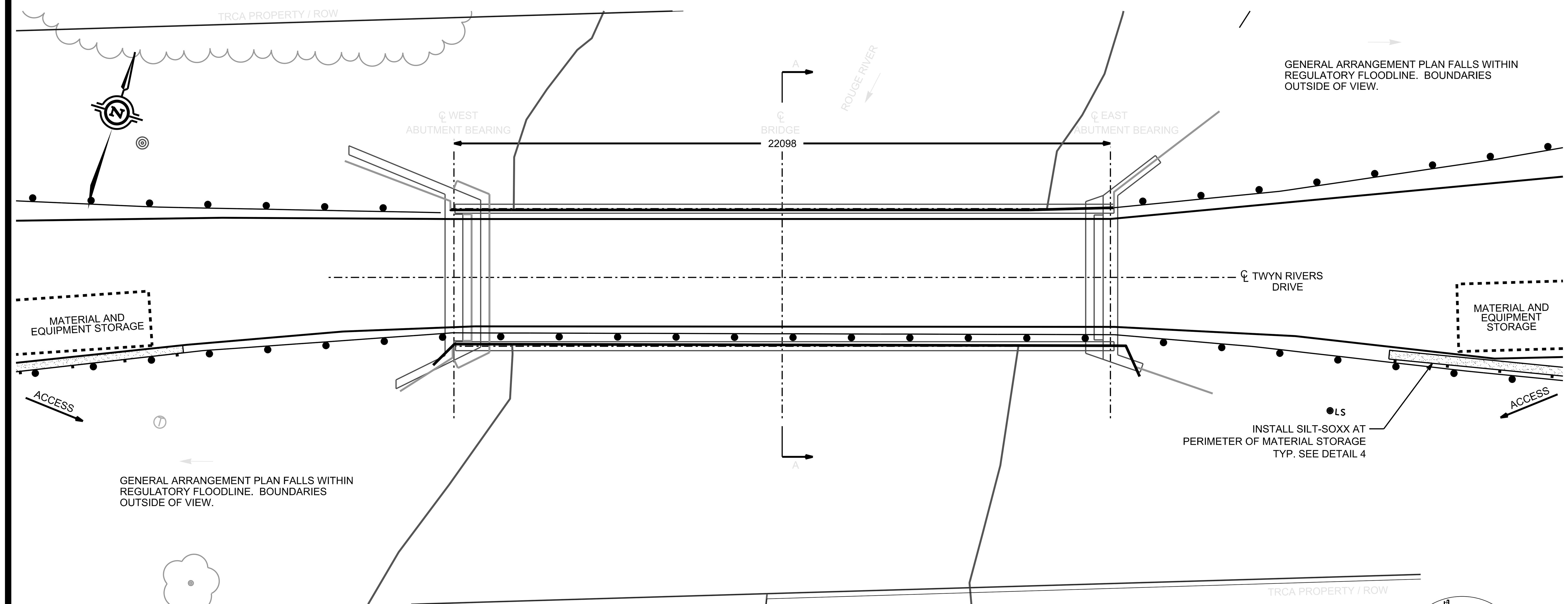
813 OLD FINCH AVE OVER ROUGE RIVER

DETAILS

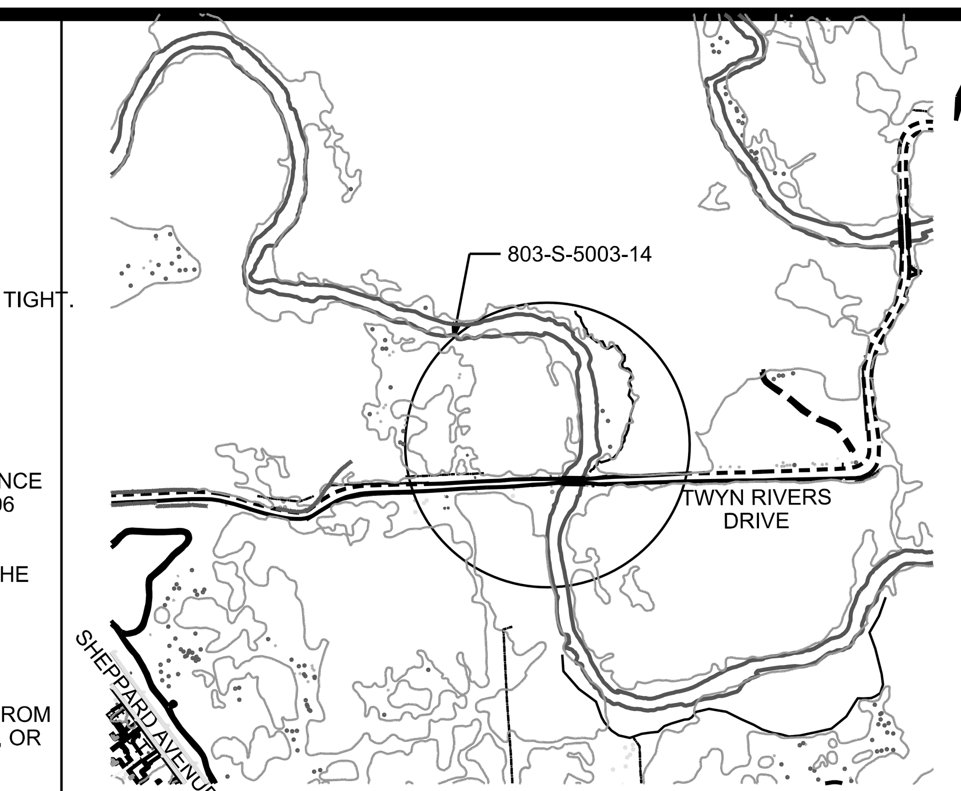
BRIDGE REPAIR

DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No. 12SE-10S	
SCALE:	AS SHOWN			DRAWING NUMBER	813-S5013-6	SHEET	S2
DATE:	JULY 3, 2013						

6.27.2013 813-S5013-6.dgn

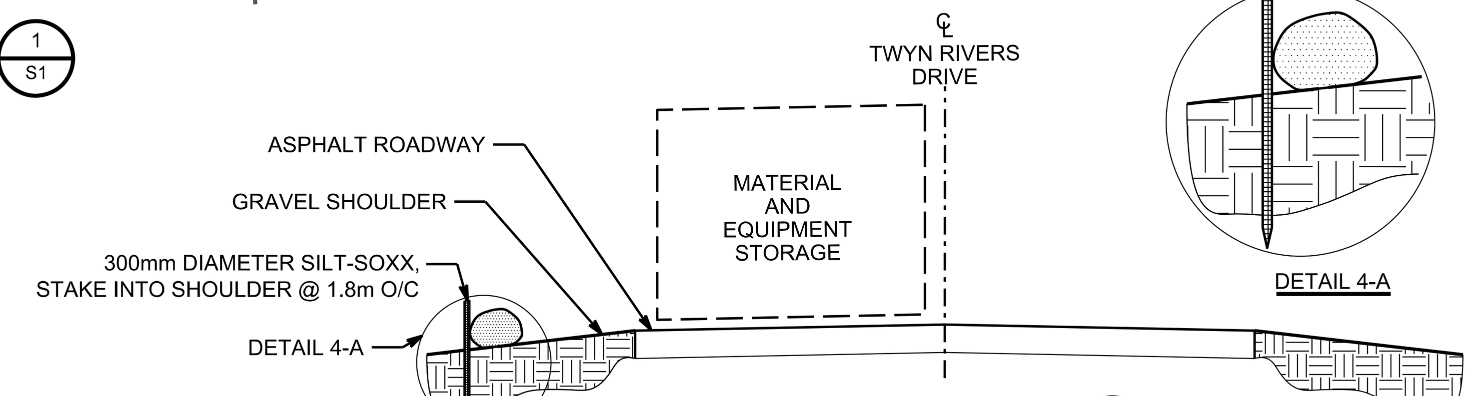


PLAN 1/S1
SCALE 1:200

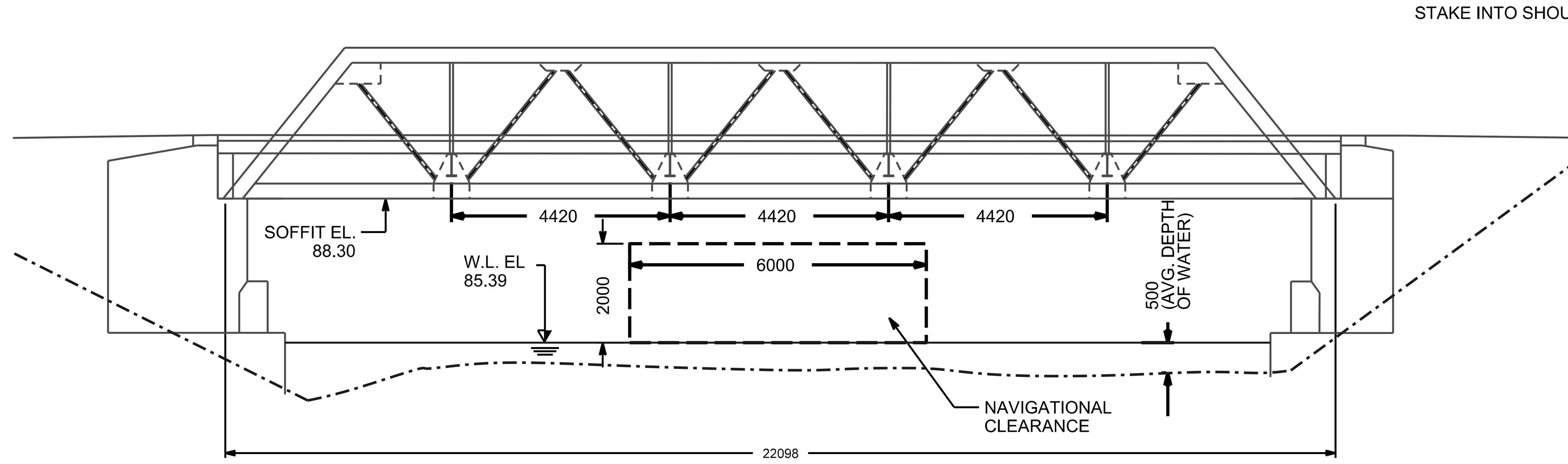


KEY PLAN
N.T.S

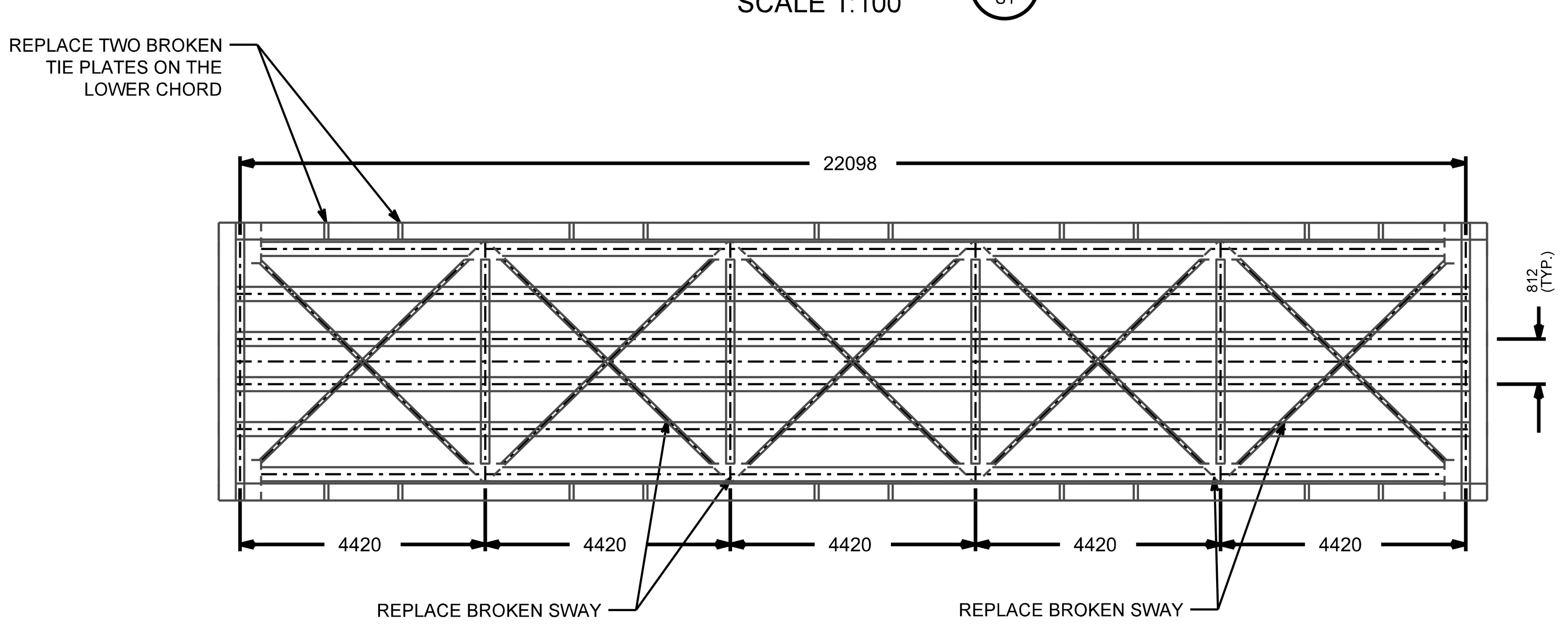
NOT TO SCALE



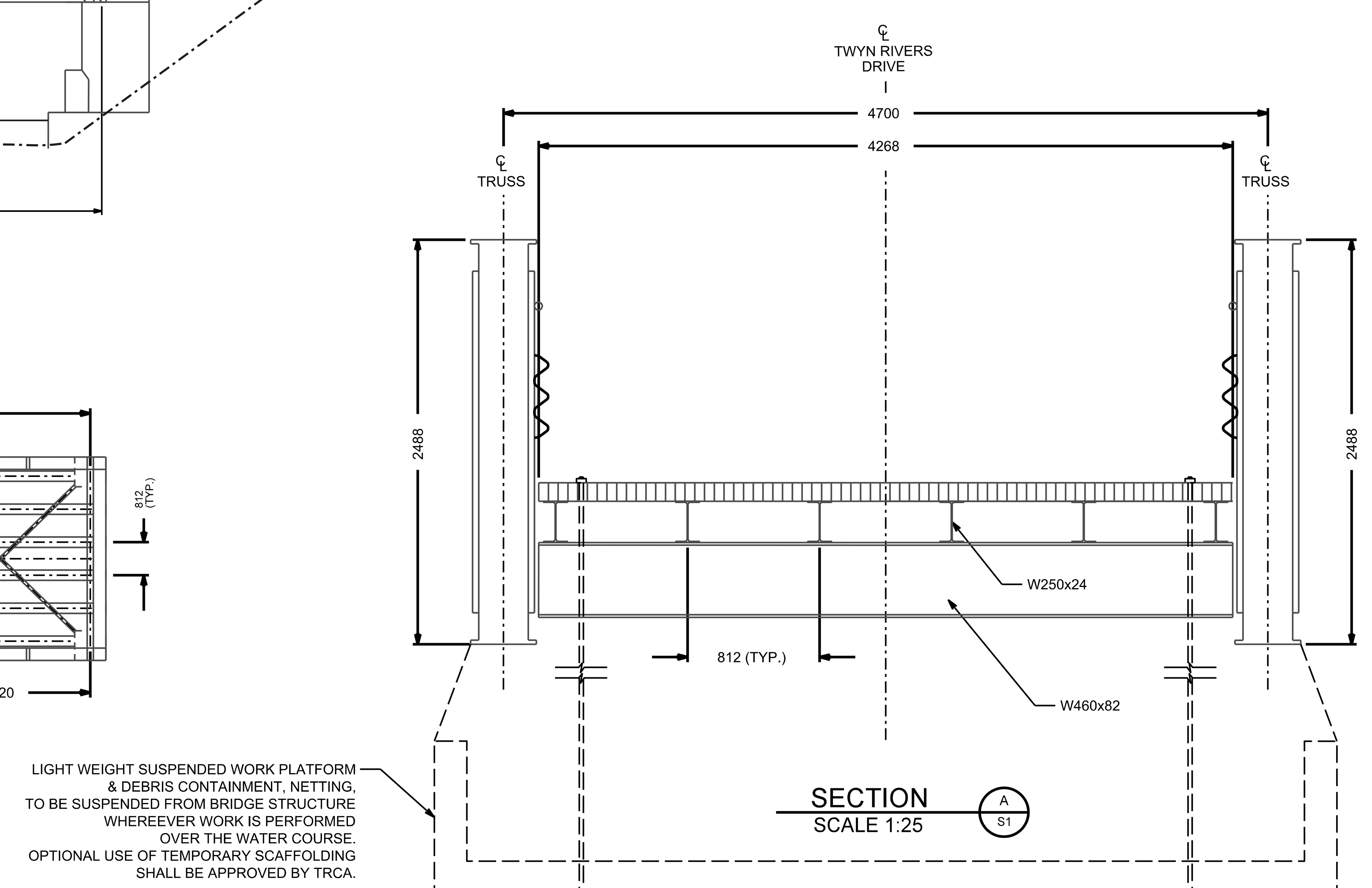
DETAIL 4/S1
N.T.S.



ELEVATION 2/S1
SCALE 1:100



BOTTOM VIEW 3/S1
SCALE 1:100



SECTION A/S1
SCALE 1:25

STRUCTURAL NOTES

STRUCTURAL STEEL

1. ALL STEEL WORK SHALL BE IN ACCORDANCE WITH OPSS MUNI 906, CAN/CSA S6-14, AND CAN/CSA G 40.21.

2. STRUCTURAL STEEL TO BE CAN/CSA G 40.21 GRADE 350 W

3. HIGH STRENGTH BOLTS, NUTS, AND WASHERS ARE ASTM A325 TYPE 1, AND SHALL BE GALVANIZED, INSTALL SNUG TIGHT.

4. WELDING ELECTRODES TO CSA W48 SERIES.

GENERAL NOTES:

DESIGN CODE

1. THE STRUCTURE REHABILITATION IS DESIGNED IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN/CSA-S6-06 (CHBDC).

2. ALL WORK SHALL CONFORM TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS.

3. ASSOCIATED ENGINEERING LTD. DOES NOT ASSUME ANY RESPONSIBILITY FOR LOSSES, DAMAGES, OR COSTS ARISING FROM THE USE OR REUSE OF THESE DRAWINGS BY PERSONS, FIRMS, OR CORPORATIONS WITHOUT PRIOR WRITTEN CONSENT.

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.

2. DRAWINGS ARE NOT TO BE SCALED.

3. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.

4. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE CITY.

5. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM WORK FALL IN THE RIVER OR ON OTHER AREAS BELOW THE BRIDGE.

6. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER. ALL DAMAGED EROSION AND SEDIMENT CONTROL MEASURES SHOULD BE REPAIRED AND/OR REPLACED WITHIN 48 HOURS OF THE INSPECTION.

7. DISTURBED AREAS WILL BE MINIMIZED TO THE EXTENT POSSIBLE, AND TEMPORARILY OR PERMANENTLY STABILIZED OR RESTORED AS THE WORK PROGRESSES.

8. ALL IN-WATER AND NEAR WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS.

9. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, NURSERY AND MIGRATORY PERIODS, NEAR-WATER ACTIVITIES MAY ONLY OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 TO MARCH 31.

GENERAL NOTES CONT'D:

10. BRIDGE WILL BE CLOSED TO ALL THROUGH TRAFFIC DURING CONSTRUCTION.

11. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, INCLUDING SEDIMENT, THEN ALTERNATIVE MEASURES MUST BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS. TRCA ENFORCEMENT OFFICER SHOULD BE IMMEDIATELY CONTACTED. ADDITIONAL ESC MEASURES TO BE KEPT ON SITE AND USED AS NECESSARY.

12. AN ENVIRONMENTAL MONITOR WILL ATTEND THE SITE TO INSPECT ALL NEW CONTROLS, AS WELL AS ON A REGULAR BASIS, OR FOLLOWING RAIN/SNOW MELT EVENT, TO MONITOR ALL WORKS, AND IN PARTICULAR WORKS RELATED TO EROSION AND SEDIMENT CONTROLS, DEWATERING OR UNWATERING, RESTORATION AND IN- OR NEAR- WATER WORKS. SHOULD CONCERNS ARISE ON SITE THE ENVIRONMENTAL MONITOR WILL CONTACT THE TRCA ENFORCEMENT OFFICER AS WELL AS THE PROPONENT.

13. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED 30 METERS FROM THE WATER.

14. ALL GRADES WITHIN THE REGULATORY FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.

15.THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE OF THE ONSET OF THE PROJECT TO ENSURE THAT THE WORKS WILL BE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE CONTRACTOR WILL REMOVE ALL UNFIXED ITEMS FROM THE REGIONAL STORM FLOOD PLAIN THAT WOULD HAVE THE POTENTIAL TO CAUSE A SPILL OR AN OBSTRUCTION TO FLOW, E.G., FUEL TANKS, PORTA-POTTIES, MACHINERY, EQUIPMENT, CONSTRUCTION MATERIALS, ETC.

16. PLEASE NOTIFY TRCA ENFORCEMENT OFFICER (MICHEAL BRETANSKYAT 416.661.6600 X 5699) AND TRCA PROJECT MANAGER (HEATHER WRIGHT AT 416.661.6600 X 5766) 48 HOURS PRIOR.

17. AN ENVIRONMENTAL MONITOR WILL BE ON SITE, AND PROVIDE ADVICE, TO ENSURE THAT ACTIVITIES THAT COULD HAVE A NEGATIVE IMPACT TO THE NATURAL ENVIRONMENT ARE EFFECTIVELY MITIGATED AS CONSTRUCTION PROCEEDS. THE ENVIRONMENTAL MONITOR SHALL NOTIFY THE TRCA ENFORCEMENT OFFICER AND PROJECT MANAGER IF AN ISSUE ARISES.

18. NO ACCESS ROAD FOR CONSTRUCTION VEHICLES PERMITTED.

19. TO AVOID INTERFERENCE WITH THE EGGS, NESTS OR YOUNG OF BIRDS PROTECTED UNDER THE FEDERAL MIGRATORY BIRDS CONVENTION ACT, REMOVALS SHOULD NOT OCCUR FROM MAY 1 TO AUGUST 1 OF ANY GIVEN YEAR. IDEALLY, REMOVALS SHOULD OCCUR FROM AUGUST THROUGH DECEMBER TO AVOID INTERFERENCE WITH ALL NESTING BIRDS. SHOULD REMOVALS BE REQUIRED WITHIN THE MAY 1 TO AUGUST 1 BREEDING PERIOD, A QUALIFIED AVIAN BIOLOGIST SHOULD CONDUCT A THOROUGH SURVEY IMMEDIATELY PRIOR TO THE DESIRED TREE REMOVAL DATE TO CONFIRM PRESENCE OR ABSENCE OF PROTECTED SPECIES. IF PROTECTED SPECIES ARE PRESENT, REMOVALS CANNOT OCCUR WITHOUT A PERMIT FROM THE CANADIAN WILDLIFE SERVICE.

20. IF ANY DEBRIS IS TO BYPASS THE CONTAINMENT AREA AND ENTER THE WATER COURSE, THE CONTRACTOR SHALL COLLECT IT BY HAND.

21. SITE RESTORATION OF ALL DISTURBED AREA SHALL BE IN ACCORDANCE WITH TRCA POST- CONSTRUCTION RESTORATION GUIDELINES (2004), INCLUDING BUT NOT LIMITED TO REMOVAL OF TEMPORARY FILL MATERIALS, SEEDING USING TRCA APPROVED NATIVE SEED MIXTURE AND PLANTING OF NATIVE SPECIES TREES.

22. CONTAINMENT SYSTEM WILL BE INSPECTED DAILY TO ENSURE EFFECTIVE CONTAINMENT.

23. NO VEGETATION IS TO BE REMOVED.

AS-BUILT

METRIC
ALL DIMENSIONS SHOWN HERE ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

CONSULTANTS

Associated Engineering

DIGITAL INFORMATION		No.	DATE	REVISIONS	INITIAL	SIGNED
ELEVATION & DETAILS	y13117det.dgn					
DESIGN	y13117pd.dgn					
KEYMAP	y13117key.dgn	3	JAN.31/20	AS-BUILT	C.C.	S.N.
MAPPING	y13117top.dgn	2	SEP.25/18	ISSUED FOR CONSTRUCTION	C.C.	S.N.
STREETLINE	y13117psl.dgn	1	JUN.1/18	ISSUED FOR TENDER	C.C.	S.N.

TORONTO Engineering & Construction Services

ORIGINALLY SEALED BY S.S. NAGI DATED 2018-09-25

ORIGINALLY SEALED BY C.T. CONCOLINO DATED 2018-09-26

FRANK CLARIZIO, P.Eng. DIRECTOR,DESIGN & CONSTRUCTION, MUNICIPAL INFRASTRUCTURE & GARDINER PROJECT, ENGINEERING & CONSTRUCTION SERVICES

MICHAEL D'ANDREA, M.E.SC., P.Eng CHIEF ENGINEER & EXECUTIVE DIRECTOR, ENGINEERING AND CONSTRUCTION SERVICE

JODIE ATKINS, P.Eng. ACTING MANAGER, STRUCTURE & EXPRESSWAYS, ENGINEERING AND CONSTRUCTION SERVICES

TWYN RIVERS DR OVER ROUGE RIVER BRIDGE

BRIDGE REPAIRS
GENERAL ARRANGEMENT

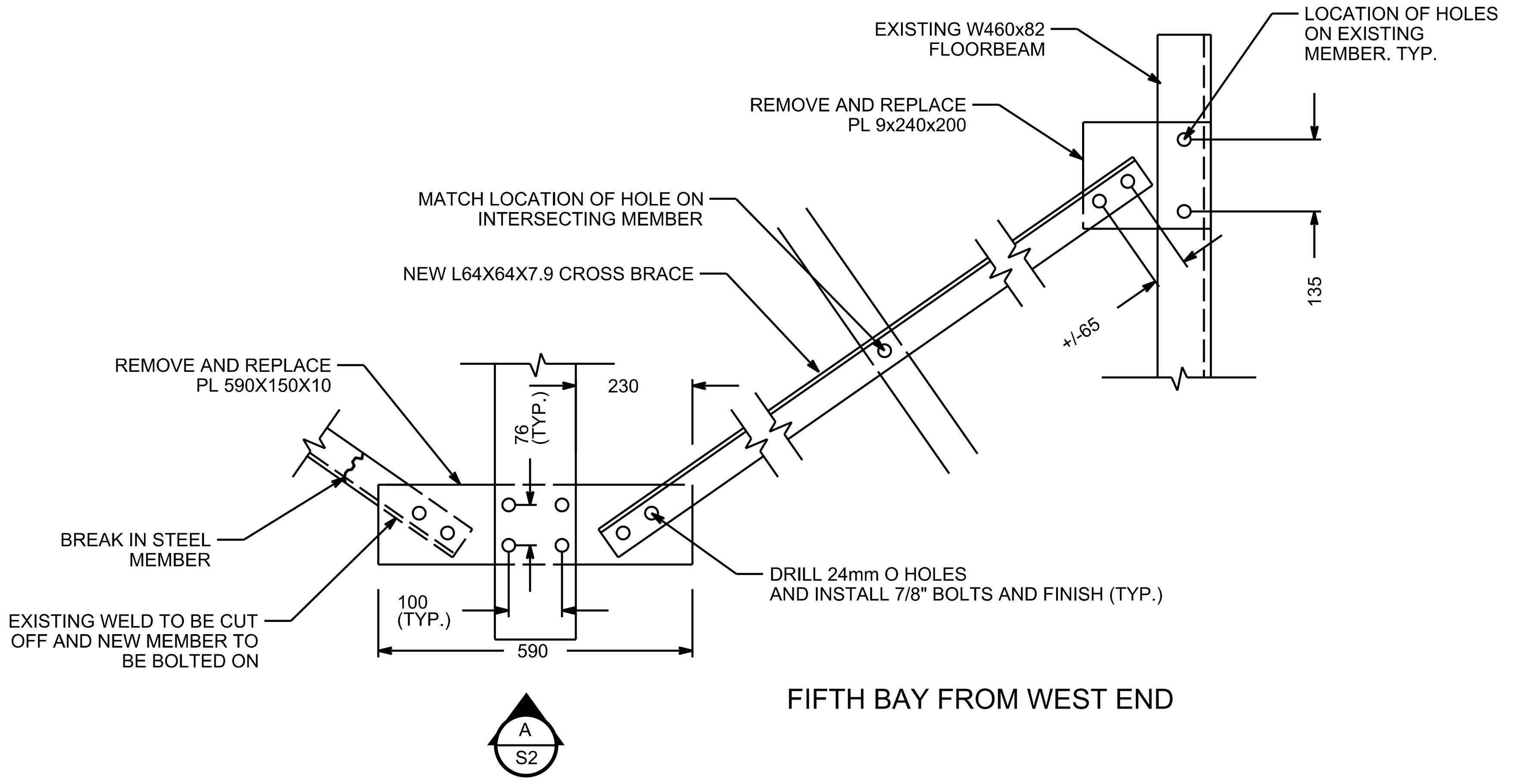
DESIGN	S.Z.	DRAWN	S.Z.	CHECKED	S.N.	CONTRACT No. 17ECS-TI-07BE
SCALE	AS SHOWN			DRAWING NUMBER	803-S-5003-14	SHEET S1
DATE	JANUARY, 2020					

NOTES:

1. FOR GENERAL NOTES SEE DRAWING 803-S5003-14

2. ALL DIMENSIONS ARE APPROXIMATE AND ARE TO BE VERIFIED BY CONTRACTOR IN THE FIELD PRIOR TO UNDERTAKING WORK

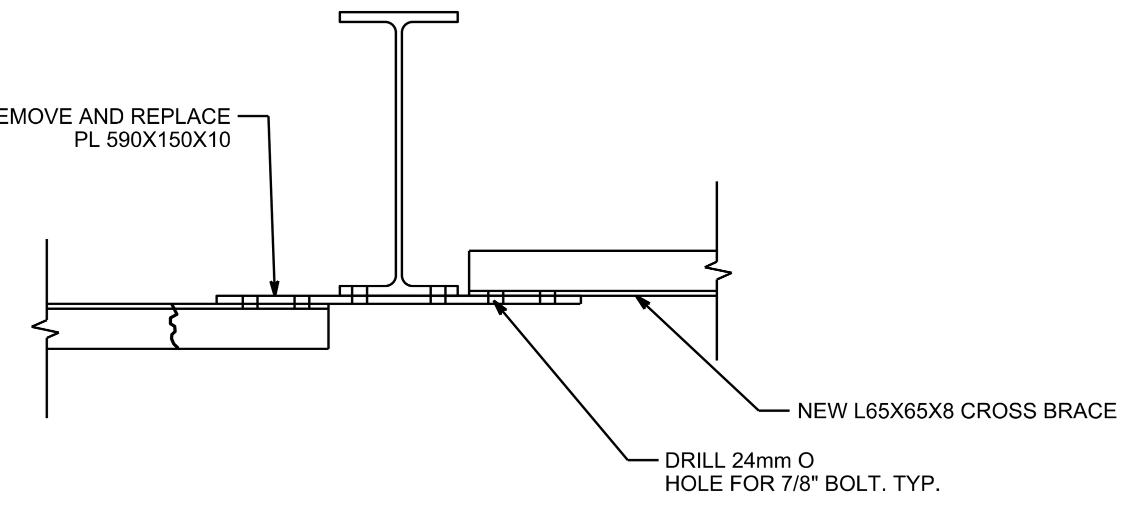
3. FOLLOWING WELDING, TOP FLANGE, WELD, AND AREAS OF GRATING WITH DAMAGED GALVANIZING ARE TO BE COATED WITH TWO COATS ZINC RICH SPRAY IN ACCORDANCE WITH THE CONTRACT SPECIFICATIONS.



PLAN

FIFTH BAY FROM WEST END - SWAY-BRACE CONNECTION 1/S2

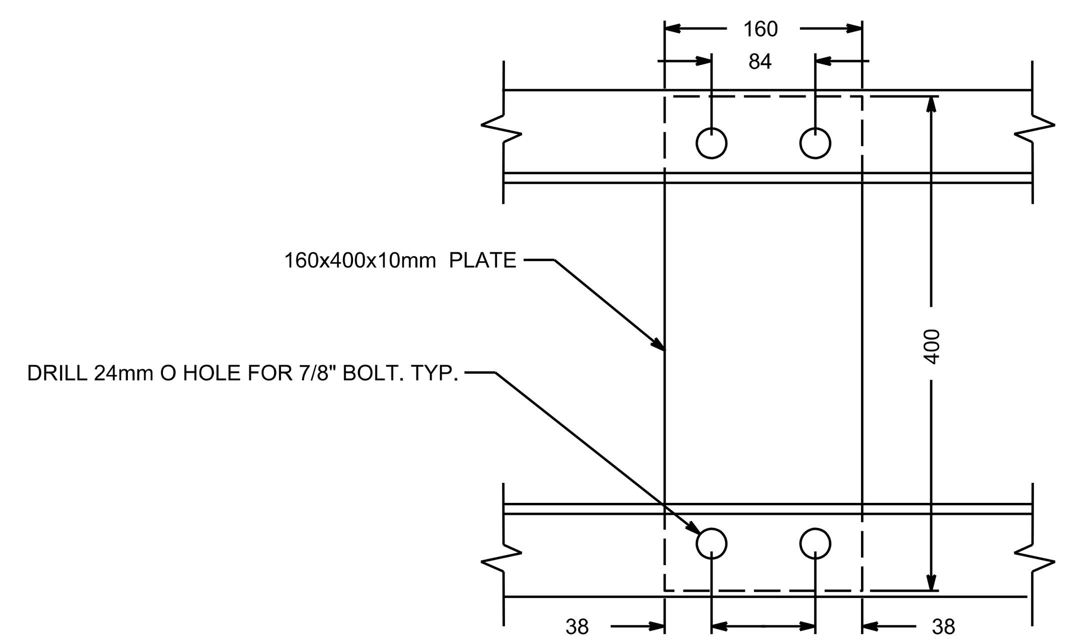
1:20



ELEVATION

SWAY-BRACE CONNECTION A/S2

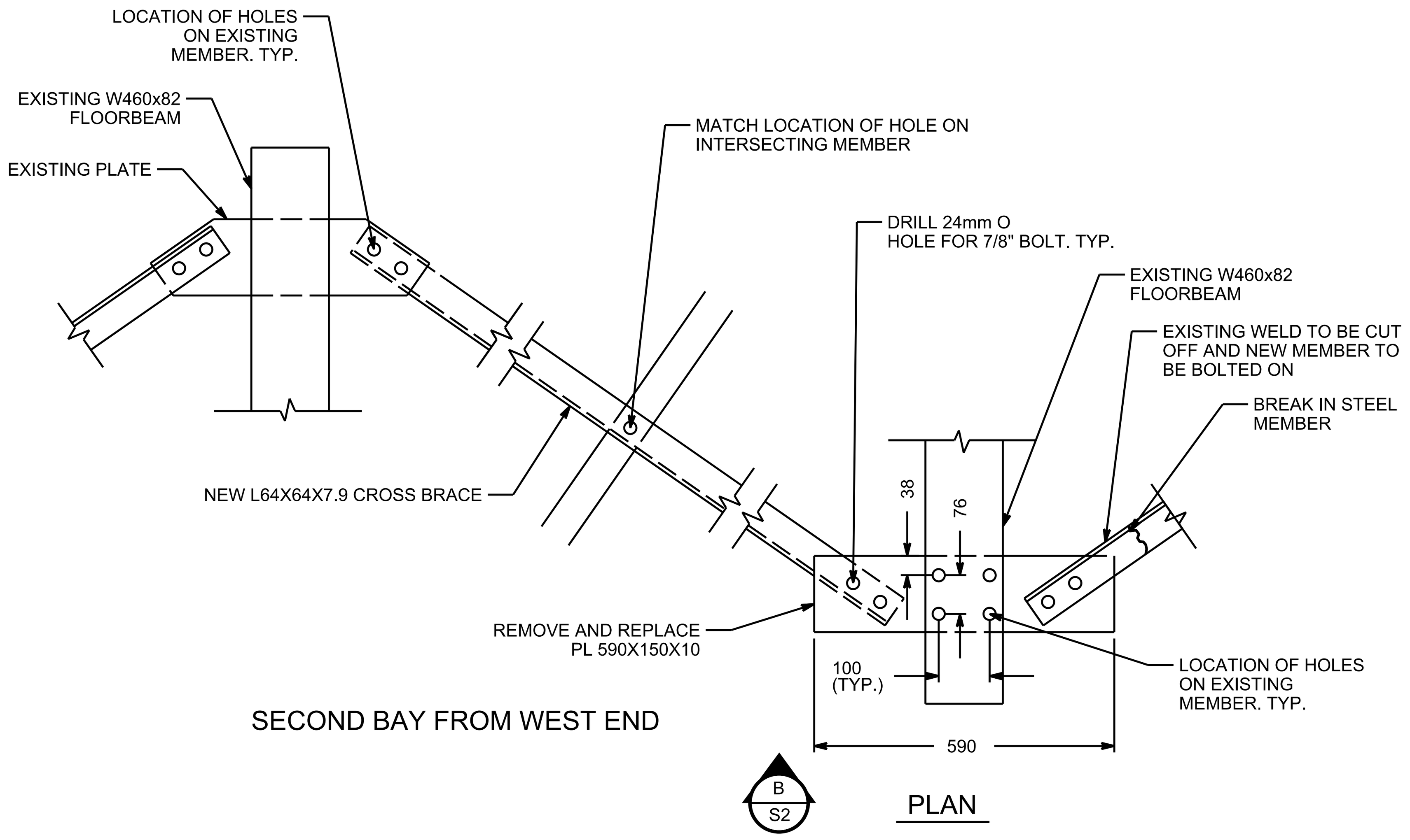
1:20



PLAN

TIE PLATE 3/S2

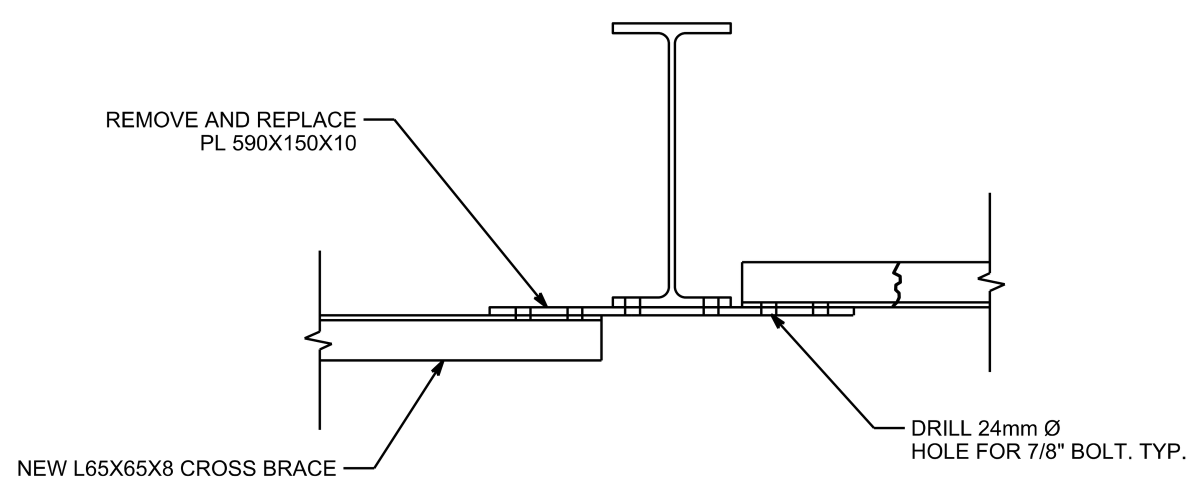
1:10



PLAN

SECOND BAY FROM SOUTH - SWAY-BRACE CONNECTION 2/S2

1:20



ELEVATION

SWAY-BRACE CONNECTION B/S2

1:20

AS-BUILT

METRIC
ALL DIMENSIONS SHOWN HERE ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

CONSULTANTS

Associated Engineering

No.	DATE	REVISIONS	INITIAL	SIGNED
3	JAN.31/20	AS-BUILT	S.R.	S.N.
2	SEP.25/18	ISSUED FOR CONSTRUCTION	S.R.	S.N.
1	JUN.1/18	ISSUED FOR TENDER	S.R.	S.N.

DETAILS y13117det.dgn

DIGITAL INFORMATION

TORONTO Engineering & Construction Services

ORIGINALLY SEALED BY S.S. NAGI DATED 2018-09-25

ORIGINALLY SEALED BY C.T. CONCOLINO DATED 2018-09-26

FRANK CLARIZIO, P.Eng. DIRECTOR,DESIGN & CONSTRUCTION, MUNICIPAL INFRASTRUCTURE & GARDINER PROJECT, ENGINEERING & CONSTRUCTION SERVICES

MICHAEL D'ANDREA, M.E.SC., P.Eng. CHIEF ENGINEER & EXECUTIVE DIRECTOR, ENGINEERING AND CONSTRUCTION SERVICE

LUIS DE JESUS, P.Eng. MANAGER, STRUCTURE & EXPRESSWAYS, ENGINEERING AND CONSTRUCTION SERVICES

TWYN RIVERS DR OVER ROUGE RIVER BRIDGE

BRIDGE REPAIRS

DETAILS

DESIGN	S.Z.	DRAWN	S.Z.	CHECKED	S.N.	CONTRACT No. 17ECS-TI-06BE
SCALE	AS SHOWN			DRAWING NUMBER	803-S-5003-15	SHEET S2
DATE	JANUARY, 2020					

AS-BUILT

METRIC
ALL DIMENSIONS SHOWN HERE ARE IN MILLIMETERS UNLESS OTHERWISE NOTED

CONSULTANTS

Associated Engineering

	3	JAN.31/20	AS-BUILT	C.C.	S.N.
MAPPING y13117top.dgn	2	SEP.25/18	ISSUED FOR CONSTRUCTION	C.C.	S.N.
STREETLINE y13117psl.dgn	1	JUN.1/18	ISSUED FOR TENDER	C.C.	S.N.
DIGITAL INFORMATION	No.	DATE	REVISIONS	INITIAL	SIGNED

TORONTO Engineering & Construction Services

ORIGINALLY SEALED BY S.S. NAGI DATED 2018-09-25

ORIGINALLY SEALED BY C.T. CONCOLINO DATED 2018-09-26

MICHAEL D'ANDREA, M.E.SC., P.Eng. CHIEF ENGINEER & EXECUTIVE DIRECTOR, ENGINEERING AND CONSTRUCTION SERVICE

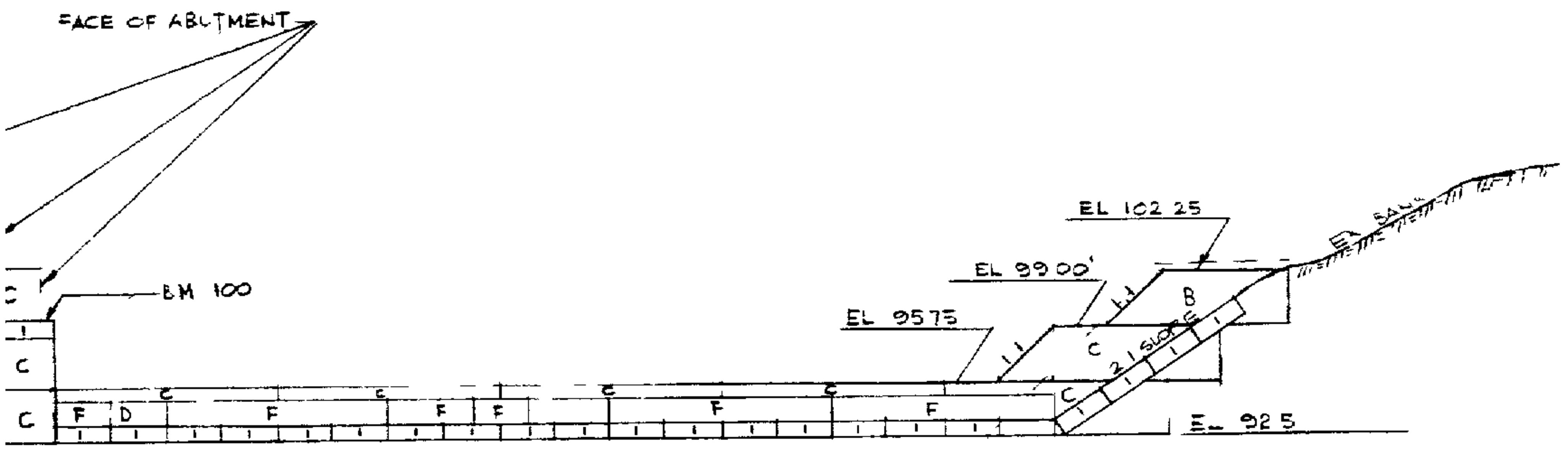
FRANK CLARIZIO, P.Eng. DIRECTOR,DESIGN & CONSTRUCTION, MUNICIPAL INFRASTRUCTURE & GARDINER PROJECT, ENGINEERING & CONSTRUCTION SERVICES

JODIE ATKINS, P.Eng. ACTING MANAGER, STRUCTURE & EXPRESSWAYS, ENGINEERING AND CONSTRUCTION SERVICES

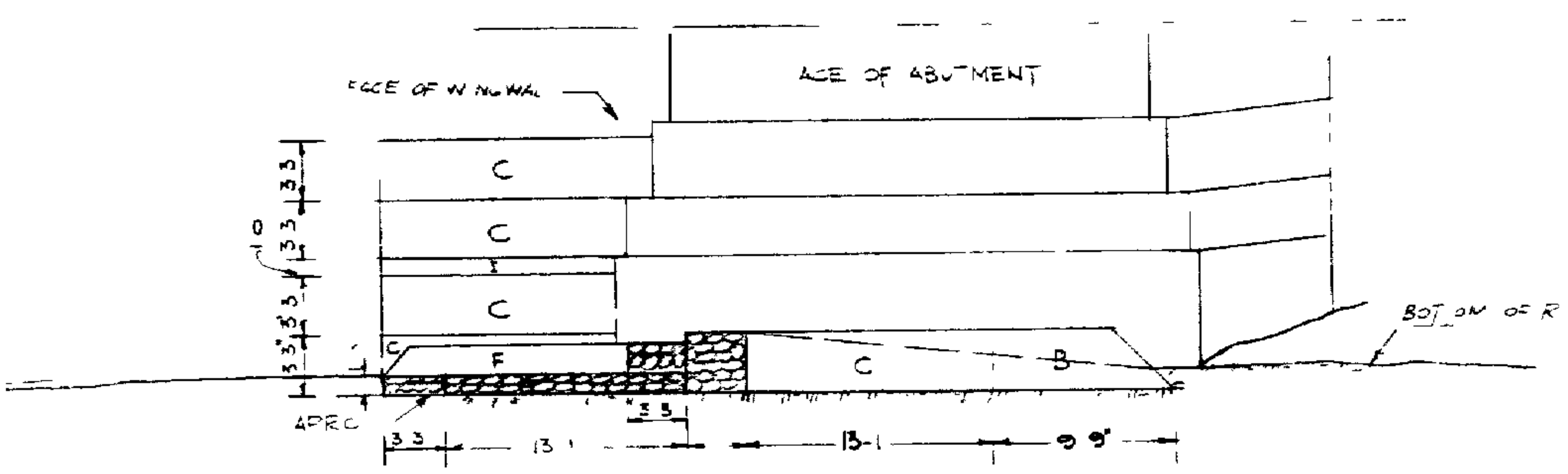
TWYN RIVERS DR OVER ROUGE RIVER BRIDGE

BRIDGE REPAIRS
TRAFFIC CONTROL PLAN

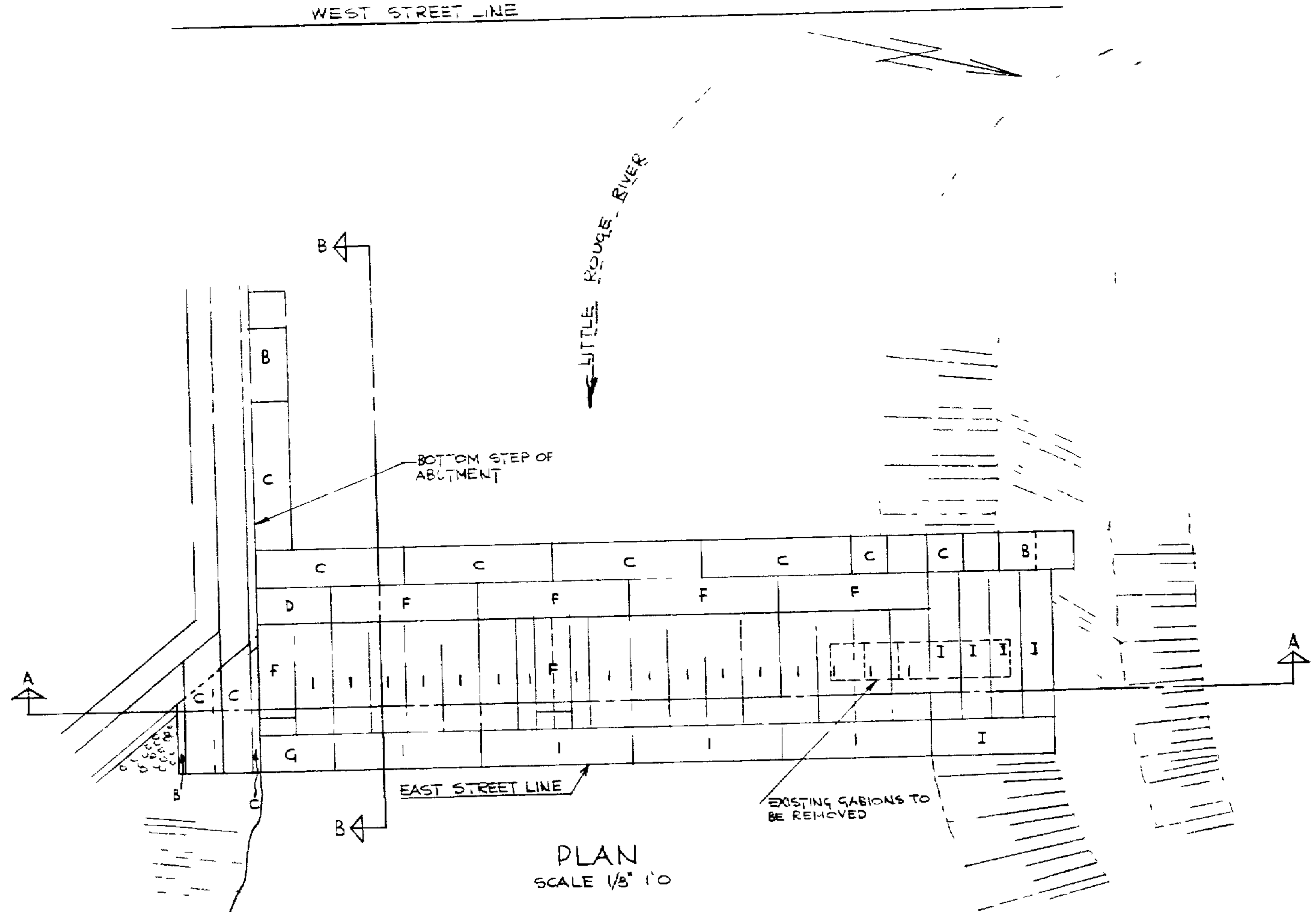
DESIGN	S.R.	DRAWN	A.W.	CHECKED	S.N.	CONTRACT No.	17ECS-TI-07BE
SCALE	AS SHOWN			DRAWING NUMBER	803-S-5003-16	SHEET	S3
DATE	JANUARY, 2020						



SECTION A A
SCALE 1/8"=1'0"



SECTION B B
SCALE 1/8" 1'0



PLAN
SCALE 1/8" 1'0

TYPE	DIMENSIONS	NO
B	9 9" x 3 3 x 5	5
C	13-1' x 3 3 x 3	11
I	3 x 3 3 x 1 0	28
F	13' x 3 3 x	6
D	6 6' x 3 3 x 1 6	1
G	6 6 3	1
H	9 9 x 3 3	1

NOTE METRIC SIZE GABIONS TO BE USED

08506 V01

NO	REVISION	DATE	BY	CHKD
1	LOCATION & NUMBER OF GABIONS AMENDED	MARCH 66	E T	N C

TOWNSHIP OF SCARBOROUGH
WORKS DEPARTMENT

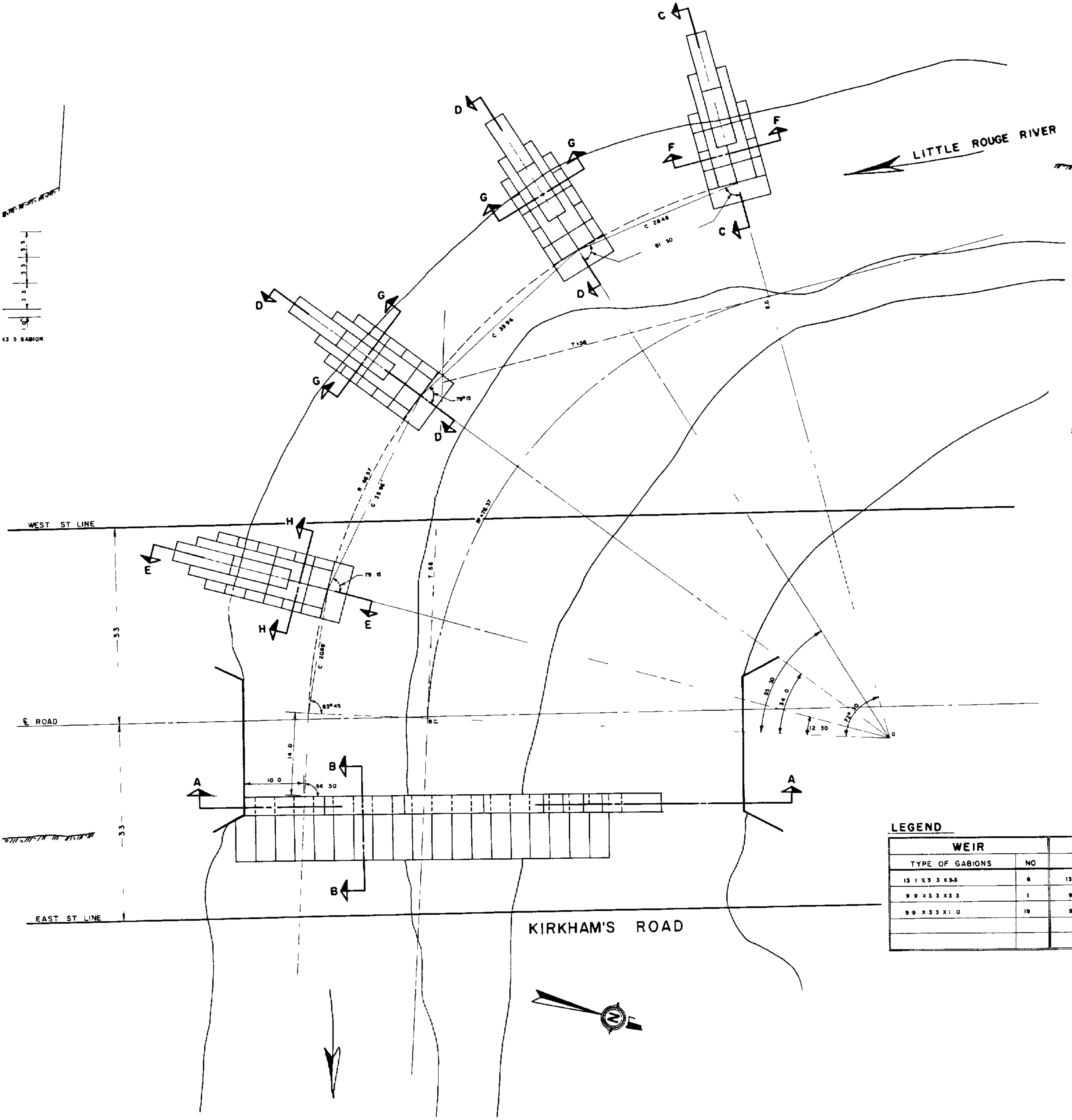
PROPOSED RIVER WORKS

LITTLE ROUGE RIVER

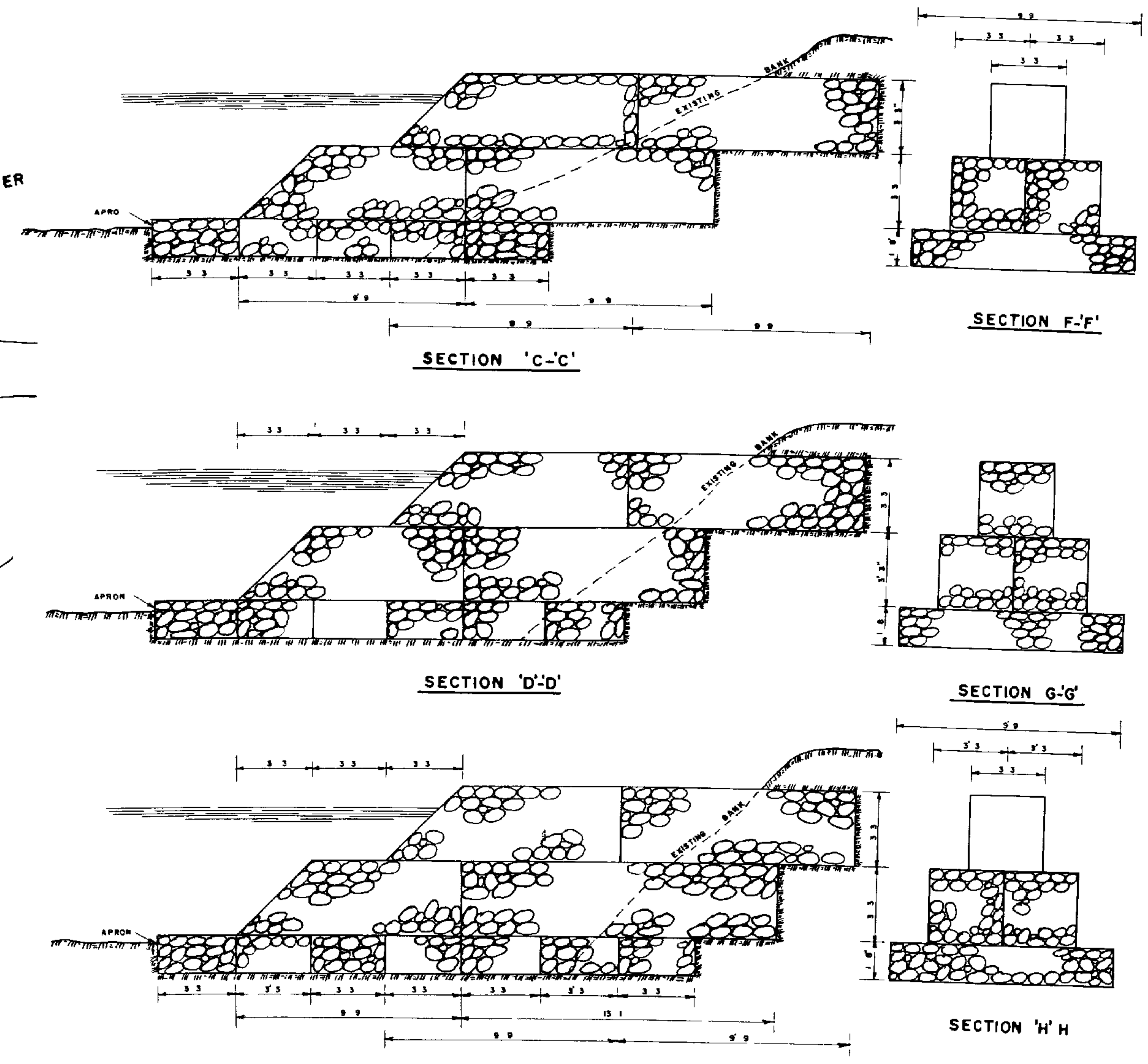
HILLSIDE BRIDGE

5006-S-1

SCALES AS SHOWN
DRAWN BY E TOBIA
DATE JAN 27th 66
CHECKED BY
DATE
DIRECTOR OF OPERATIONS
CONSTRUCTION ENGINEER
DATE
FILE No 2856 E



PLAN
SCALE 3/32 1 0



SECTION 'C-'C'

SECTION F-'F'

SECTION 'D'-D'

SECTION G-'G'

SECTION 'E'-'E'

SECTION 'H' H

GROINS
SCALE 1/4" 1 0"

LEGEND

WEIR		GROINS	
TYPE OF GABIONS	NO	TYPE OF GABIONS	NO
13 1 X 3 3 X 3 3	6	13 1 X 3 3 X 3 3	2
9 9 X 3 3 X 3 3	1	9 9 X 3 3 X 3 3	22
9 9 X 3 3 X 1 0	19	9 9" X 3 3' X 1 6	24

NO.	REVISIONS	DATE	BY	CHKD.

08500 V01

TOWNSHIP OF SCARBOROUGH
WORKS DEPARTMENT

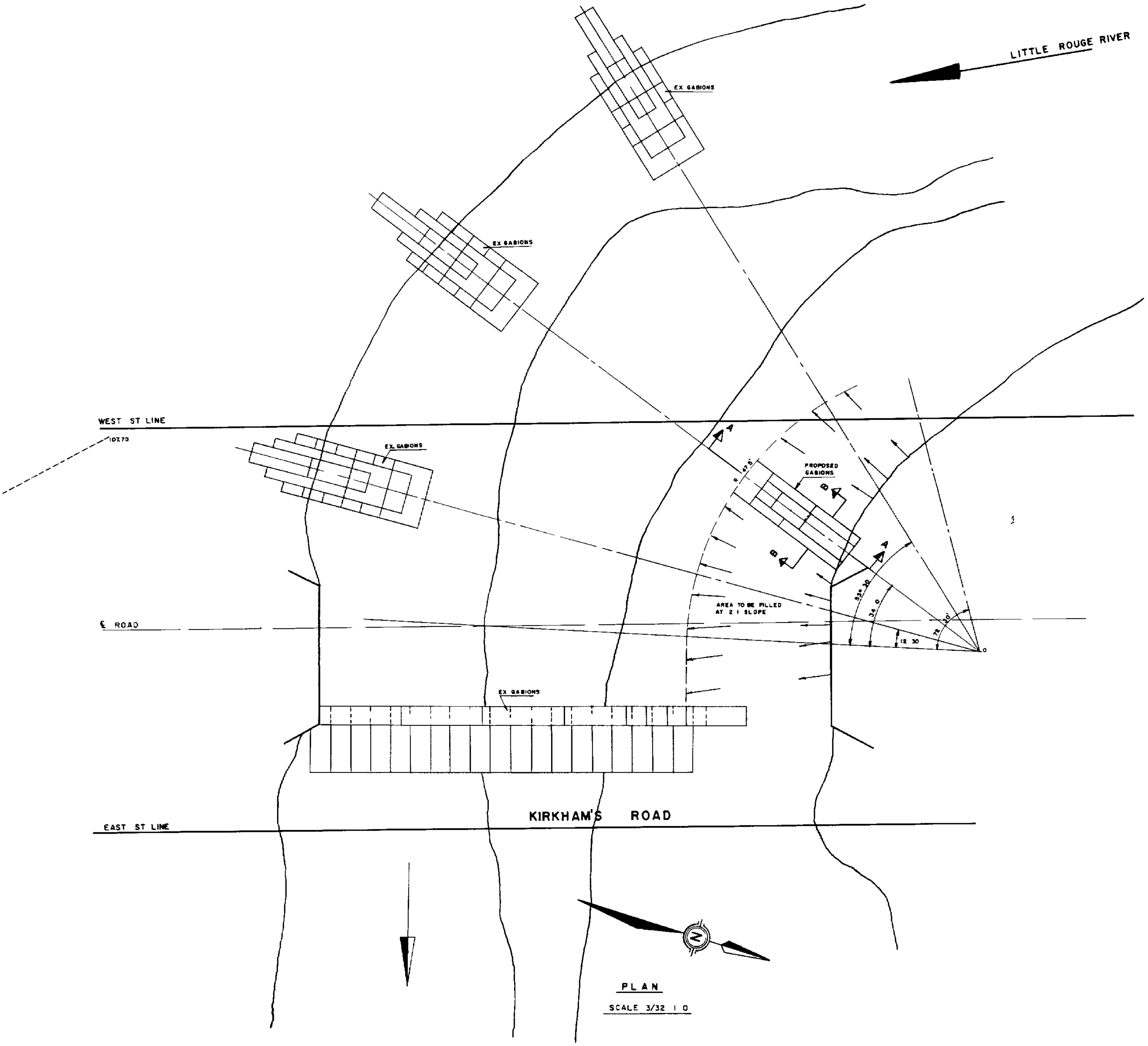
PROPOSED RIVER WORKS

LITTLE ROUGE RIVER

HILLSIDE BRIDGE

5006-S-2

SCALE AS SHOWN	DRAWN BY [signature] DATE Sept 13th 1963 CHECKED BY DATE	DEPUTY COMM OF WORKS SEWER OR ROAD CONST ENG DATE	PLAN Nº 2856 G



08501 V01

5006-S-3

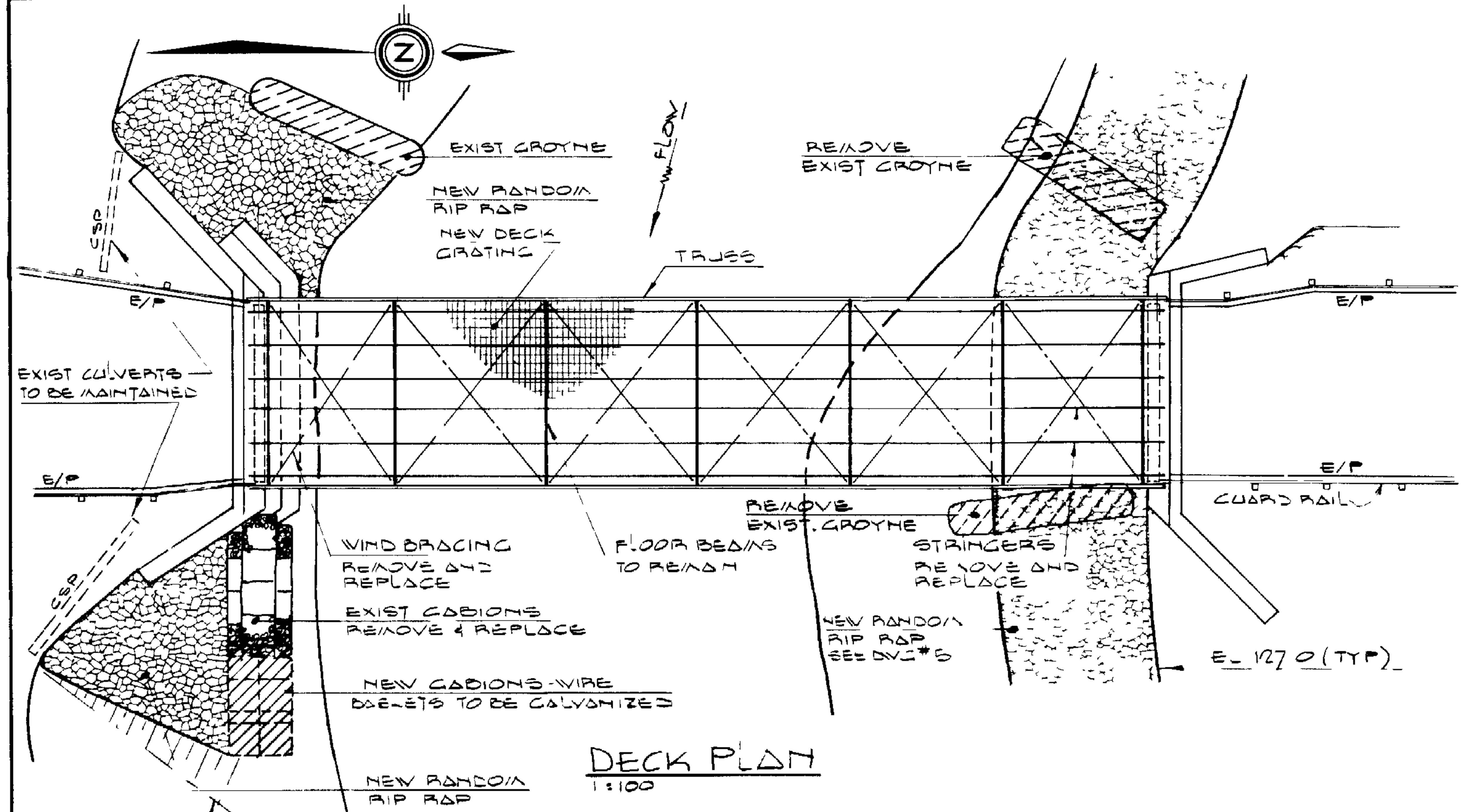
SCARBOROUGH
WORKS DEPARTMENT

PROPOSED RIVER WORKS

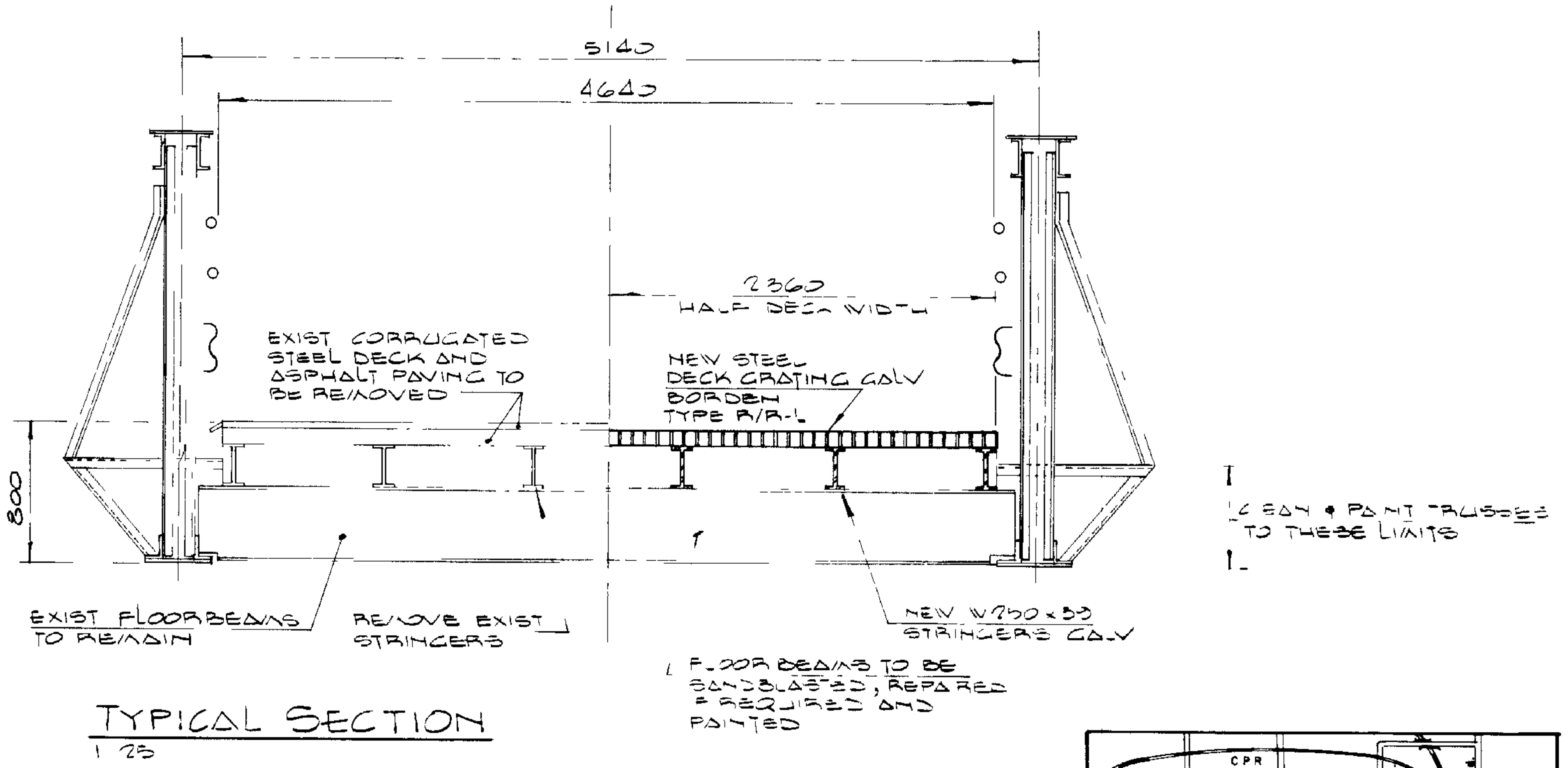
LITTLE ROUGE RIVER

HILLSIDE BRIDGE

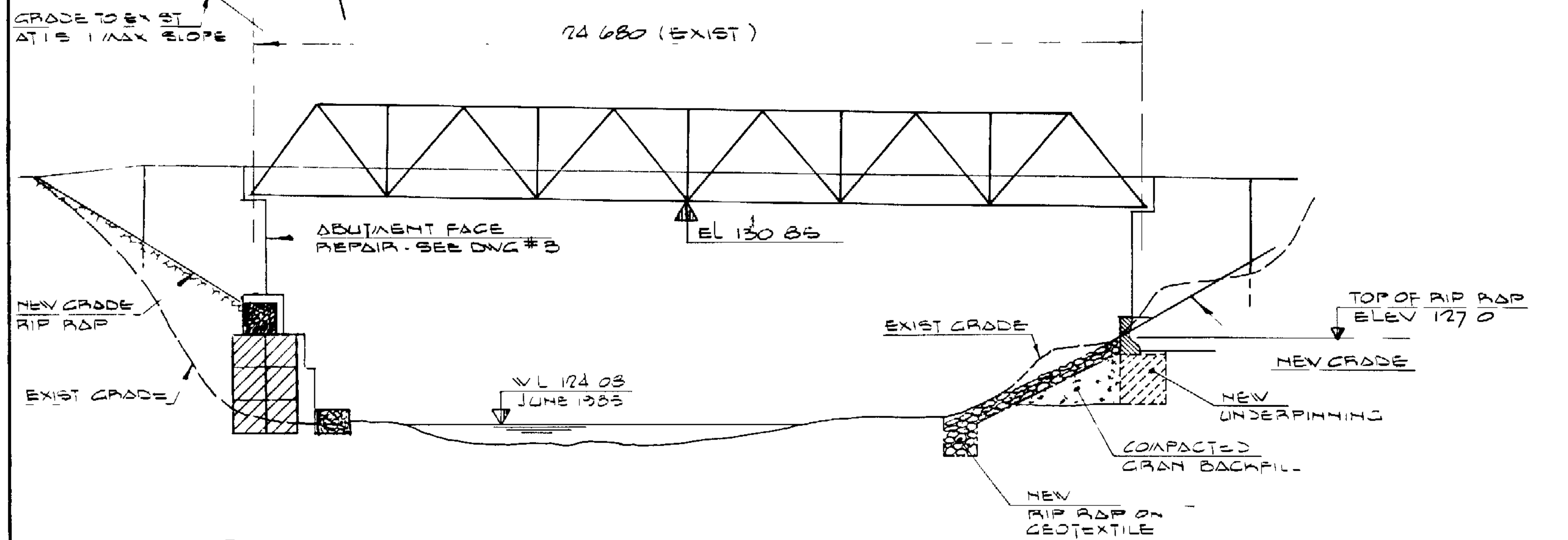
SCALE AS SHOWN	DRAWN BY C AOWN DATE OCT 1969 CHECKED BY DATE	DIRECTOR OF OPERATIONS DATE PLAN № 2856



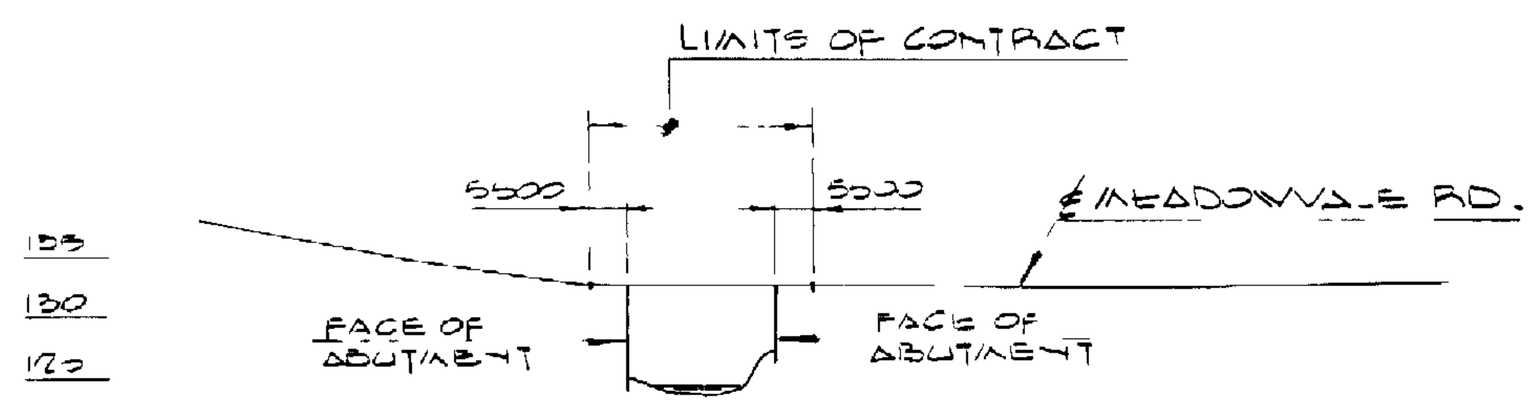
DECK PLAN
1:100



TYPICAL SECTION
1:25



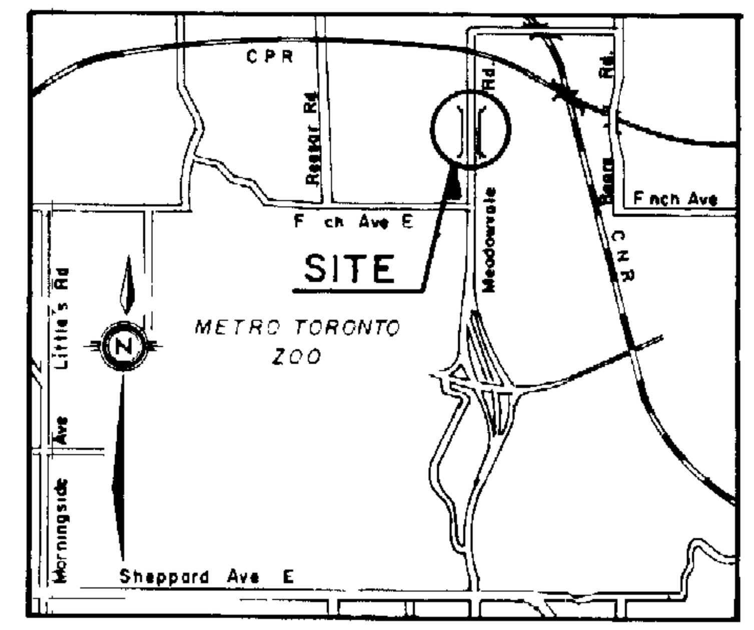
ELEVATION
1:100



℄ ROAD PROFILE
1:200 HOR
1:50 VER

SCOPE OF WORK

1. CLOSE BRIDGE TO ALL TRAFFIC
2. REMOVE EXISTING CORRUGATED STEEL DECK AND ASPHALT PAVING
3. REMOVE EXISTING STRINGERS AND WINDBRACING
4. REMOVE BALLAST WALLS AND BEARING SEATS AT BOTH ABUTMENTS AND RE-BUILD
5. INSPECT FLOOR BEAMS AND LOWER SECTION OF TRUSSES, REPAIR IF REQUIRED, SANDBLAST AND APPLY NEW COATING
6. REMOVE TWO GROYNES IN FRONT OF NORTH ABUTMENT
7. UNDERPIN NORTH ABUTMENT FOOTING AND SOUTH ABUTMENT WEST WING WALL FOOTING
8. REPAIR CONCRETE IN SOUTH ABUTMENT BY RE-FACING
9. REMOVE AND RE-BUILD GABIONS
10. CONSTRUCT NEW RIP-RAP SLOPE PAVING ON GEOTEXTILE IN FRONT OF NORTH ABUTMENT AND ON BOTH SIDES OF SOUTH ABUTMENT
11. FABRICATE, DELIVER AND ERECT NEW STRINGERS, WIND BRACING AND GRATING
12. ADJUST PAVEMENT GRADE TO SUIT



KEY PLAN

GENERAL NOTES:

1. CLASS OF CONCRETE
   ALL NEW CONC SHALL BE 30MPa
2. REINFORCING STEEL
   GRADE 400
   BAR MARK WITH SUFFIX C DENOTES COATED BAR
3. CLEAR COVER TO REINF STEEL
   FOOTINGS 100 mm ± 25
   FRONT FACE OF ABUTMENT 80 mm ± 20
   REMAINDER 70 mm ± 20
4. CONSTRUCTION NOTES
   THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS OF THE EXISTING WORK AND ALL DETAILS ON SITE AND REPORT ANY DISCREPANCY TO THE ENGINEER BEFORE PROCEEDING WITH THE REPAIR WORK.

LIST OF DRAWINGS:

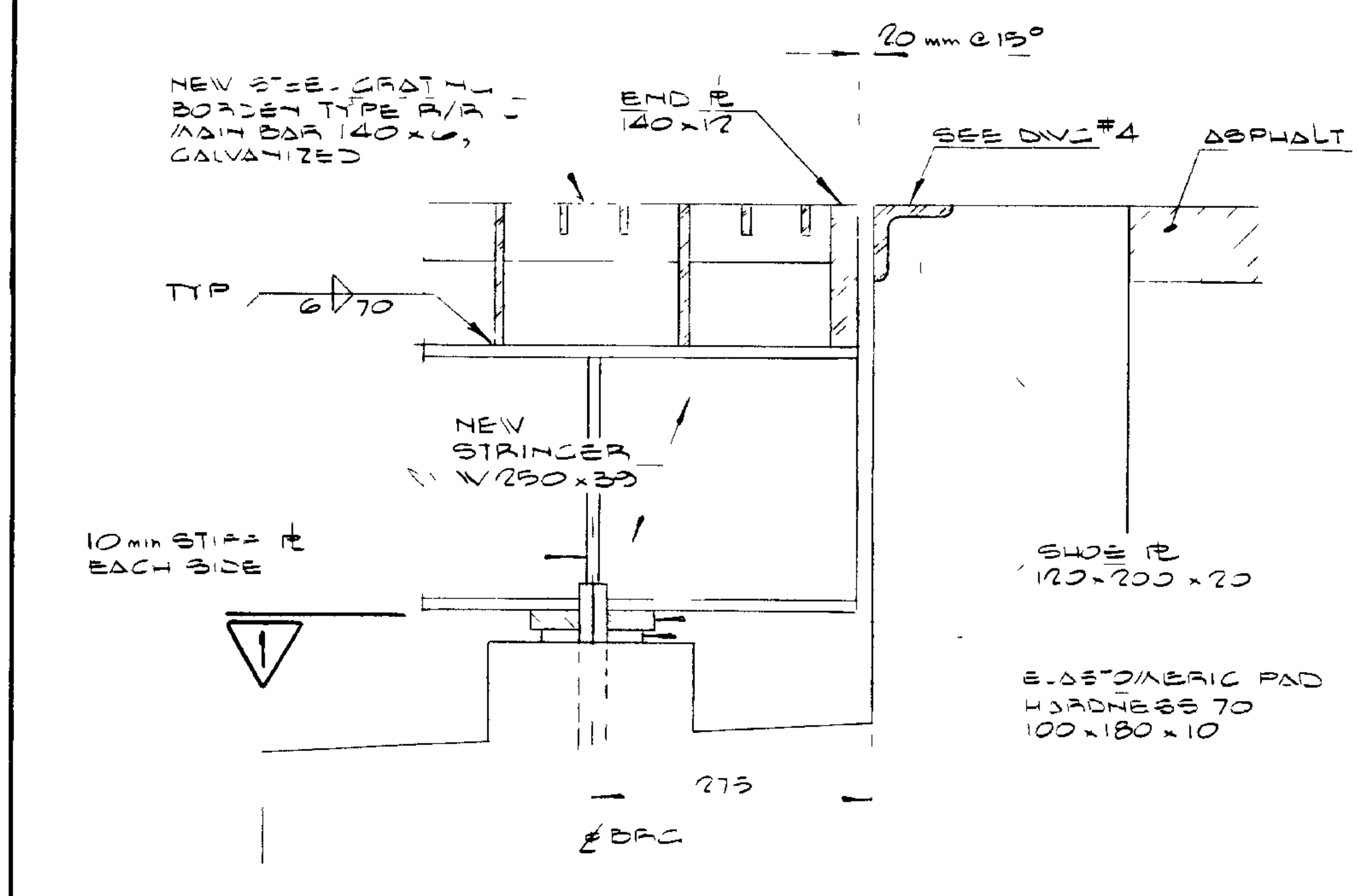
1. GENERAL ARRANGEMENT
2. STRUCTURAL STEEL
3. SOUTH ABUTMENT
4. NORTH ABUTMENT
5. RIP RAP PLAN

08499 V01

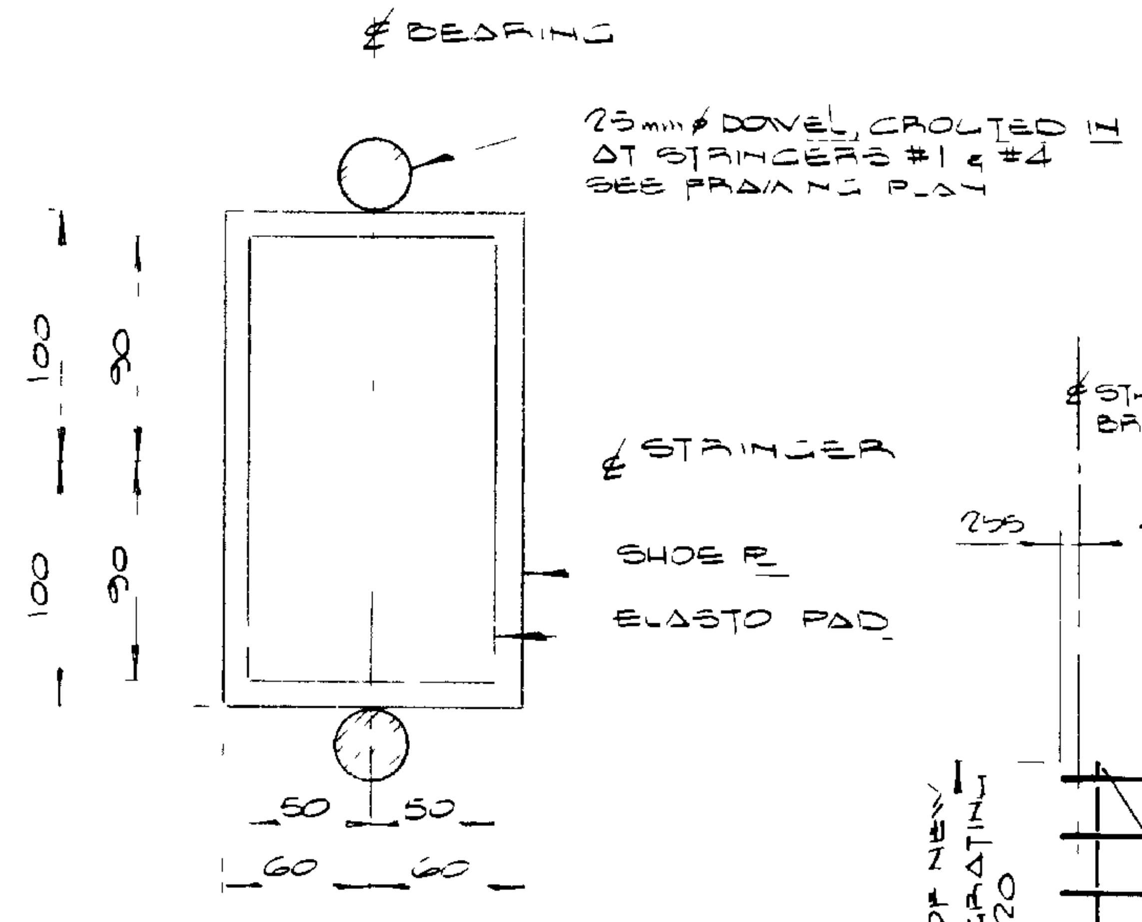
5006-S-4

APPROVED	B FARAGO (Registered Professional Engineer, Province of Ontario)	CITY OF SCARBOROUGH WORKS DEPARTMENT	Wylie & Ufnal consulting engineers	No / BY / REVISIONS / DATE	DESIGN; DRAWN G.S.; CHECKED; APPROVED B.F.; DATE AUG 1986; SCALE AS NOTED	REHABILITATION OF HILLSIDE BRIDGE — GENERAL ARRANGEMENT	PROJECT No 8527; DRAWING No 1; SHEET OF
CONSULTANT / DATE							

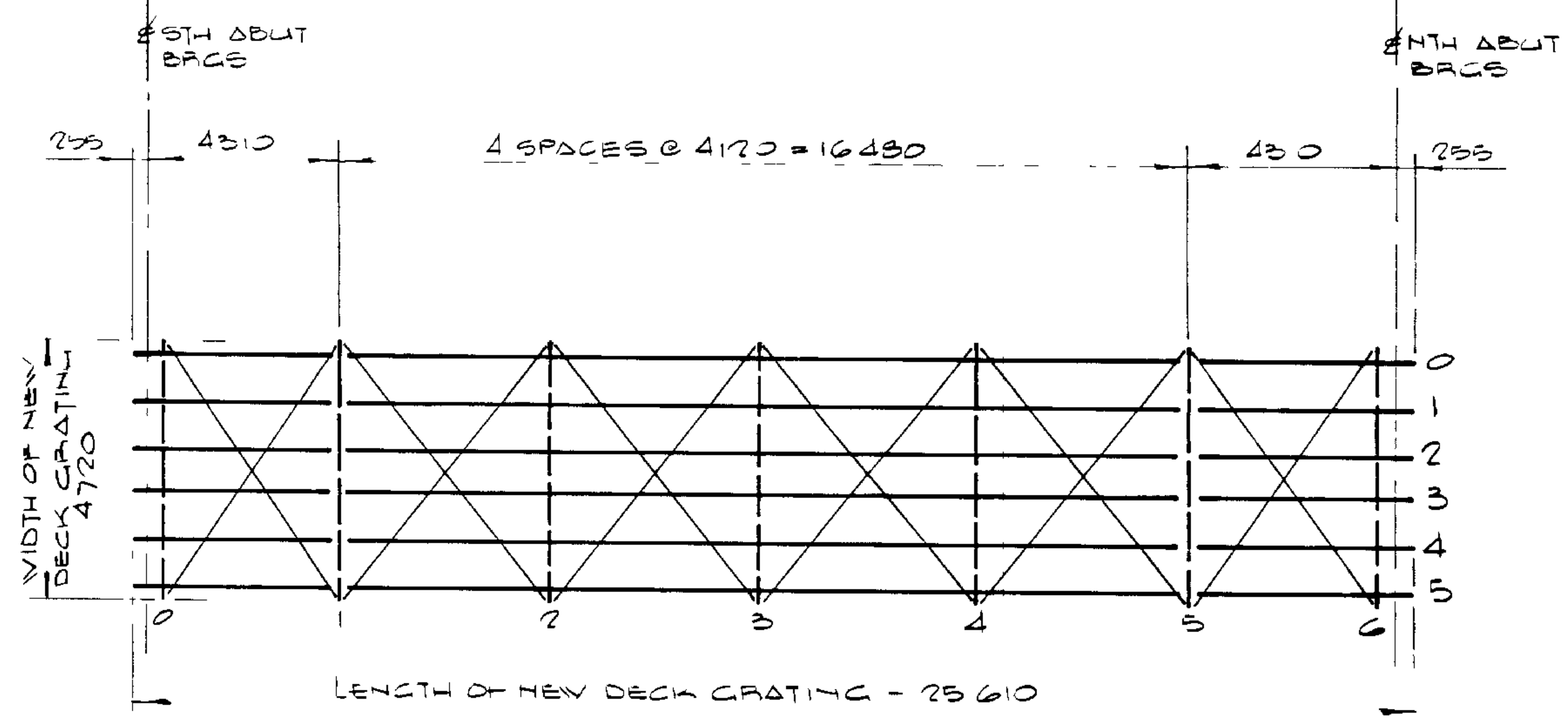
FILE No 2856A



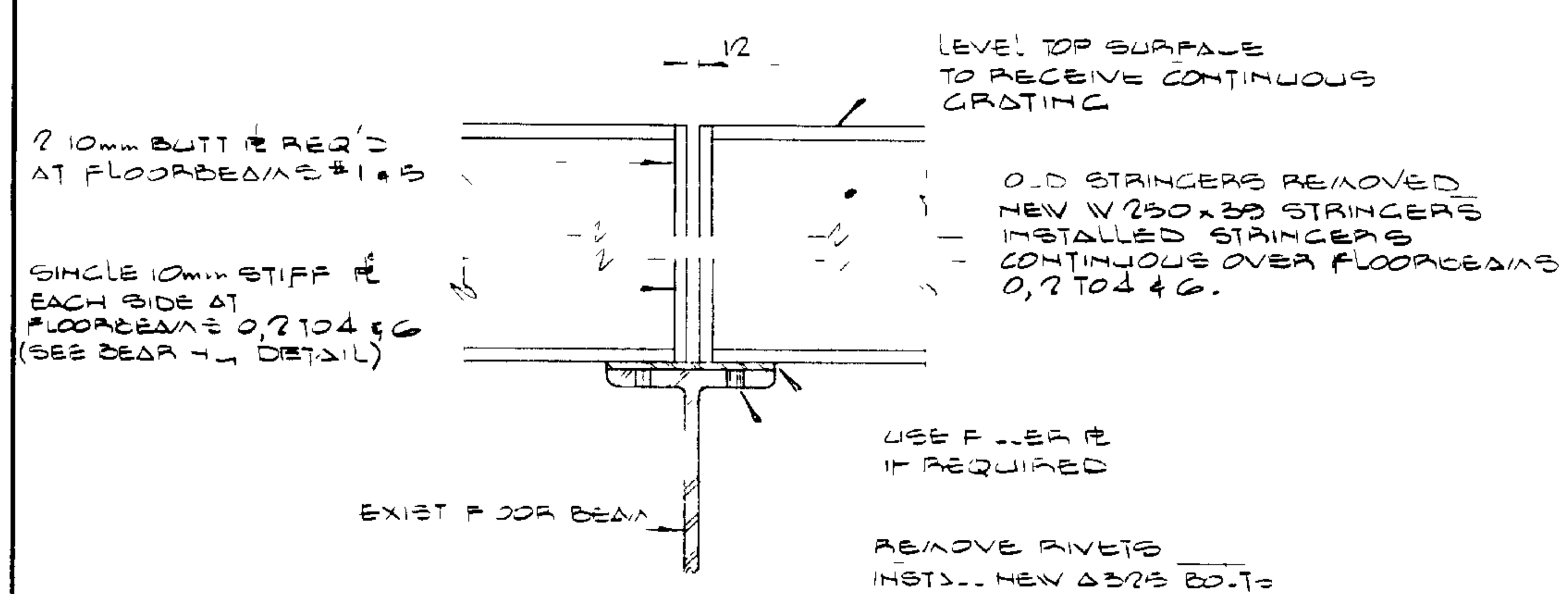
DECK JOINT & BEARING DETAIL
1:5



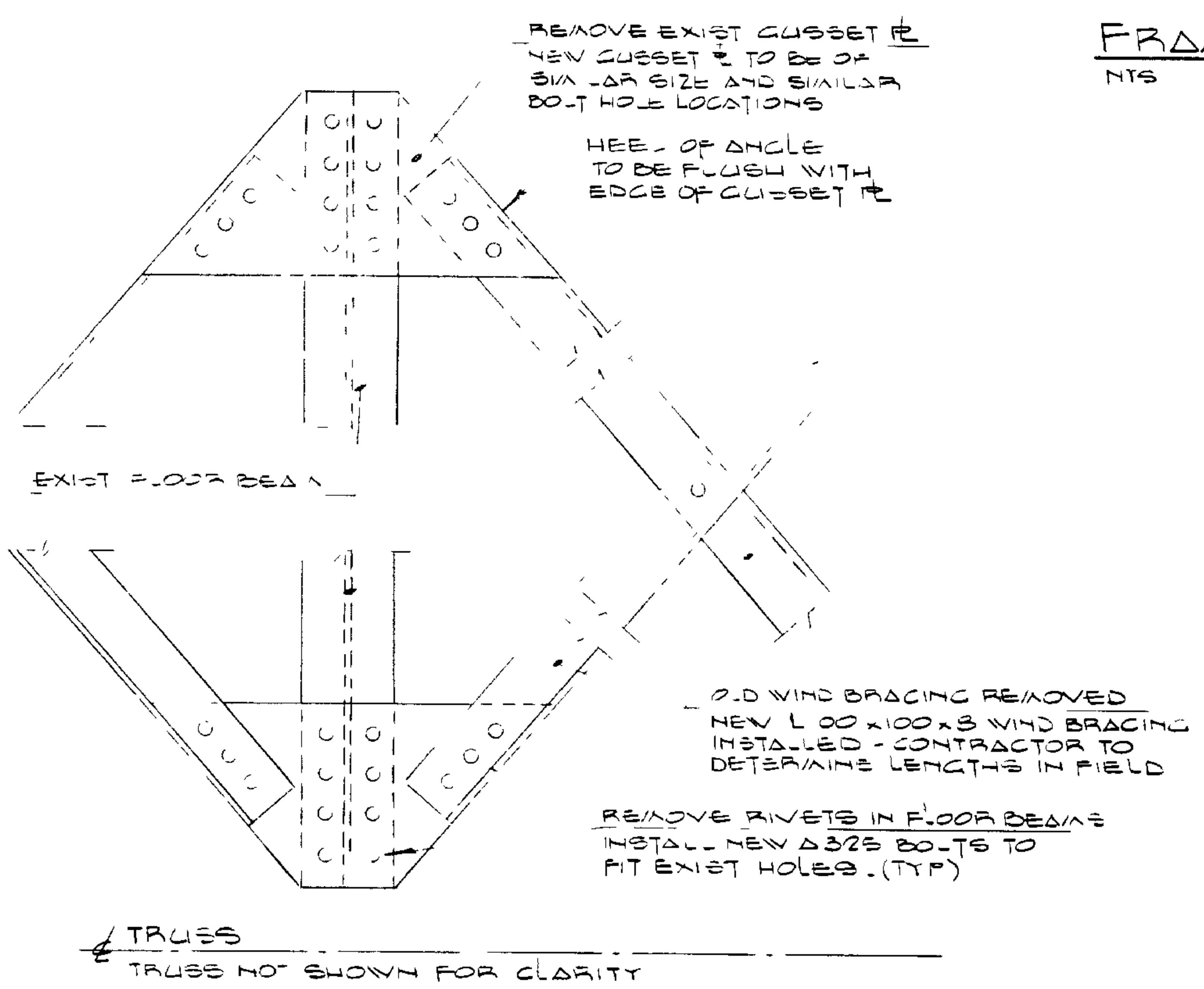
SECTION - 1
1:25



FRAMING PLAN
NTS



STRINGER TO FLOOR BEAM CONNECTION
1:5



WIND BRACE CONNECTION
1:7.5

NOTES

- STRUCTURAL STEEL SHALL CONFORM TO CSA G40.21M GRADE 300 W
- BOLTS SHALL BE ASTM A325 TYPE 3 22 mm DIA OR AS NOTED.
- GRATING SHALL BE BORDEN TYPE R/R-L, MAIN BAR SIZE 140 x 6 OR EQUAL.
- WELDING SHALL BE IN ACCORDANCE WITH CSA STANDARD W59
- OPEN STEEL GRATINGS AND STRINGERS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH CSA STANDARD G164-M1981
- FLOOR BEAMS, BRACING, GUSSETS AND BATTEN PLATES AS WELL AS THE LOWER SECTION OF THE TRUSSES TO THE TOP SURFACE OF THE FLOOR BEAM SHALL BE COATED IN ACCORDANCE WITH OPSS 911, COATING SYSTEMS T.

File No 2856B

08505 V01

5006-S-5

APPROVED			CITY OF SCARBOROUGH WORKS DEPARTMENT	Wyllie & Ufnal consulting engineers
CONSULTANT	B FARAGO — REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF ONTARIO			
DATE				

No	BY	REVISIONS	DATE

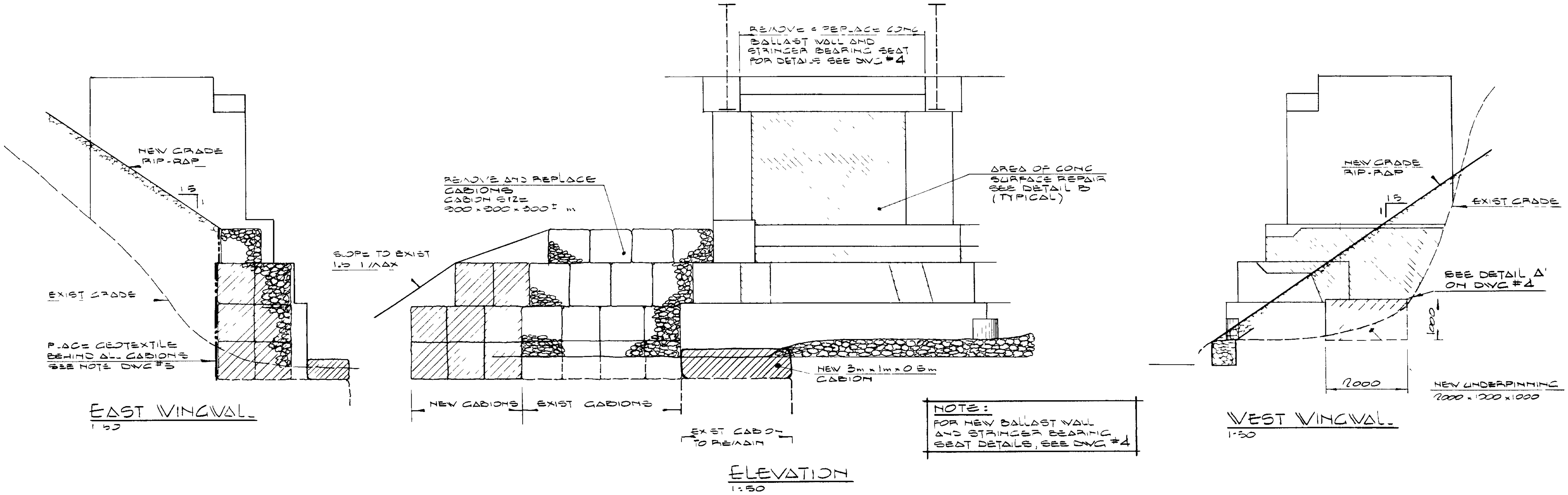
DESIGN	
DRAWN	G.J.
CHECKED	
APPROVED	B.F.
DATE	AUG 1985
SCALE	

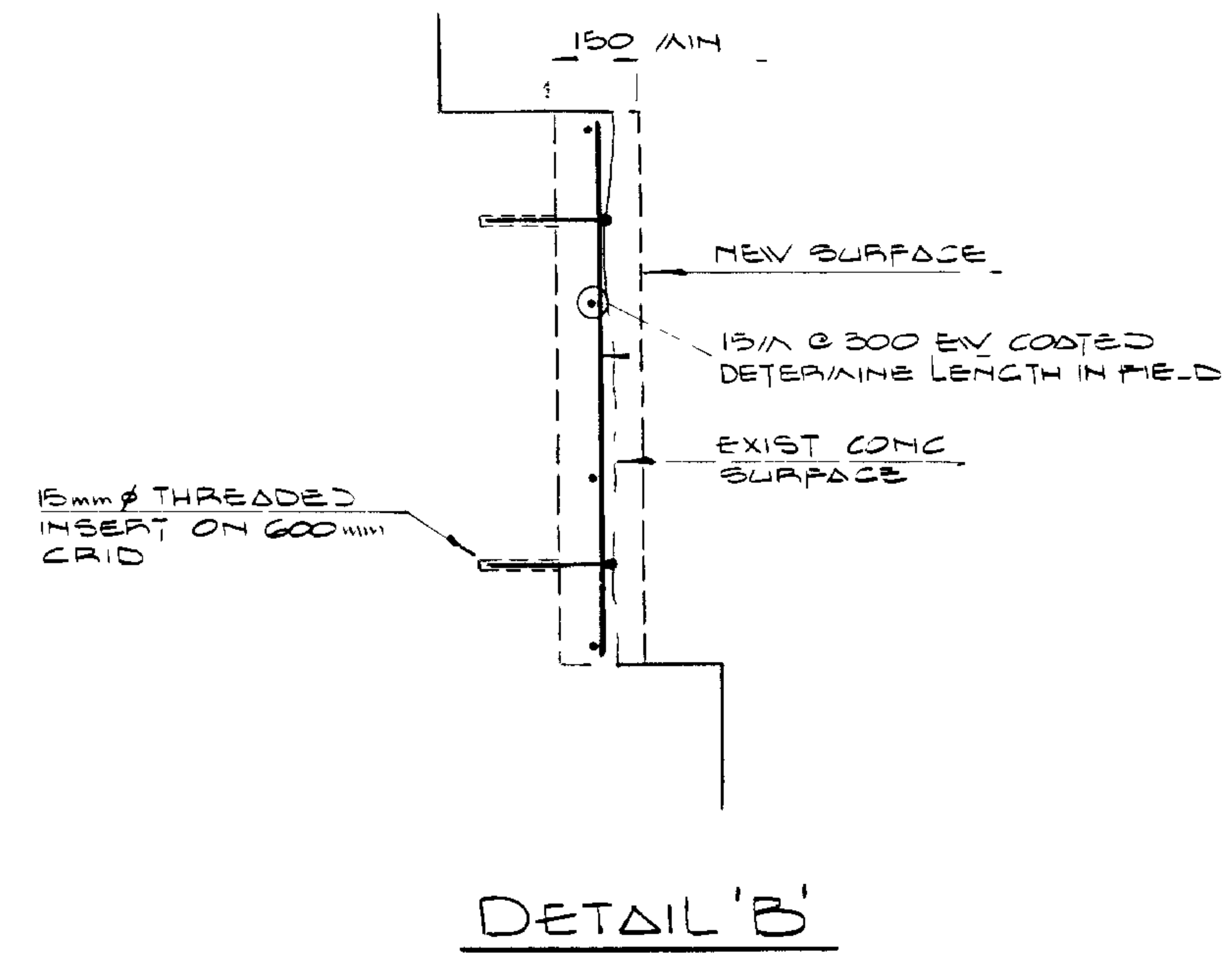
REHABILITATION OF HILLSIDE BRIDGE

STRUCTURAL STEEL

PROJECT No	DRAWING No	SHEET OF
8527	2	

File No 2856B





REPAIR NOTES.

- SAWCUT TO A DEPTH OF 25mm ALONG EDGE OF AREA TO BE REPAIRED
- CHIP OUT TO SOUND CONCRETE TO A MIN DEPTH OF 100 mm.
- INSTALL NEW SIZE 15 BARS (COATED) ANCHORED TO EXIST'NG CONC
- SANDBLAST CONC SURFACE AND REINFORCING BARS
- FORM AS REQUIRED AND PLACE 150mm MIN. SUPERPLASTICISED CONC

REV NOV 1978 TITLE HILLSIDE BRIDGE MADE BY G SUKKEL CHECKED BY

REINFORCING STEEL SCHEDULE - DIMENSION SHEET 340-0-1

S	MARK MET SIZE	SEQ NO	SUBCL	BAR TYPE CODE	NO OF BARS	A or LENGTH	B	C	D
B	NORTH ABUTMENT FOOTING								
	A15	001	C	STR	23	0.90			
	A15	002	C	"	23	0.88			
	A15	003	C	"	4	6.50			
B	NORTH & SOUTH ABUTMENTS								
	B15	001	C	17	34	1.76	0.70	0.76	0.30
	B15	002	C	17	34	2.88	1.35	0.18	1.35
	B15	003	C	STR	48	0.90			
	B15	004	C	17	32	2.93	0.40	0.13	0.40
	B15	005	C	17	12	2.75	0.40	1.95	0.40
	B15	006	C	STR	22	4.65			

TOTAL LENGTH OF BARS: 432.95 m.

TOTAL WEIGHT OF BARS: 680 KG.

NOTE: ALL OTHER REINFORCING TO BE DETERMINED IN THE FIELD BY THE CONTRACTOR.

08504 V01

5006-S-6

APPROVED	CONSULTANT	DATE	B FARAGO (Registered Professional Engineer, Province of Ontario)	CITY OF SCARBOROUGH WORKS DEPARTMENT	Wylie & Ufnal consulting engineers

NO	BY	REVISIONS	DATE

DESIGN	
DRAWN	G S
CHECKED	
APPROVED	B F
DATE	AUG 1985
SCALE	

REHABILITATION OF HILLSIDE BRIDGE

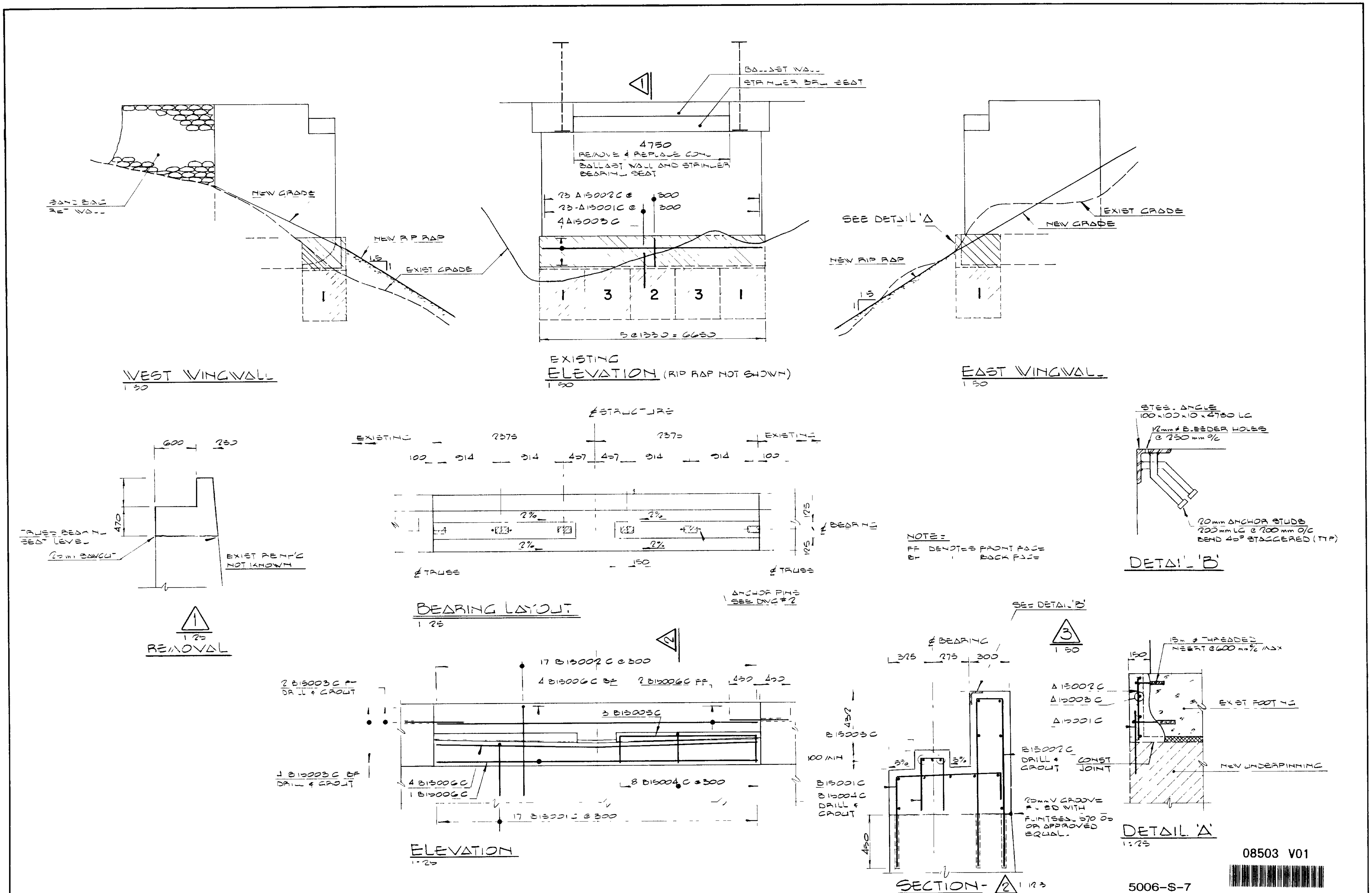
SOUTH ABUTMENT

PROJECT No 8527

DRAWING No 3

SHEET OF

FILE No 2856C



08503 V01

5006-S-7

APPROVED CONSULTANT DATE	REGISTERED PROFESSIONAL ENGINEER B FARAGO PROVINCE OF ONTARIO	CITY OF SCARBOROUGH WORKS DEPARTMENT	Wyllie & Ufnal consulting engineers

No	BY	REVISIONS	DATE

DESIGN	
DRAWN	G S
CHECKED	
APPROVED	B F
DATE	AUG 1986
SCALE	

REHABILITATION OF HILLSIDE BRIDGE

NORTH ABUTMENT

PROJECT No 8527

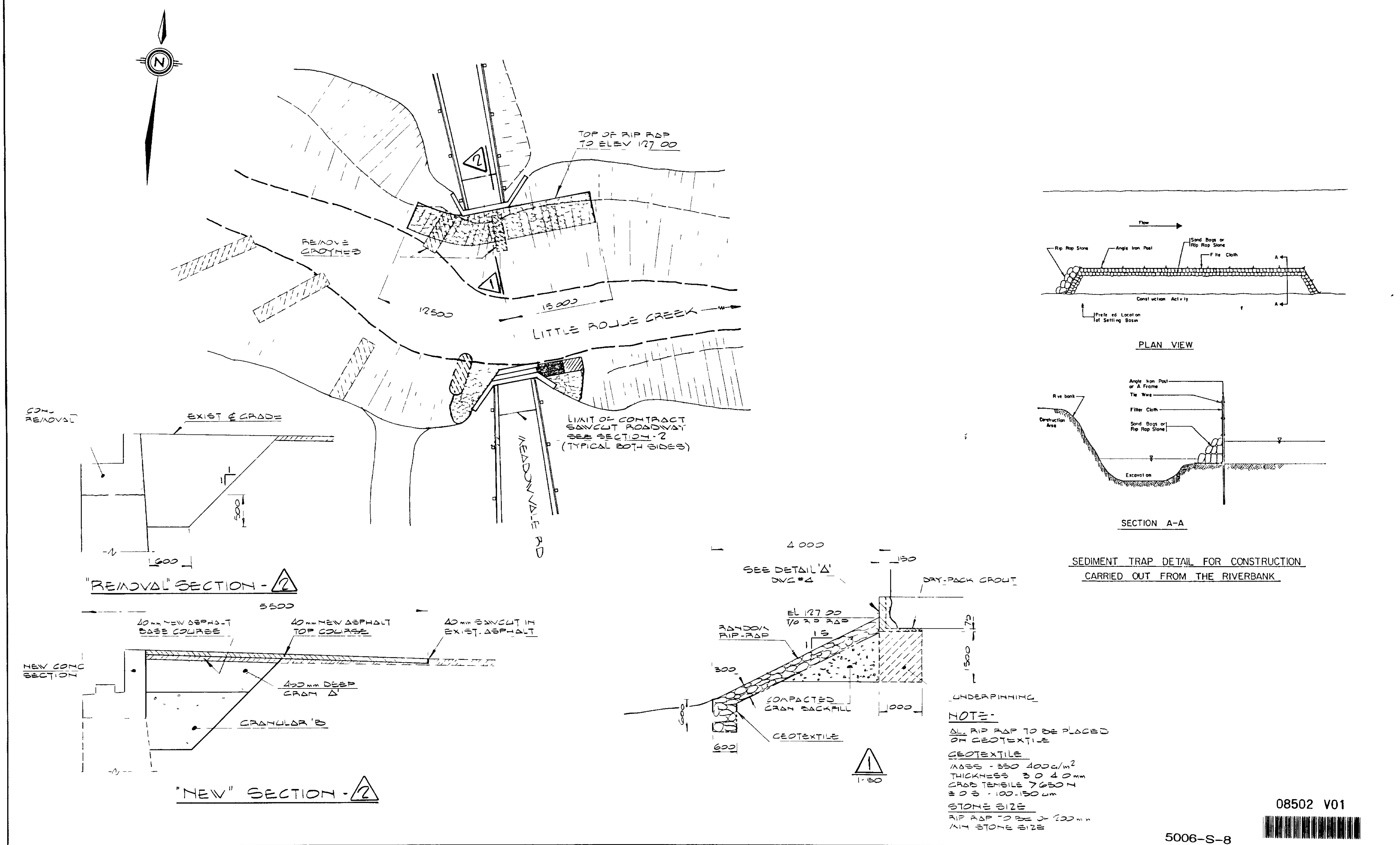
DRAWING No 4

SHEET OF

TRANSLAR

FILE No 2856D

FILE No 2856D



08502 V01

5006-S-8

APPROVED CONSULTANT DATE	REGISTERED PROFESSIONAL ENGINEER B FARAGO PROVINCE OF ONTARIO	CITY OF SCARBOROUGH WORKS DEPARTMENT	Wyllie & Ufnal consulting engineers	No | BY | REVISIONS | DATE

DESIGN	
DRAWN	G S
CHECKED	
APPROVED	B F
DATE	AUG 1985
SCALE	

REHABILITATION OF HILLSIDE BRIDGE

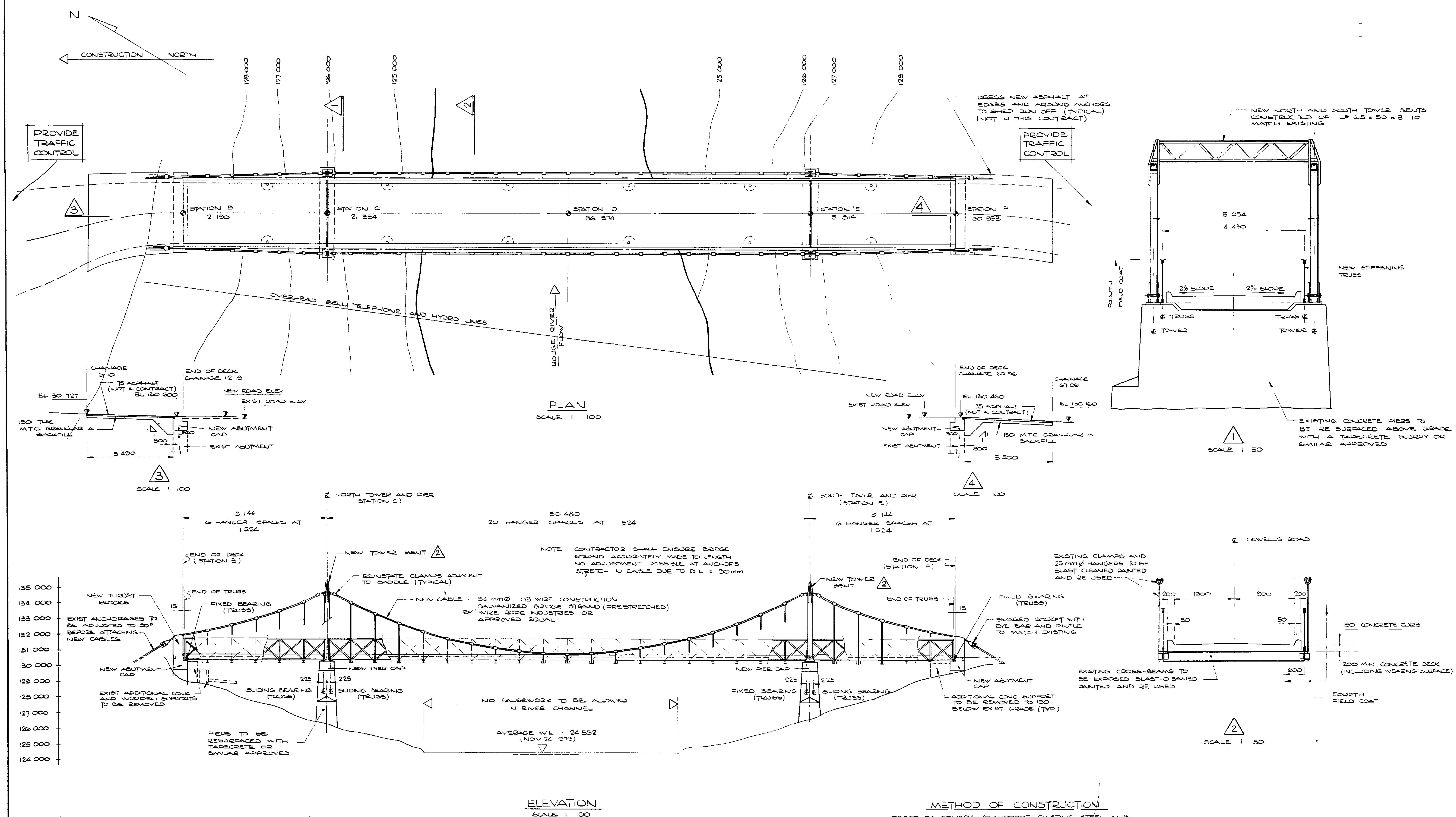
RIP RAP PLAN

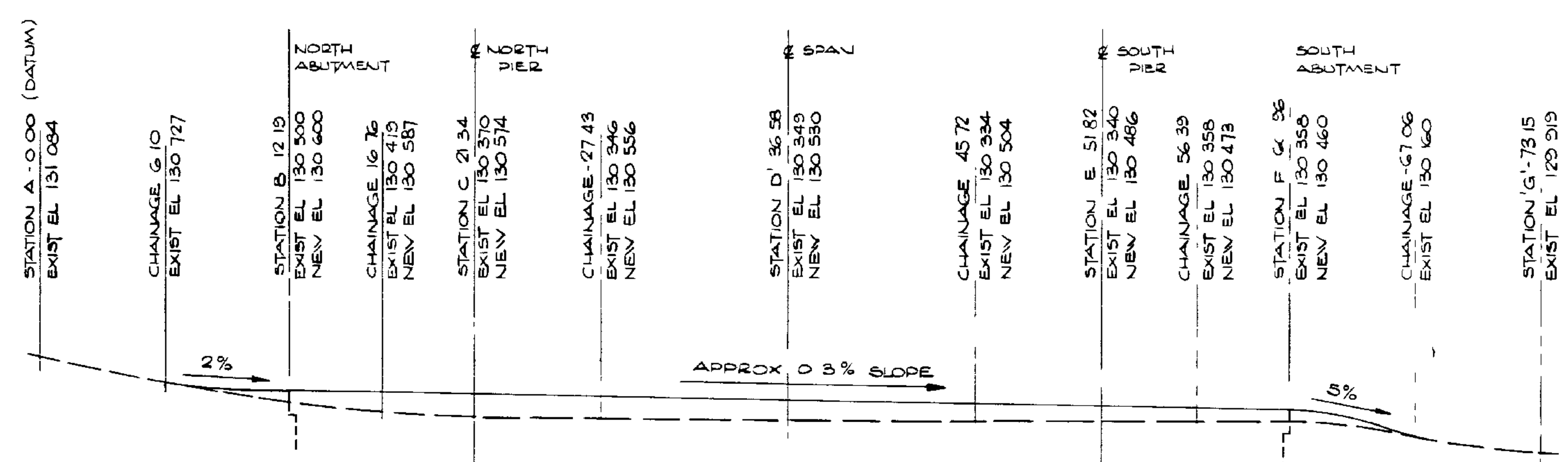
PROJECT No 8527

DRAWING No 5

SHEET OF

FILE No 2856E





PROFILE OF FINISHED PAVEMENT AT CENTRE LINE OF ROAD

SCALE - 1 200 HORIZ 1 50 VERTICAL

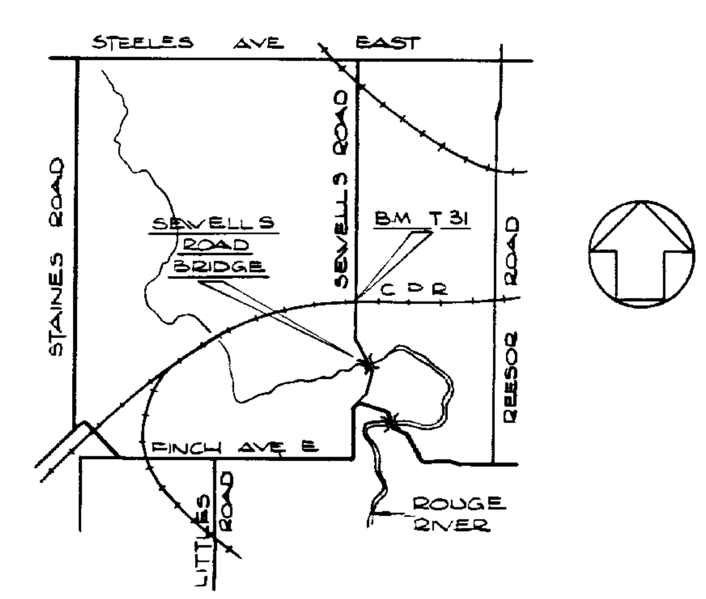
NOTE ELEVATIONS TAKEN FROM BM T31 - 130 865 AT C P R BRIDGE NORTH OF SITE CHAINAGES TAKEN FROM STATION A 12 19 m NORTH OF BRIDGE ON ROAD ℄

METHOD OF CONSTRUCTION

1 ERECT FALSEWORK TO SUPPORT EXISTING STEEL AND CONCRETE DECK
2 DEMOLISH AND REMOVE EXISTING CONCRETE DECK
3 DISMANTLE AND REMOVE EXISTING SUSPENSION CABLES STIFFENING TRUSSES AND APPURTENANCES AS CALLED FOR ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER
4 DISMANTLE AND REUSE EXISTING CABLE CLAMPS AND SUSPENSION RODS
5 DISMANTLE REPAIR AND RE-ERECT NORTH AND SOUTH TOWERS ON REPAIRED CONCRETE PIERS
6 REPAIR AS DIRECTED AND SUPPLY AND WELD SHEAR CONNECTORS TO DECK CROSS-BEAMS
7 REPAIR CONCRETE ABUTMENTS
8 SUPPLY AND ERECT NEW SUSPENSION CABLES STIFFENING TRUSSES AND APPURTENANCES, INCLUDING RE ASSEMBLY OF EXISTING CABLE CLAMPS AND SUSPENSION RODS AS CALLED FOR ON DRAWINGS OR AS DIRECTED BY THE ENGINEER
9 WHEN ALL STEELWORK IS ASSEMBLED AND IN PLACE INCLUDING BOTH EXISTING AND NEW COMPONENTS PLACE NEW 200 mm MINIMUM CONCRETE DECK AS DIRECTED
10 BLAST CLEAN AND PAINT STEELWORK
11 REMOVE FALSEWORK SUPPORTING STEELWORK AND CONCRETE DECK AND ADJUST SUSPENSION RODS AS DIRECTED BY THE ENGINEER

NOTE OTHER CONSTRUCTION PROCEDURES WILL BE CONSIDERED FULL DETAILS OF ALTERNATE METHODS MUST BE SUBMITTED AT TIME OF TENDER AND BE APPROVED IN WRITING BY THE ENGINEER BEFORE WORK COMMENCES

00410 V01



KEY PLAN

5012-S-1

GENERAL NOT

1 ALL DIMENSIONS VERIFIED IN THE THE CONTRACTOR
2 CLASS OF CONC 20mm AGGREG ABUTMENT & PIER CONC DECK & CURB
3 CLEAR COVER TO STEEL UNLESS N DECK TOP BOTT REMAINDER
4 TO ACHIEVE A M CONCRETE COVER DECK THE TOP LAYER SHALL BE TO CONCRETING COVER OF 75 ± 1
5 REINFORCING STEE 400 MPa BAR N SUFFIX C SHAL COATED BARS
6 NEW STRUCTURAL SHALL UNLESS N OTHERWISE BE IN WITH C S A G40
7 ALL WELDING SH ACCORDANCE WI STD 59 1 (LATES
8 STEEL TESTING 100% - VISUAL SH 100% - RADIOGRA WELDS IN 10% - MAGNETIC PA 50% - MAGNETIC PA
9 THIS BRIDGE HAS DESIGNED FOR H2 LIVE LOADING APPL ACCORDANCE WITH TH LATEST REQUIREMENT A A S H T O SPECIFIC

NO	DATE	ISSUES AND REVISIONS	BY
2	APR 21 1980	TOWER BENTS REVISED	BD
1	APR 11 1980	ISSUED FOR TENDER	BD

All measurements must be checked on the job by the contractor Drawings must not be scaled

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job

Gregg and Edens Limited
engineers planners economists

REGISTERED PROFESSIONAL ENGINEER N MOTRAN PROVINCE OF ONTARIO

PROFESSIONAL ENGINEER CIVIL J T GREGG PROVINCE OF ONTARIO

PROJECT TITLE

SEWELLS ROAD BRIDGE

SCARBOROUGH ONTARIO

SHEET TITLE

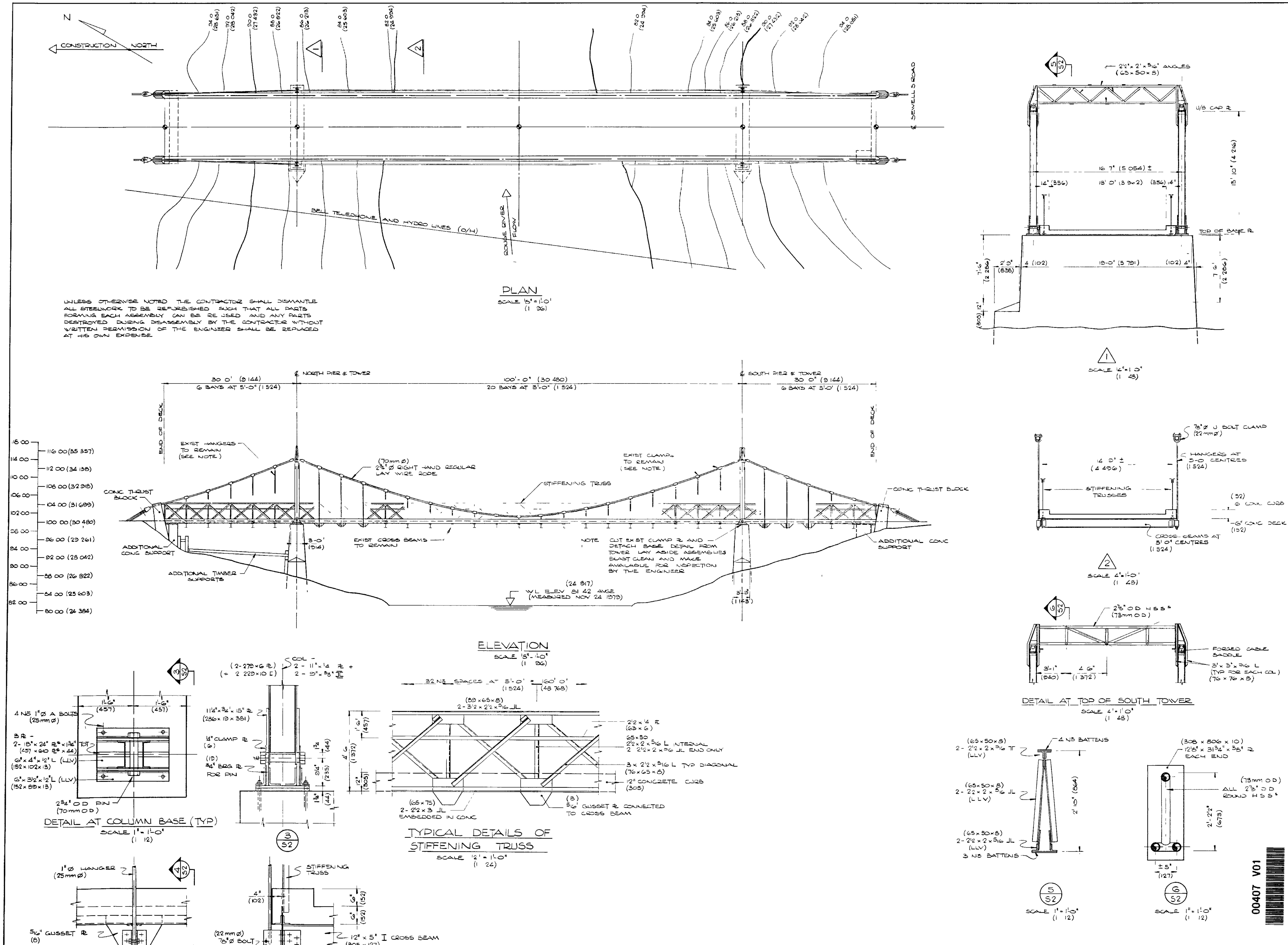
GENERAL ARRANGEMENT

SURVEYED BY D K.	DATE NOVEMBER '79
DESIGNED BY N M.	CHECKED BY J T G
DRAWN BY B D	CHECKED BY N.M.
SCALE AS NOTED	DATE MARCH 1980

PROJECT AND DRAWING NUMBER

7919-S1

DWG 157-A



UNLESS OTHERWISE NOTED THE CONTRACTOR SHALL DISMANTLE ALL STEELWORK TO BE REFURBISHED SUCH THAT ALL PARTS FORMING EACH ASSEMBLY CAN BE RE-USED AND ANY PARTS DESTROYED DURING DISASSEMBLY BY THE CONTRACTOR WITHOUT WRITTEN PERMISSION OF THE ENGINEER SHALL BE REPLACED AT HIS OWN EXPENSE

NOTES

1 DIMENSIONS ARE GIVEN IN IMPERIAL UNITS FIGURES IN BRACKETS ARE THEIR METRIC EQUIVALENTS

2 EXTREME CARE SHALL BE USED WHEN DETACHING EXISTING CABLES FROM ANCHORS TO ENSURE ANCHORS ARE UNDAMAGED

3 ANCHORS SHALL BE BLAST CLEANED MADE AVAILABLE FOR EXAMINATION AND PAINTED PRIOR TO EITHER ROAD SURFACING OR ATTACHING NEW CABLES

4 EXISTING HANGERS CABLE CLAMPS AND CROSS BEAMS ARE TO BE LAYED ASIDE AND RE-USED THEY SHALL BE MADE AVAILABLE FOR EXAMINATION BY THE ENGINEER WHO SHALL RULE ON THEIR SUITABILITY FOR RE-USE

CHEMICAL & MECHANICAL PROPERTIES OF EXISTING STEEL

SAMPLE	LOCATION	FY KSI	UTS KSI	ELONG % IN 8	C w/o	Mn w/o	S w/o	Si w/o	P w/o
# 1	WEB OF CROSS BEAM	37	58 9	24 8	0 27	0 44	0 055	0 01	0 014
# 2	WEB OF TOWER	41 9	61 3	24 8	0 19	0 52	0 029	0 30	0 014

5012-S-2

00407 V01

NO	DATE	ISSUES AND REVISIONS	BY
1	APRIL 1980	ISSUED FOR TENDER	

All measurements must be checked on the job by the contractor Drawings must not be scaled

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job

Gregg and Edens Limited
engineers planners economists

N MOTRAN
J T GREGG

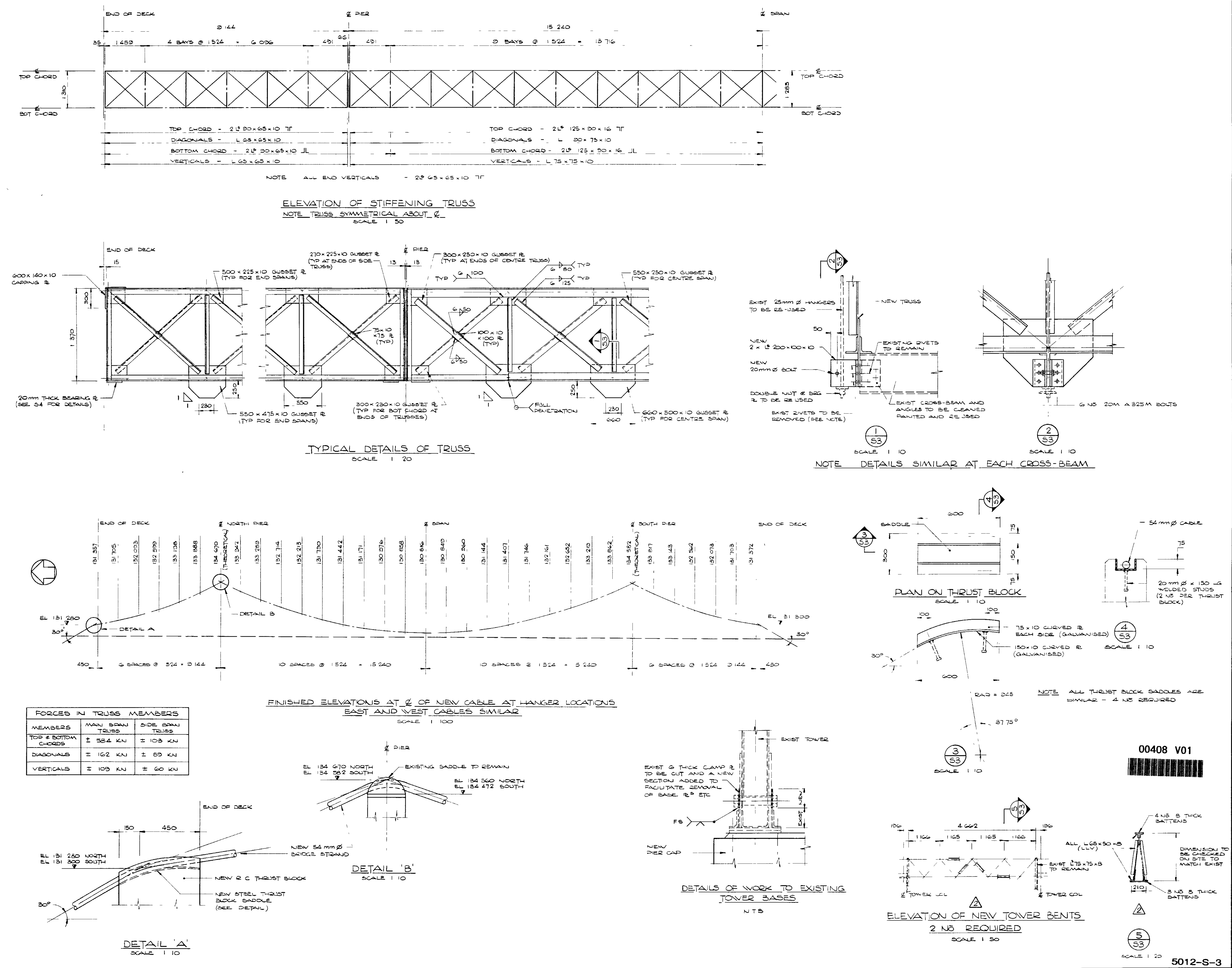
PROJECT TITLE
SEWELL'S ROAD BRIDGE
SCARBOROUGH ONTARIO

SHEET TITLE
DETAILS OF EXISTING BRIDGE

SURVEYED BY | DATE
DESIGNED BY | CHECKED BY
DRAWN BY B D | CHECKED BY
SCALE AS NOTED | DATE

PROJECT AND DRAWING NUMBER
7919 - S2

DWG 157 B



FORCES IN TRUSS MEMBERS

MEMBERS	MAIN SPAN TRUSS	SIDE SPAN TRUSS
TOP & BOTTOM CHORDS	± 584 KN	± 103 KN
DIAGONALS	± 162 KN	± 89 KN
VERTICALS	± 109 KN	± 60 KN

NOTES

1. RIVET REMOVAL
   - CUT OR BURN OFF RIVET HEADS FROM SCRAPPED SIDE OF JOINT ONLY
   - DRIVE RIVETS OUT WITH APPROVED RIVET REMOVING TOOL
   - DO NOT BURN OUT RIVETS

NO	DATE	ISSUES AND REVISIONS	BY
2		TOWER BENTS REVISED	BD
1		ISSUED FOR TENDER	BD

All measurements must be checked on the job by the contractor. Drawings must not be scaled.

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job.

Gregg and Edens Limited
engineers planners economists

N MOTRAN
J T GREGG

PROJECT TITLE

SEWELLS ROAD BRIDGE

SCARBOROUGH ONTARIO

SHEET TITLE

STEELWORK DETAILS AND CABLE LAYOUT

SURVEYED BY	D K	DATE	NOVEMBER '79
DESIGNED BY	N.M	CHECKED BY	J T G
DRAWN BY	B D.	CHECKED BY	N M
SCALE	AS NOTED	DATE	MARCH 1980

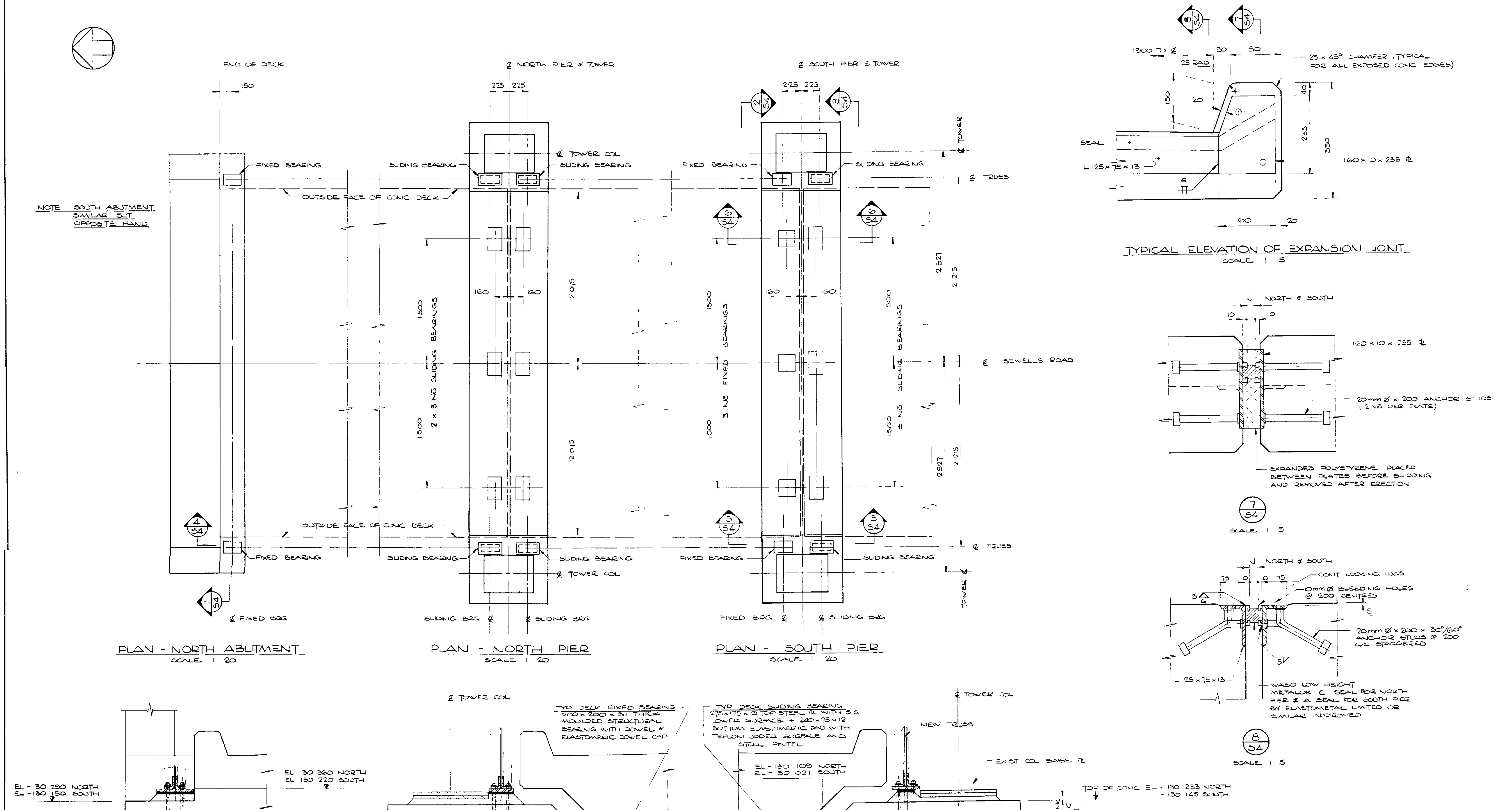
PROJECT AND DRAWING NUMBER

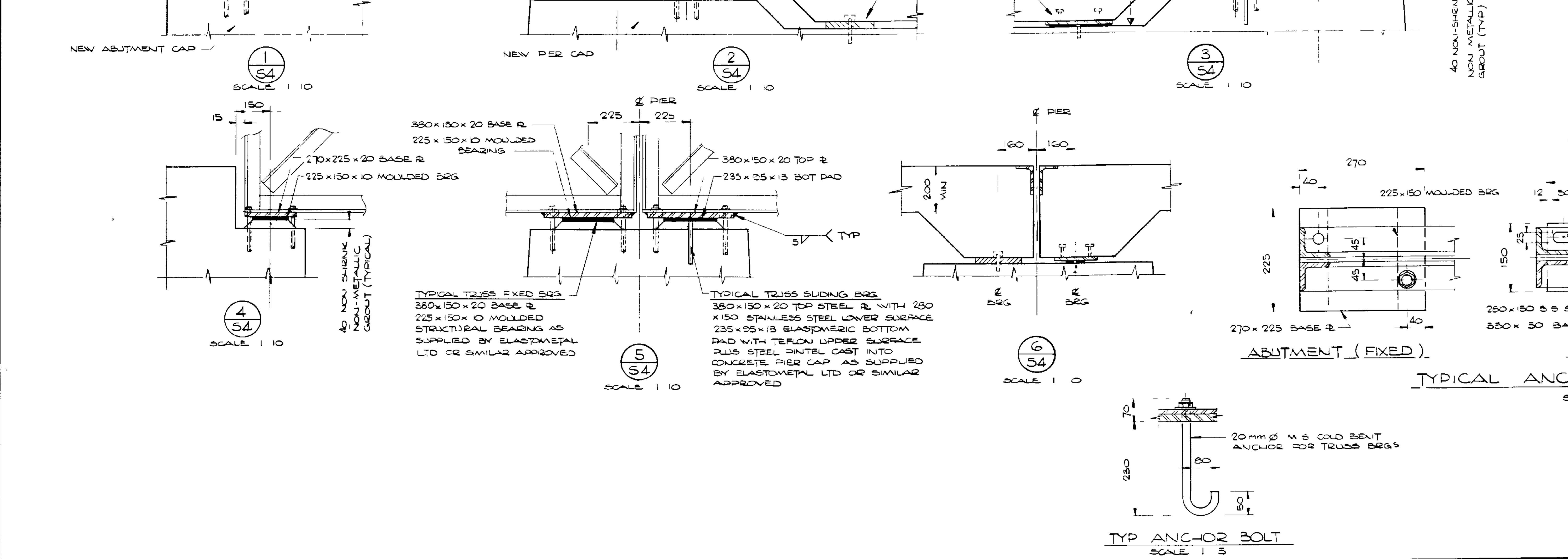
7919-S3

00408 V01

5012-S-3

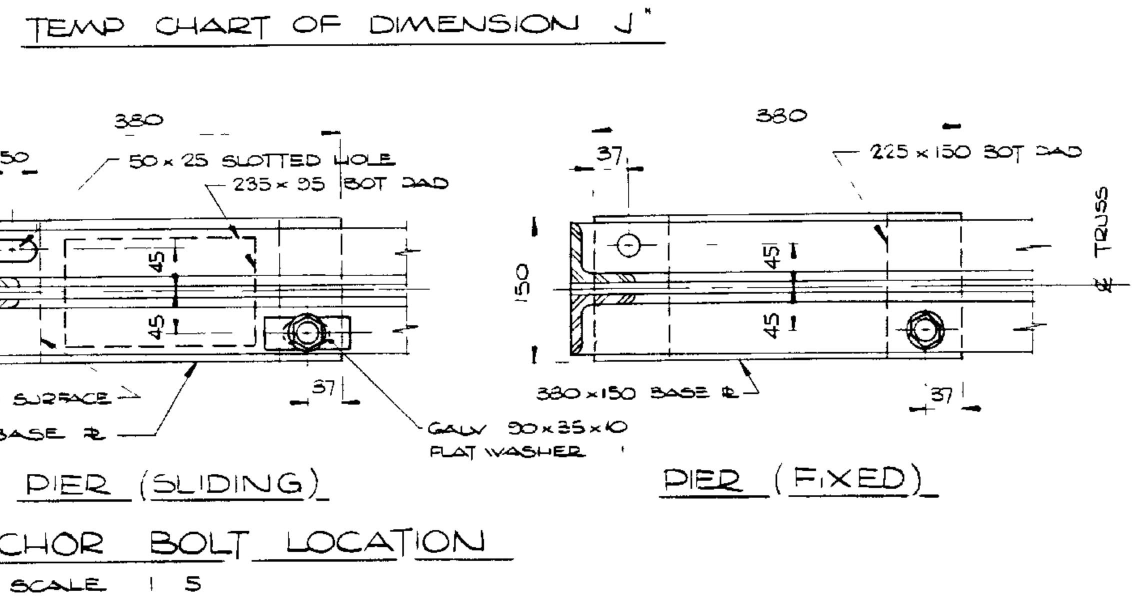
DWG 157-C





TEMP °F	40	50	60	70	80	90
TEMP °C	5	10	16	21	27	32
J SOUTH	20	19	18	17	16	15
J NORTH	60	57	54	51	48	46

TEMP CHART OF DIMENSION 'J'



00409 V01

5012-S-4

NO	DATE	ISSUES AND REVISIONS	BY
2	APR 21 1980	DECK BEARINGS REVISED	BD
1	APR 11 1980	ISSUED FOR TENDER	BD

All measurements must be checked on the job by the contractor. Drawings must not be scaled.

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job.

Gregg and Edens Limited
engineers planners economists

REGISTERED PROFESSIONAL ENGINEER N MOTRAN PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER CIVIL J T GREGG PROVINCE OF ONTARIO

PROJECT TITLE

SEWELLS ROAD BRIDGE

SCARBOROUGH ONTARIO

SHEET TITLE

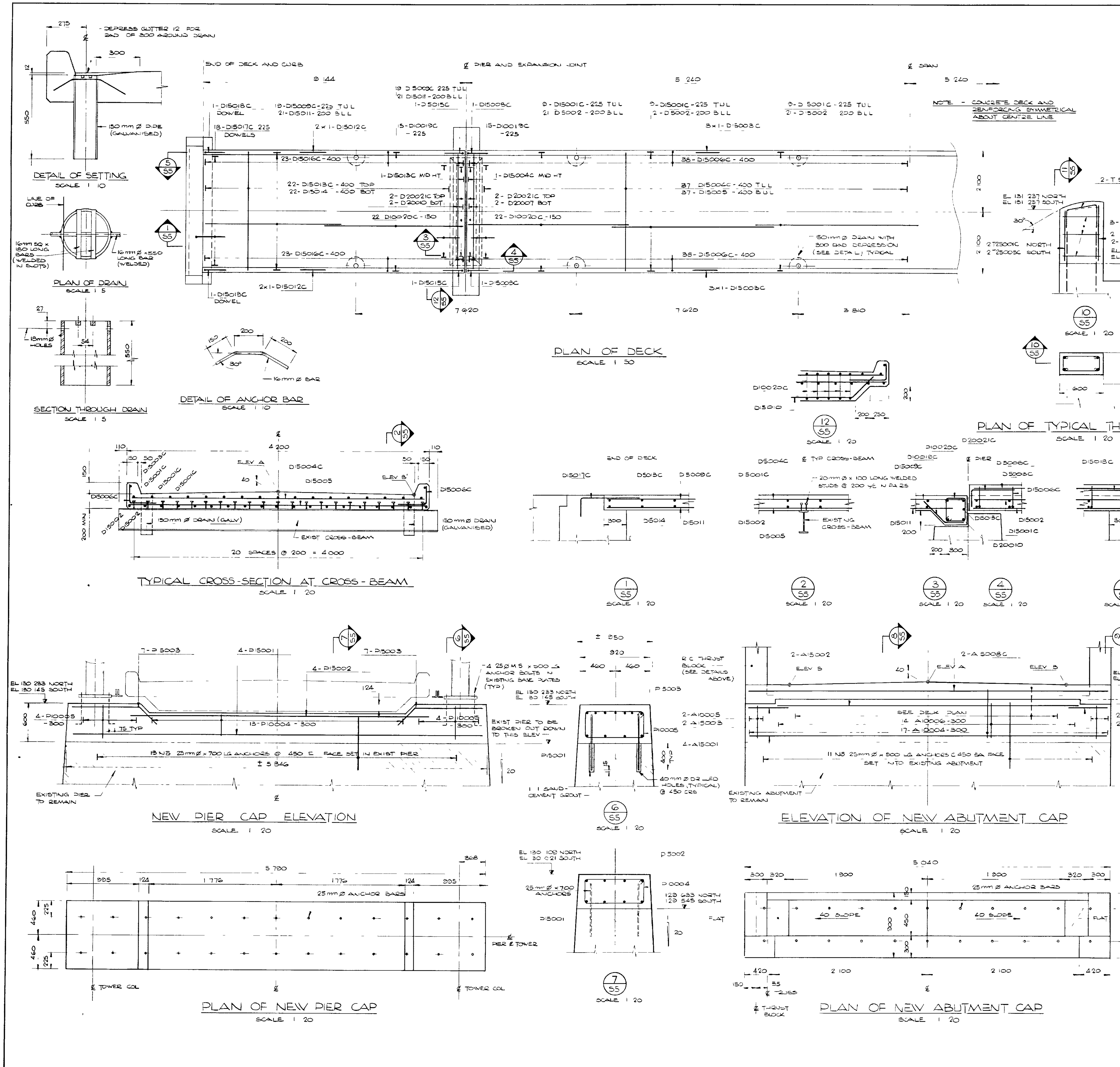
BEARING AND EXPANSION JOINT DETAILS

SURVEYED BY D K	DATE NOVEMBER '79
DESIGNED BY N M	CHECKED BY J T G
DRAWN BY B D	CHECKED BY N M
SCALE AS NOTED	DATE MARCH 1980

PROJECT AND DRAWING NUMBER

7919 - S4

DWG 157-D



STATION	CHAINAGE	A	B
	6 10	130 7	
B	12 9	130 600	130 560
	6 76	130 567	130 547
C	21 34	130 574	130 534
	27 43	130 556	130 516
D	36 58	130 530	130 490
	45 72	130 504	130 464
E	51 52	130 456	130 446
	56 39	130 473	130 433
F	60 96	130 460	130 420
	67 06	130 160	

SCREED ELEVATIONS

NOTES

1 CONC DECK SURFACE FINISH
- STRIKE OFF TRUE TO GRADE
- WOOD FLOAT FINISH
- LIGHT BROOM FINISH

2 APPROVED RETARDANT TO BE USED IN CENTRE SPAN DECK CONCRETE ONLY

3 NO WETTING OF CONCRETE AND TOOLS SHALL BE PERMITTED DURING FINISHING OPERATIONS

4 ALL EXPOSED CONCRETE EDGES TO HAVE 25 CHAMFER

12438 V01

NO	DATE	ISSUES AND REVISIONS	BY
2	APR 21 1980	GENERAL REVISIONS TO REINF	BD
1	APR 11 1980	ISSUED FOR TENDER	BD

All measurements must be checked on the job by the contractor Drawings must not be scaled

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job

Gregg and Edens Limited
engineers planners economists

5012-S-5

REGISTERED PROFESSIONAL ENGINEER N MOTRAN PROVINCE OF ONTARIO

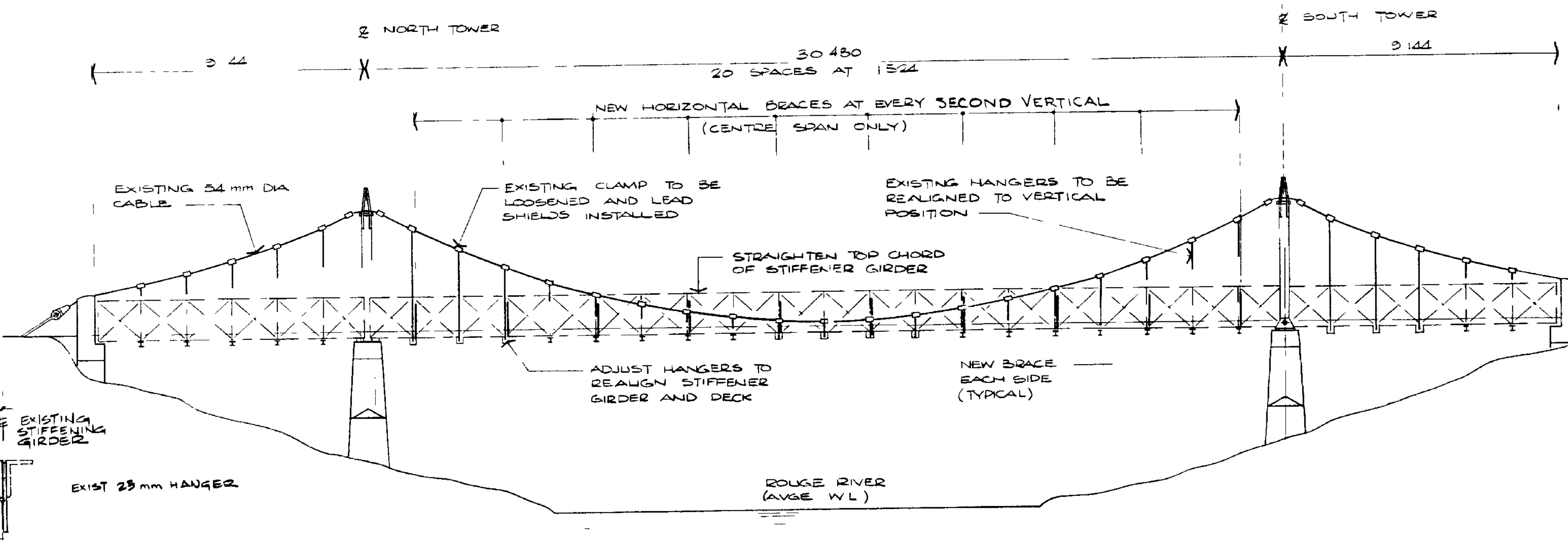
REGISTERED PROFESSIONAL ENGINEER J GREGG PROVINCE OF ONTARIO

PROJECT TITLE

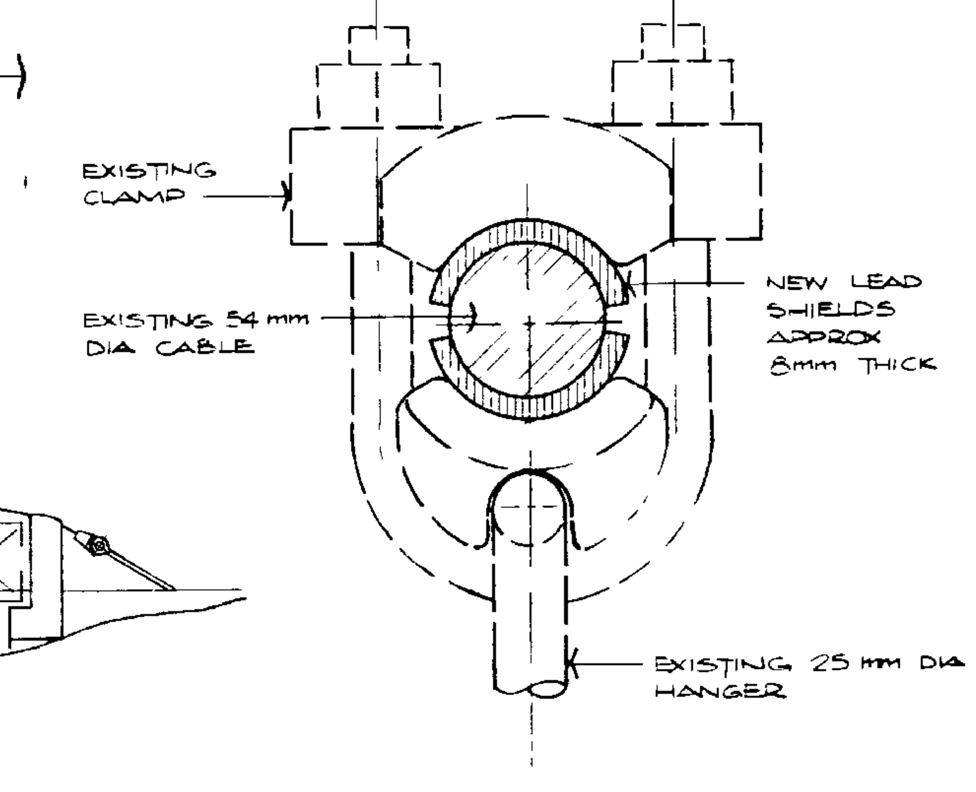
SEWE

SCARB

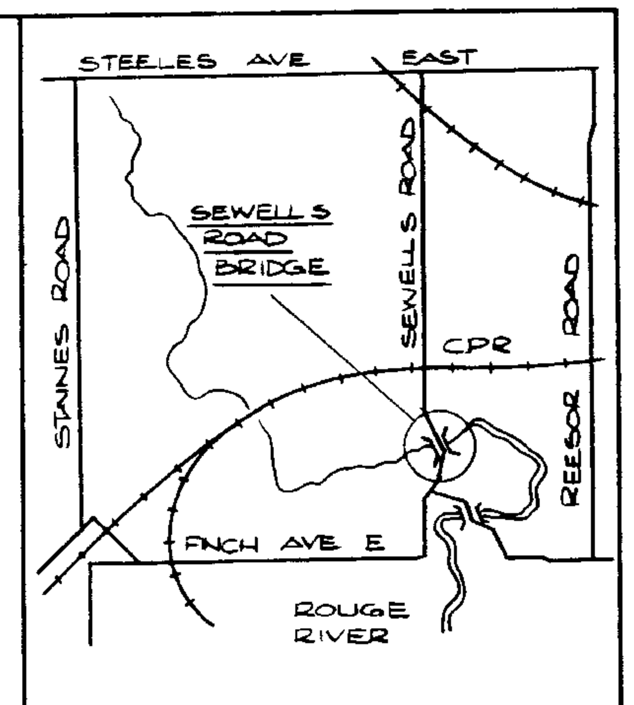
SHEET T



ELEVATION
1 100

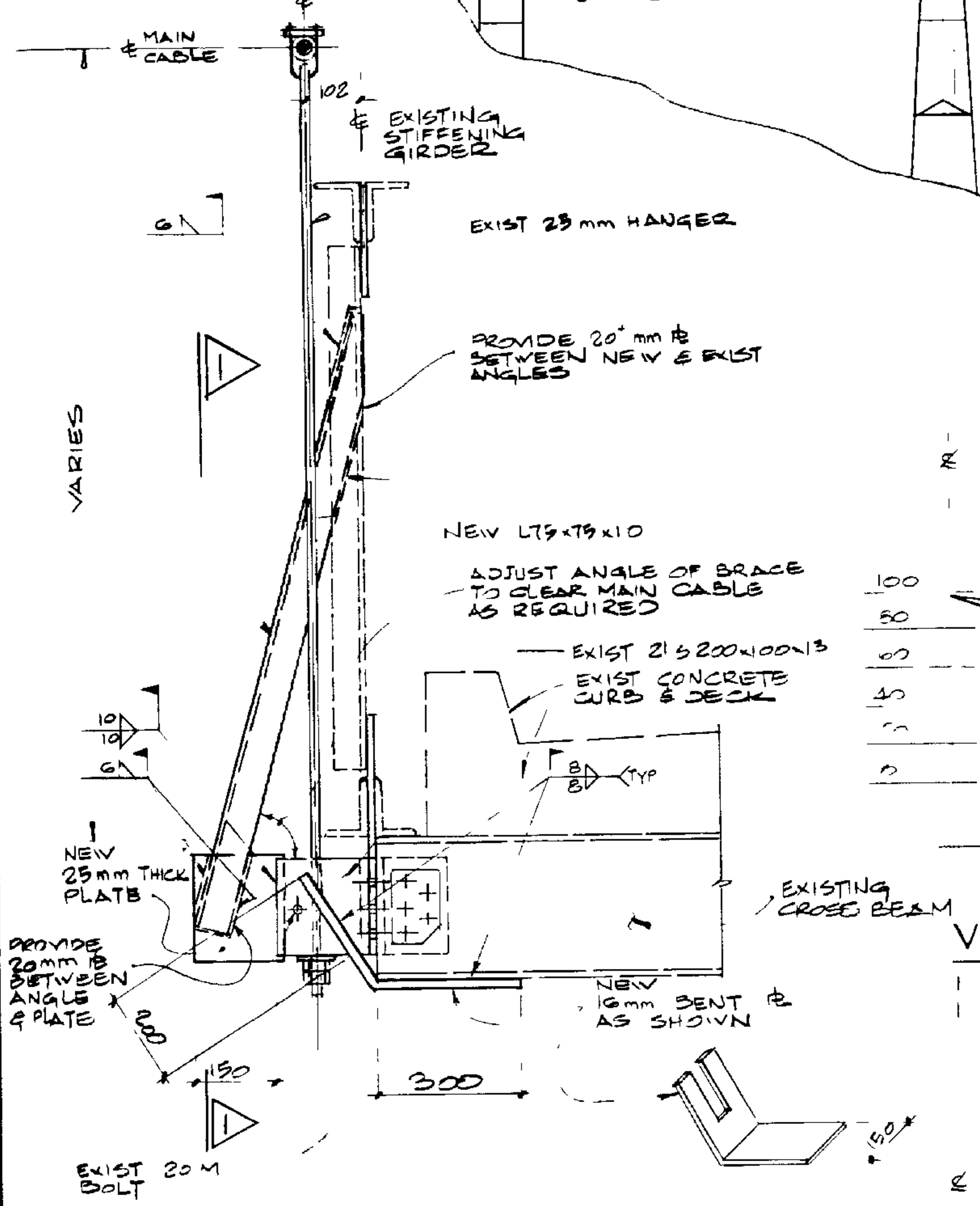


DETAIL 'A'
1 2

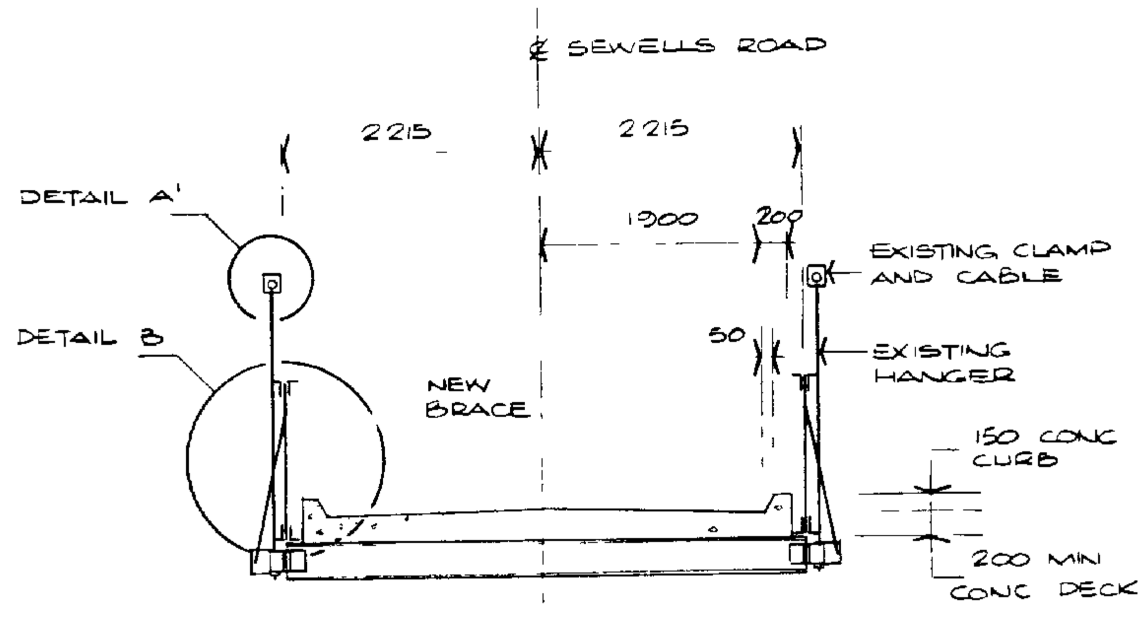


KEY PLAN

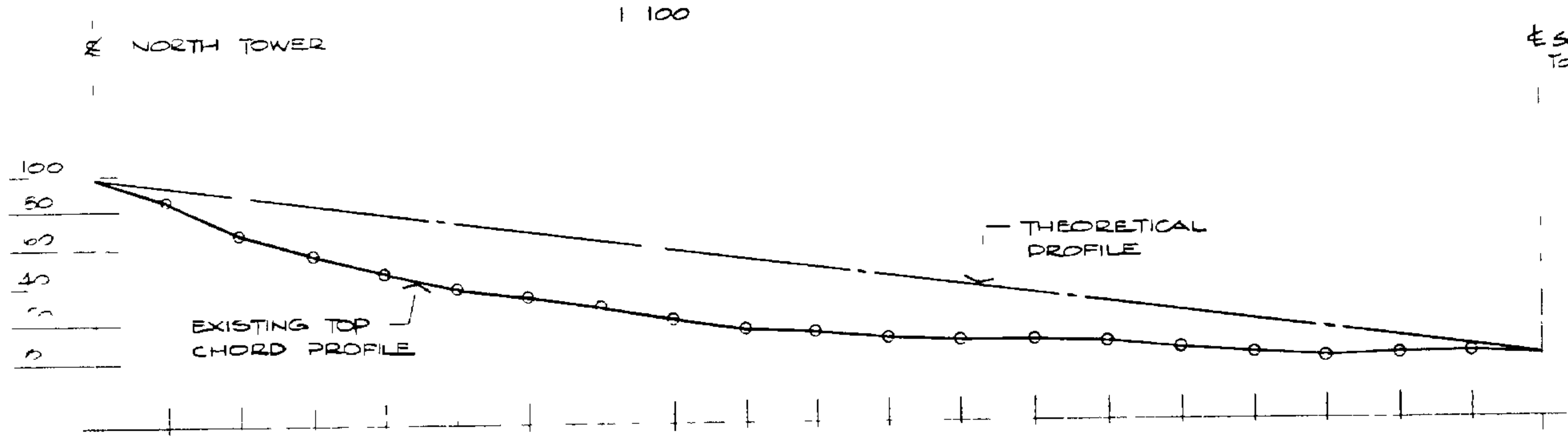
00411 V01



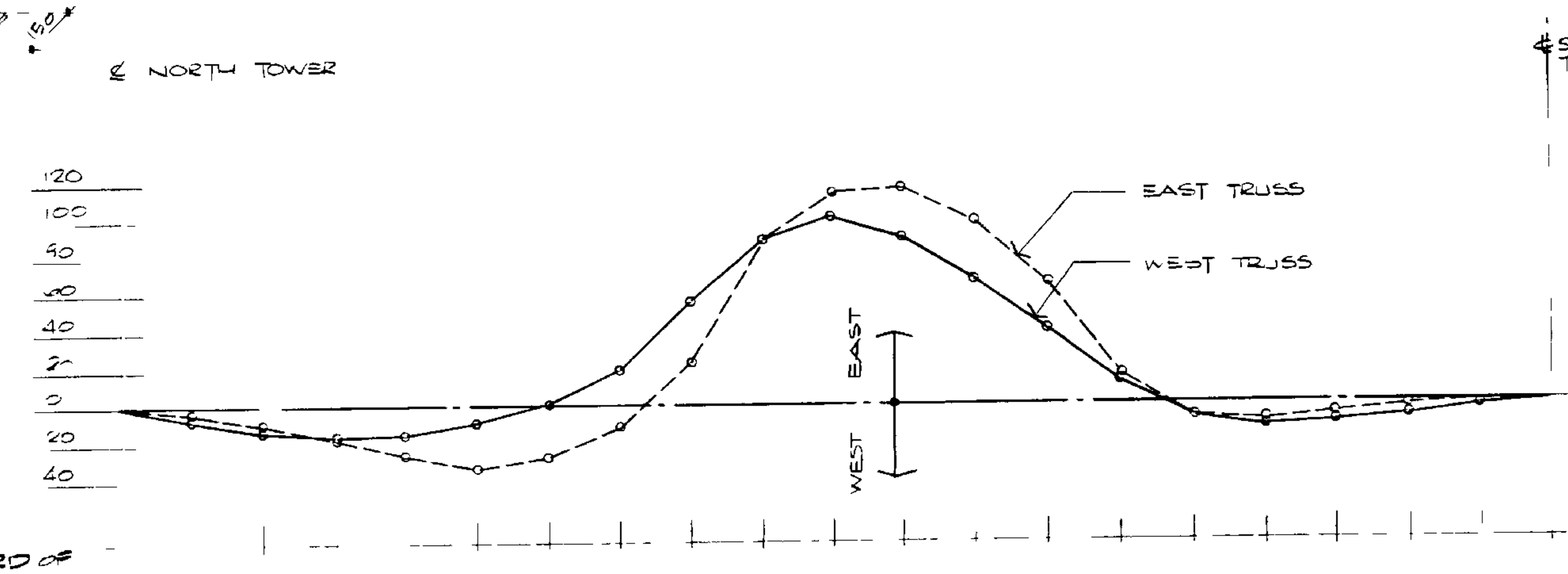
DETAIL 'B'



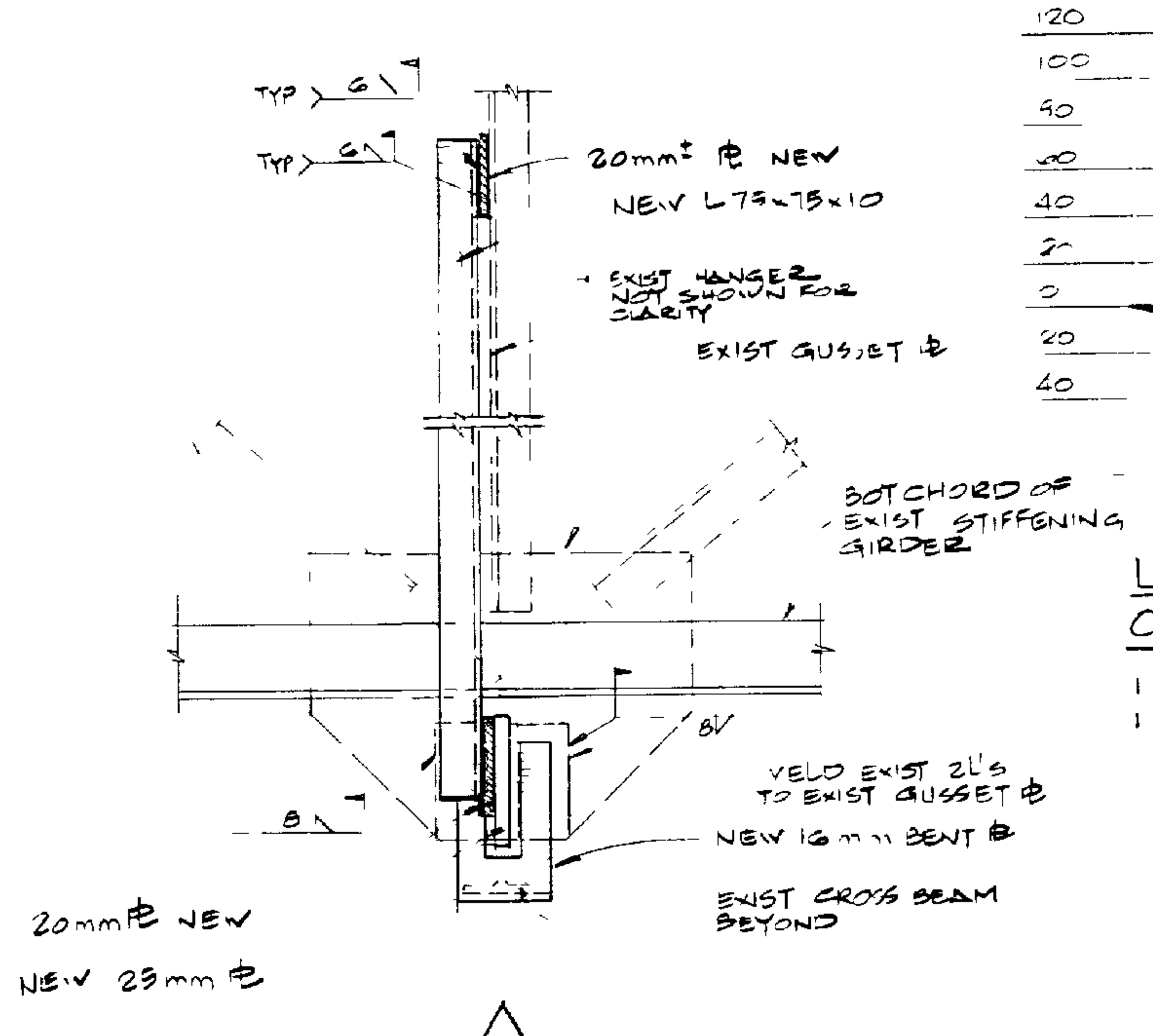
TYPICAL CROSS SECTION
1 50



VERTICAL DEFLECTION OF STIFFENING GIRDER
1 100 HORZ
1 25 VERT



LATERAL DEFLECTION OF TOP CHORDS OF STIFFENER GIRDER
1 100 LONGITUDNAL
1 25 TRANSVERSE



1
1 10

SUGGESTED REPAIR SEQUENCE

1. LOOSEN CABLE CLAMPS ONE AT A TIME AND RESTORE TO PROPER POSITION ON CABLE VERTICALLY OVER POINT OF ATTACHMENT OF HANGERS TO DECK CROSS-BEAMS
2. INSTALL LEAD SHIELDS AND TIGHTEN NUTS AT BOTTOM OF HANGERS DO WORK SEQUENTIALLY, REPOSITIONING ONE CLAMP PER CABLE AT ANY ONE TIME WHILE ALL OTHER CLAMPS & HANGERS ARE SECURED
3. ADJUST HANGERS AT CROSS-BEAM SUPPORTS TO RAISE AND REALIGN STIFFENING GIRDERS AND DECK OF MAIN SPAN TO ORIGINAL PROFILE.
4. RAISE STIFFENING GIRDERS BY SEQUENTIALLY TIGHTENING NUTS AT LOWER ENDS OF HANGER RODS SEVERAL ITERATIONS OF NUT TIGHTENING MAY BE REQUIRED TO ACHIEVE THE PROPER VERTICAL ALLIGNMENT
5. STRAIGHTEN TOP CHORD OF STIFFENING TRUSSES TO A HORIZONTAL ACCURACY OF 4mm±, AND INSTALL NEW BRACES BETWEEN THE TOP CHORD OF STIFFENING TRUSSES AND STEEL DECK BEAM, ONE AT EACH SECOND TRUSS PANEL AS SHOWN.
6. STRAIGHTEN TOP CHORD OF STIFFENING TRUSSES IF SO REQUIRED USING APPROVED METHODS
7. THE TOP CHORDS OF TRUSSES MAY BE STRAIGHTENED BY CUTTING & SPLICING IN NEW ANGLES, BY HEAT TREATMENT, OR BY APPLYING LATERAL FORCE OR COMBINATION OF ALL THREE, ALL SUBJECT TO PRIOR REVIEW & APPROVAL BY THE ENGINEER
8. ALTERNATIVE METHODS & SEQUENCE OF REPAIR MAY BE USED, SUBJECT TO THE PRIOR APPROVAL OF THE ENGINEER

GENERAL NOTES

1. ALL EXISTING DIMENSIONS SHALL BE VERIFIED IN THE FIELD BY THE CONTRACTOR
2. NEW STRUCTURAL STEEL SHALL BE IN ACCORDANCE WITH CSA G40.21 44W
3. ALL WELDING SHALL BE IN ACCORDANCE WITH CSA STD S91 (LATEST REVISION)
4. BOLTS SHALL BE ASTM A 325 TYPE 3 HS
5. MTC APPROVED EPOXY ADHESIVE COMPOUND TO NEW STEEL TO CONCRETE SURFACES.

NO	DATE	ISSUES AND REVISIONS	BY
1	JULY 1988	QTY OF BRACES INCREASED	JTG

All measurements must be checked on the job by the contractor Drawings must not be scaled

All drawings and specifications are the property of the Consultants and must be returned at the completion of the job

Gregg and Edens Limited
engineers planners economists

REGISTERED PROFESSIONAL ENGINEER
CIVIL
J T GREGG
PROVINCE OF ONTARIO

5012-S-6

PROJECT TITLE

REPAIRS TO SEWELLS ROAD BRIDGE

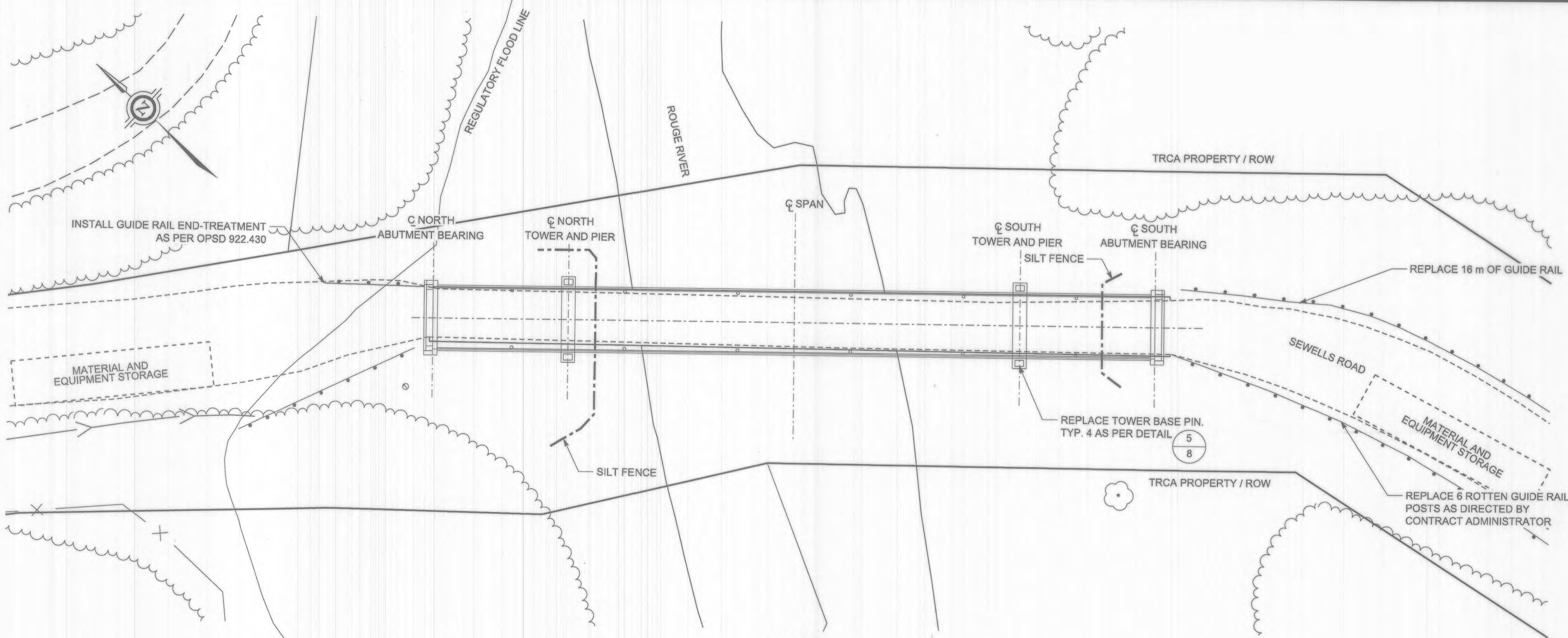
SCARBOROUGH ONTARIO

SHEET TITLE

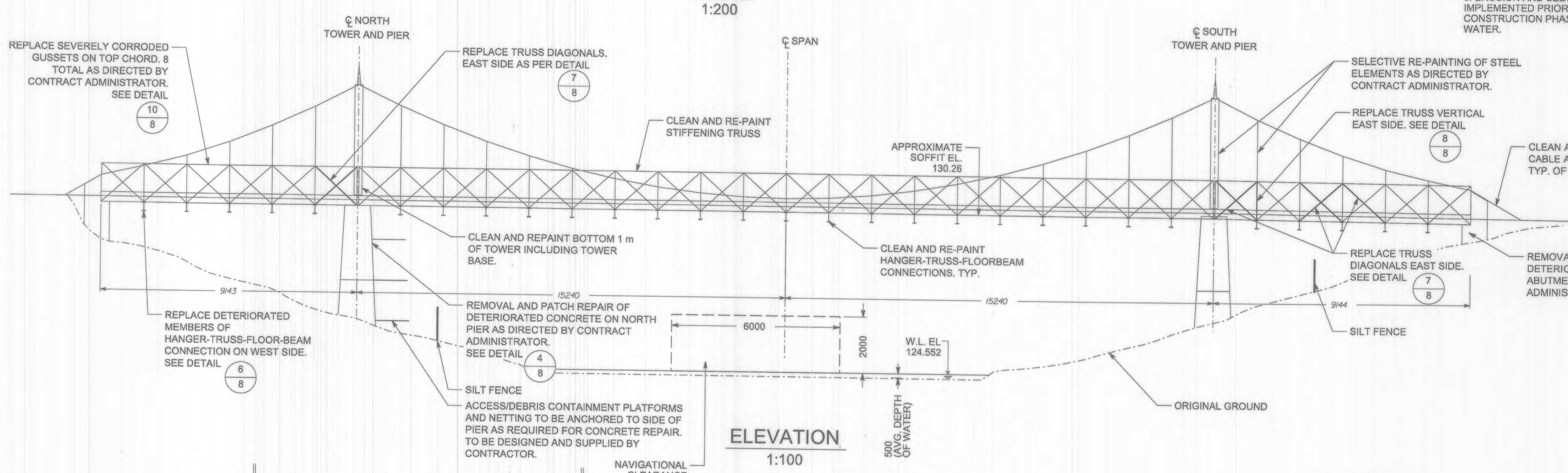
GE
ARI
ANI

5012 - S 6

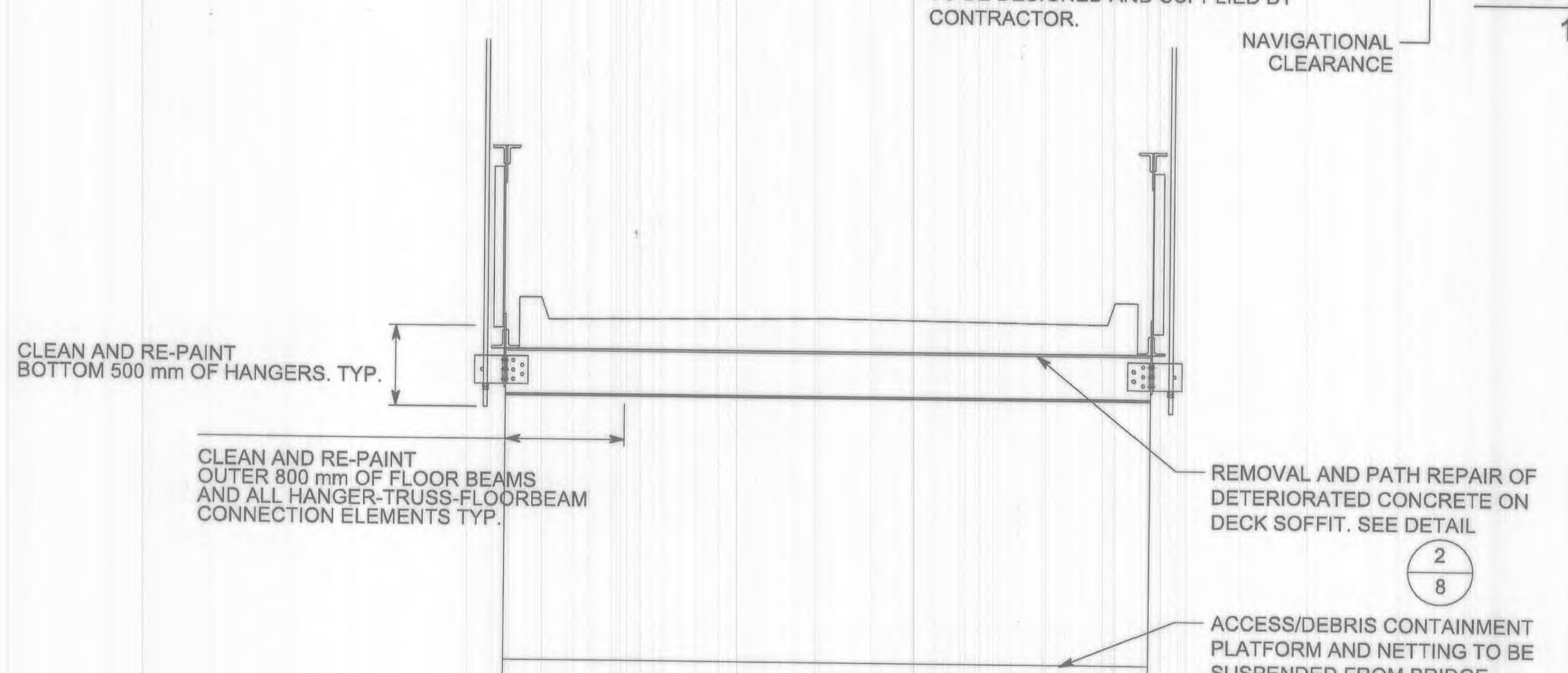
SURVEYED BY
DESIGNED BY
DRAWN BY BD | CHECKED BY JTG
SCALE AS SHOWN | DATE JULY 1987
PROJECT AND DRAWING NUMBER
7919 - R1



PLAN
1:200



ELEVATION
1:100



EXISTING SECTION
1:40

GENERAL NOTES:

DESIGN CODE

1. THE STRUCTURE REHABILITATION IS DESIGNED IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN/CSA-S6-06 (CHBDC).

2. ALL WORK SHALL CONFORM TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS.

3. ASSOCIATED ENGINEERING LTD. DOES NOT ASSUME ANY RESPONSIBILITY FOR LOSSES, DAMAGES, OR COSTS ARISING FROM THE USE OR REUSE OF THESE DRAWINGS BY PERSONS, FIRMS, OR CORPORATIONS WITHOUT PRIOR WRITTEN CONSENT.

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.

2. UNLESS OTHERWISE SHOWN, SAWCUT AT THE LIMITS OF CONCRETE REMOVALS SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.

3. DRAWINGS ARE NOT TO BE SCALED.

4. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.

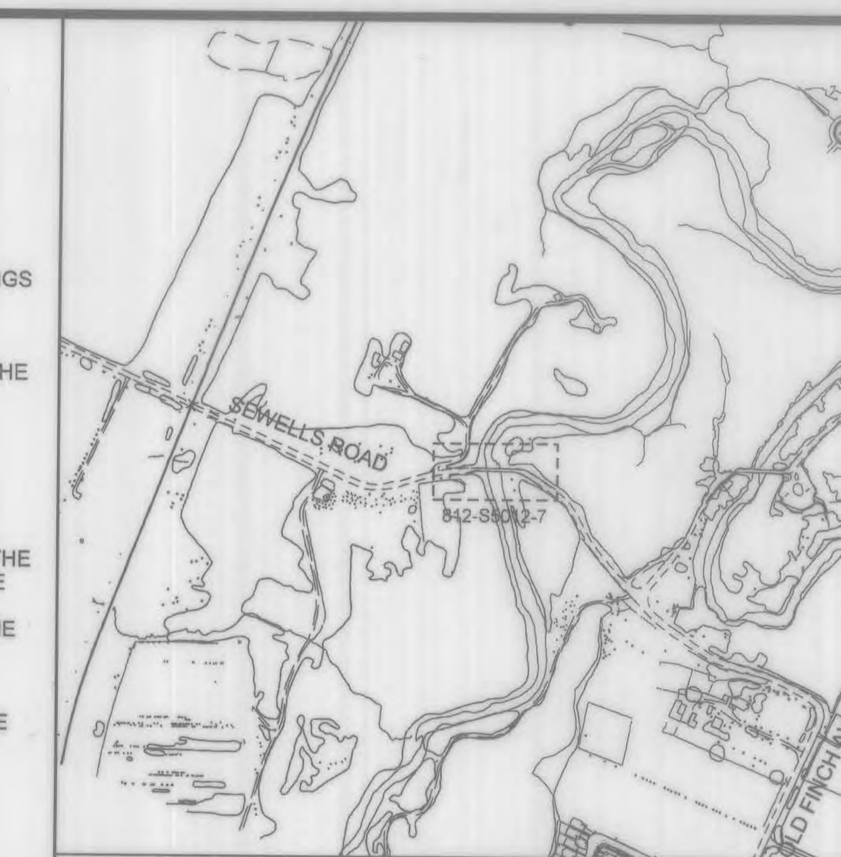
5. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE CITY.

6. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM WORK FALL IN THE RIVER OR ON OTHER AREAS BELOW THE BRIDGE.

7. BRIDGE WILL BE CLOSED TO ALL THROUGH TRAFFIC DURING CONSTRUCTION.

8. ALL IN-WATER AND NEAR WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS IN ACCORDANCE WITH THE TRCA EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION (2006).

9. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING, THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.



KEY PLAN

RELATED DRAWINGS: NOT TO SCALE

GENERAL NOTES CONT'D:

10. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED 30 METRES FROM THE WATER.

11. ALL GRADES WITHIN THE REGIONAL STORM FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.

12. THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE PROPONENT/ CONTRACTOR SHALL REMOVE ALL ITEMS FROM THE REGIONALSTORM FLOOD PLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (I.E. FUEL TANKS, UNFIXED EQUIPMENT, ETC.).

13. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/ AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, THEN ALTERNATIVE MEASURES
SHOULD BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS.

14. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, NURSERY AND MIGRATORY PERIODS, IN- AND NEAR-WATER ACTIVITIES MAY ONLY OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 TO MARCH 31.

15. TO AVOID INTERFERENCE WITH THE EGGS, NESTS OR YOUNG OF BIRDS PROTECTED UNDER THE FEDERAL MIGRATORY BIRDS CONVENTION ACT, REMOVALS SHOULD NOT OCCUR FROM MAY 1 TO AUGUST 1 OF ANY GIVEN YEAR. IDEALLY, REMOVALS SHOULD OCCUR FROM AUGUST THROUGH DECEMBER TO AVOID INTERFERENCE WITH ALL NESTING BIRDS. SHOULD REMOVALS BE REQUIRED WITHIN THE MAY 1 TO AUGUST 1 BREEDING PERIOD, A QUALIFIED AVIAN BIOLOGIST SHOULD CONDUCT A THOROUGH SURVEY IMMEDIATELY PRIOR TO THE DESIRED TREE REMOVAL DATE TO CONFIRM PRESENCE OR ABSENCE OF PROTECTED SPECIES. IF PROTECTED SPECIES ARE PRESENT, REMOVALS CANNOT OCCUR WITHOUT A PERMIT FROM THE CANADIAN WILDLIFE SERVICE.

16. DECK DRAINS TO BE COVERED WITHFILTER FABRIC TO ENSURE NO DEBRIS IS LOST FROM BRIDGE DECK.

17. IF ANY DEBRIS IS TO BYPASS THE CONTAINMENT AREA AND ENTER THE WATER COURSE, THE CONTRACTOR SHALL COLLECT IT BY HAND.

18. SITE RESTORATION OF ALL DISTURBED AREA SHALL BE IN ACCORDANCE WITH TRCA POST-CONSTRUCTION RESTORATION GUIDELINES (2004).

19. VEHICULAR ACCESS BELOW THE BRIDGE STRUCTURE WILL NOT BE PERMITTED.

20. NO VEGETATION IS TO BE REMOVED.

SCOPE OF REHABILITATION WORK

THE GENERAL SCOPE OF THE BRIDGE REPAIR WORK OF THE CONTRACT SHALL INCLUDE THE FOLLOWING:

1. PATCH REPAIR NORTH PIER, DECK SOFFIT AND SOUTH ABUTMENT.

2. HANGER-TRUSS-FLOORBEAM CONNECTION REPAIR.

3. TRUSS GUSSET REPLACEMENT.

4. TRUSS VERTICAL/DIAGONALS REPLACEMENT.

5. TOWER BASE PIN REPAIR.

6. GUIDE RAIL REPAIR AND END TREATMENT INSTALLATION.

7. CLEANING AND REPAINTING OF STRUCTURAL ELEMENTS.

STRUCTURAL NOTES

CLASS OF CONCRETE

MINUMUM STRENGTH	AT 7 DAYS 25 MPa AT 28 DAYS 35 MPa
CLEAR COVER TO REINFORCING STEEL	DECK SOFFIT 50±10 ABUTMENT & PIER 70±20

REINFORCING STEEL

1. REINFORCING STEEL SHALL BE GRADE 400W UNLESS OTHERWISE SPECIFIED.

2. UNLESS SHOWN OTHERWISE, TENSION LAP SPLICES FOR BLACK REINFORCING STEEL BARS SHALL BE CLASS B.

STRUCTURAL STEEL

1. ALL STEEL WORK SHALL BE IN ACCORDANCE WITH OPSS 906, CAN/CSA S6-06, AND CAN/CSA G 40.21.

2. STRUCTURAL STEEL:

TOWER PINS	CAN/CSA G 40.21 GRADE 350 AT
ALL OTHER	CAN/CSA G 40.21 GRADE 350 WT

3. HIGH STRENGTH BOLTS, NUTS, AND WASHERS TO ASTM A325M, INSTALL SNUG TIGHT.

4. WELDING ELECTRODES TO CSA W48 SERIES.

Associated Engineering

CONSULTANTS

DIGITAL INFORMATION	
SURVEY(Year)	N/A
DESIGN	y13118pd.dgn, y13118pf.dgn, y13118det.dgn
UTILITY	y13118ugs.dgn
MAPPING	y13118top.dgn, y13118top_2.dgn
STREETLINE	y13118psl.dgn

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A.M. LAWS 100143187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 July 3/13 PROVINCE OF ONTARIO

TONY PAGNANELLI, P.ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

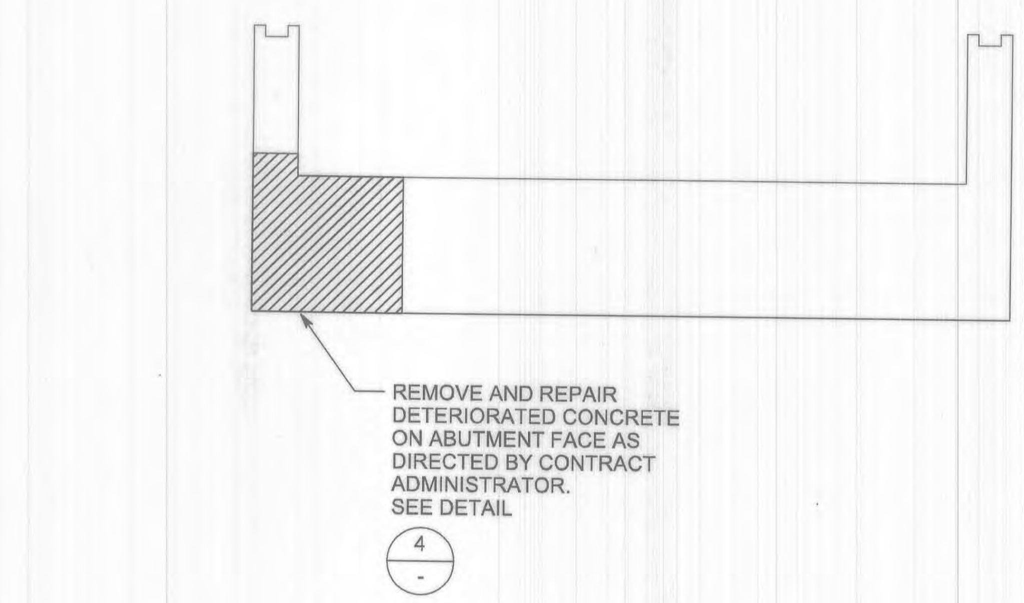
JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND CONSTRUCTION

812 SEWELLS ROAD OVER ROUGE RIVER

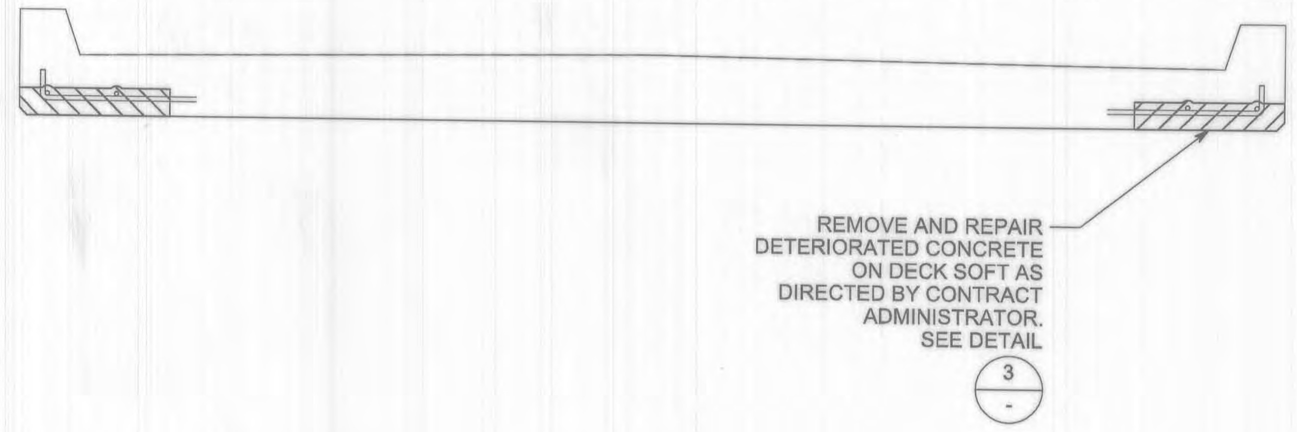
GENERAL ARRANGEMENT
BRIDGE REPAIRS

DESIGN	A.L.	DRAWN	J.W.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS NOTED			DRAWING NUMBER	812-S5012-7	SHEET S1
DATE:	JULY 3, 2013					

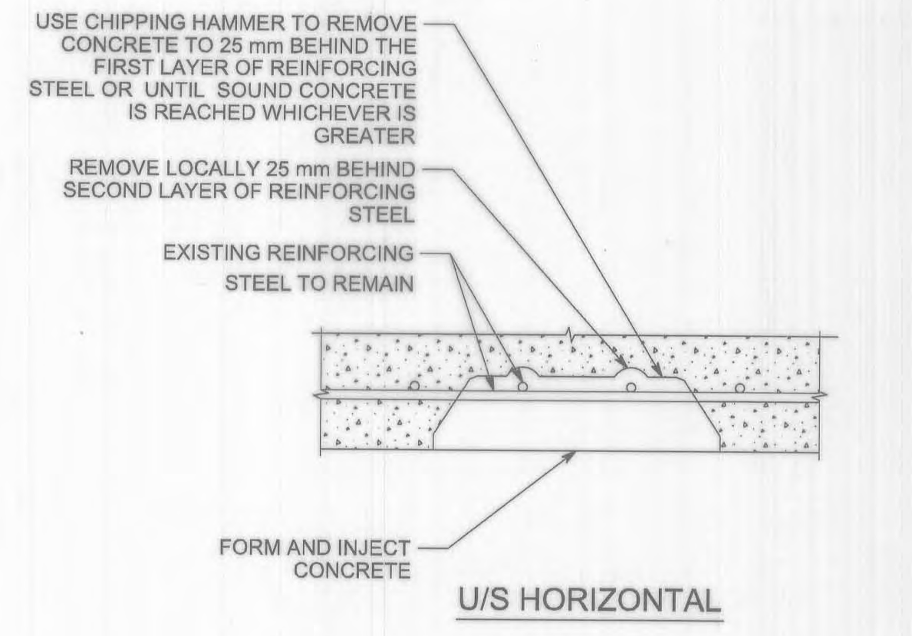
Mo.Day.Yr 812-S5012-7.dgn



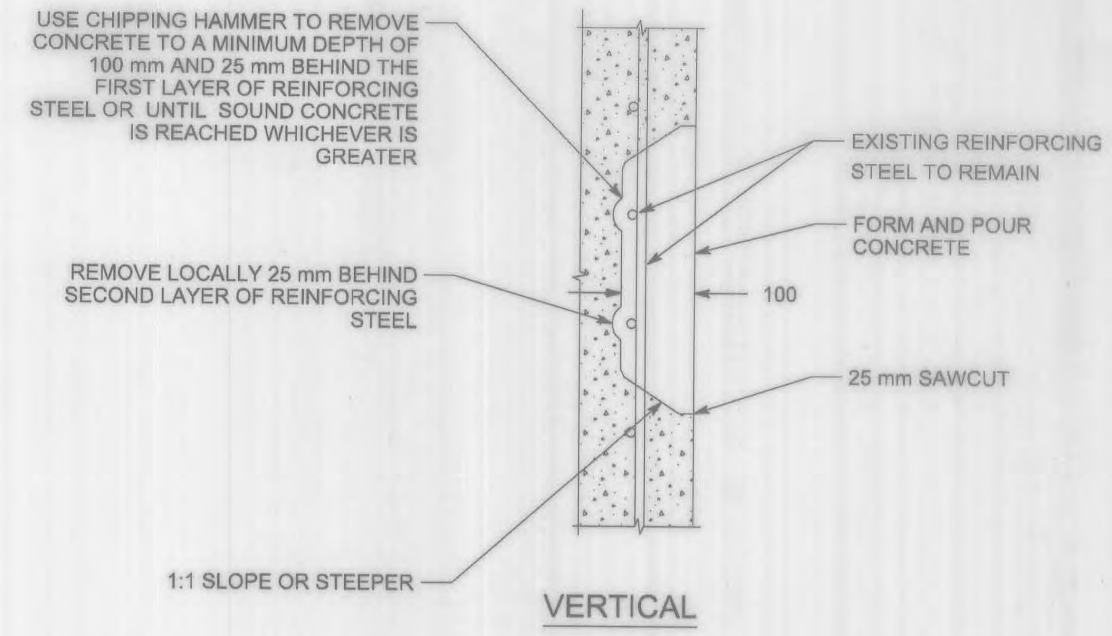
1 - SOUTH ABUTMENT CONCRETE REPAIR
1:40



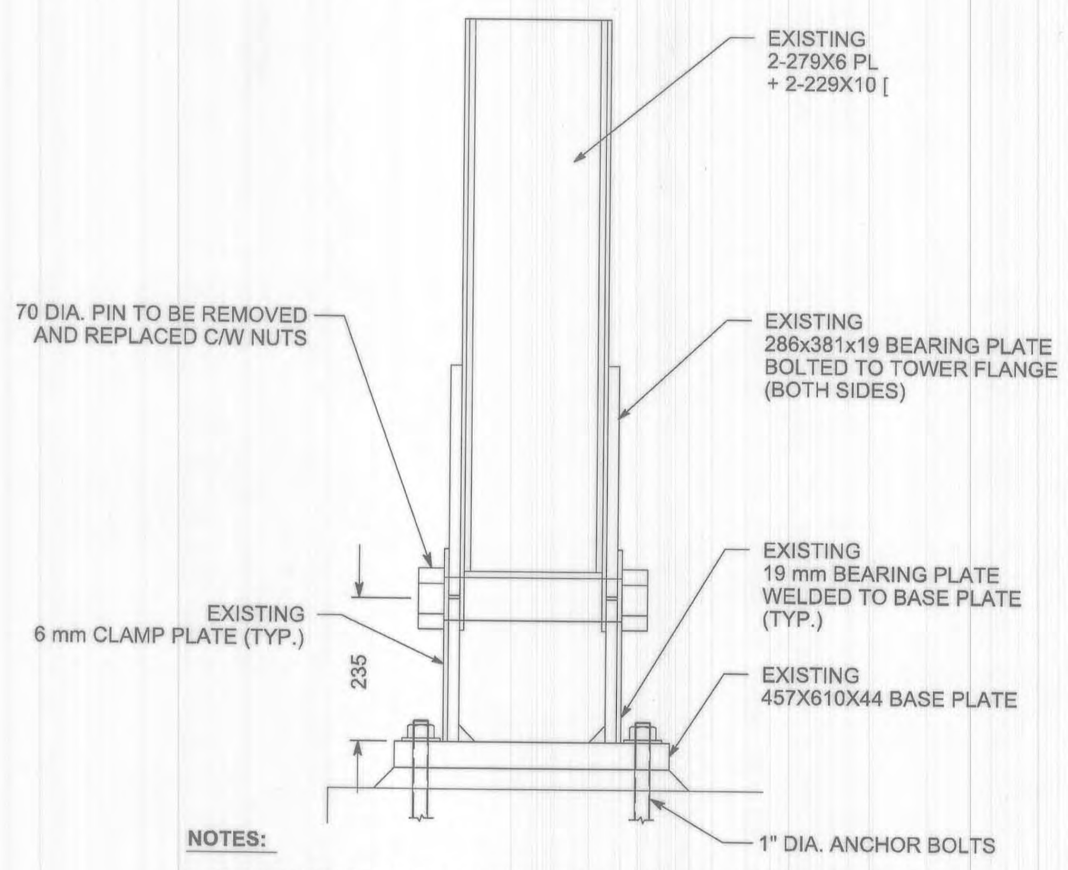
2 - DECK SOFFIT REPAIR
1:20



3 - REMOVAL/REFACING SECTION
1:10



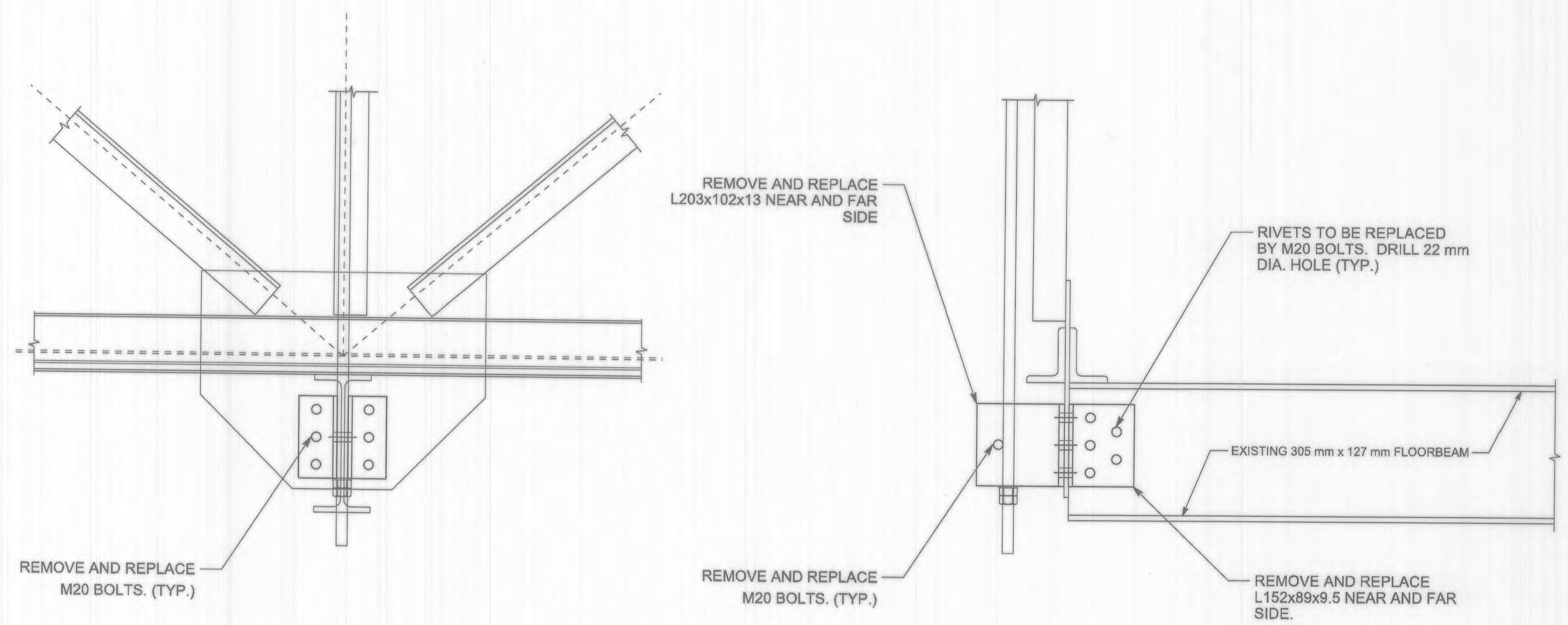
4 - REMOVAL/REFACING SECTION
1:10



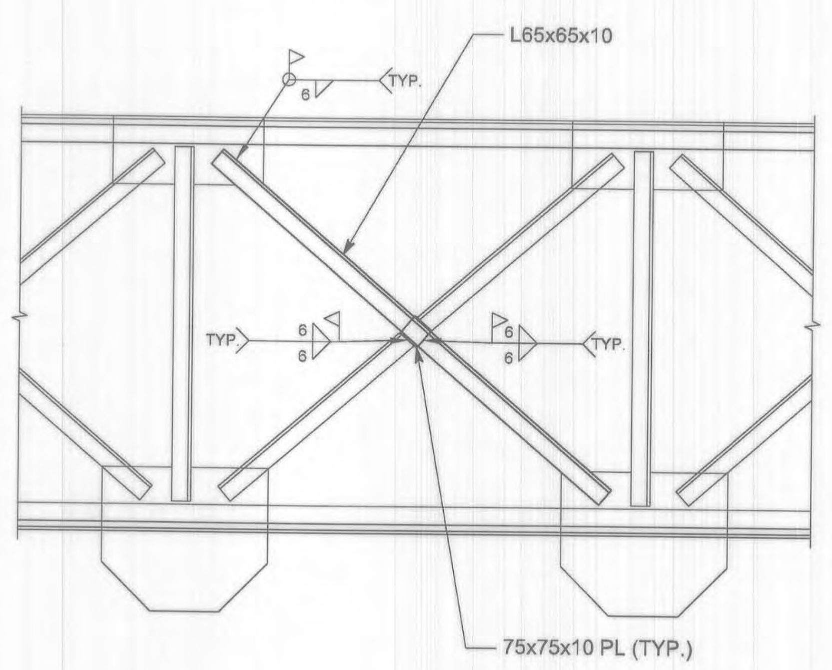
NOTES:

1. CONTRACTOR TO DESIGN, SUPPLY, INSTALL, AND REMOVE TEMPORARY SUPPORT FOR TOWER TO FACILITATE PIN REPLACEMENT.
2. UPON REMOVAL OF PIN, IF BEARING PLATES EXHIBIT SIGNIFICANT CORROSION, LARGER DIAMETER PIN SHALL BE INSTALLED AS SPECIFIED BY CONTRACT ADMINISTRATOR, AT NO EXTRA COST TO THE CITY.

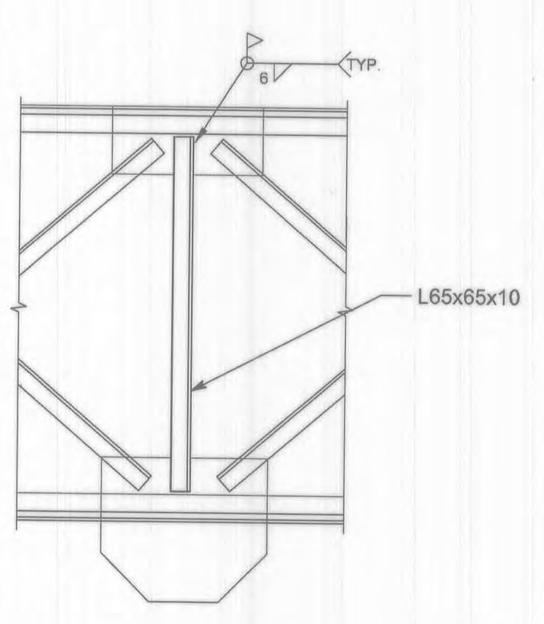
5 - TOWER BASE PIN REPLACEMENT
1:20



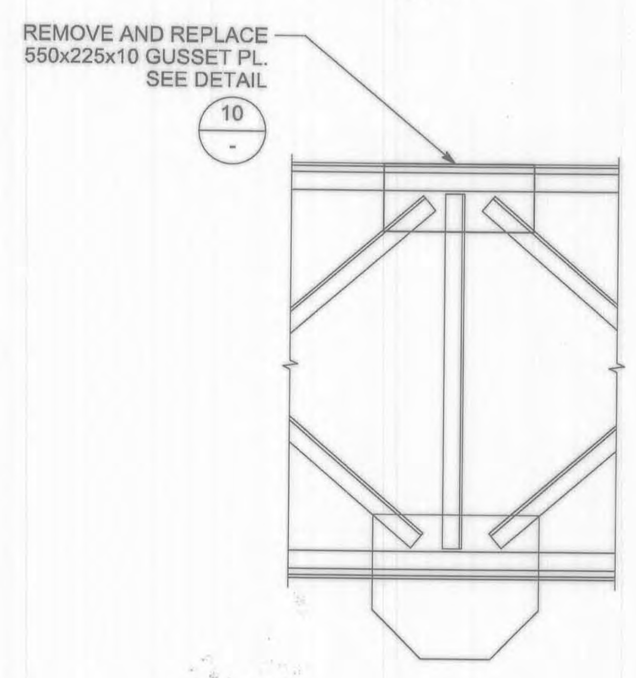
6 - HANGER-FLOORBEAM-TRUSS CONNECTION REPAIR
1:10



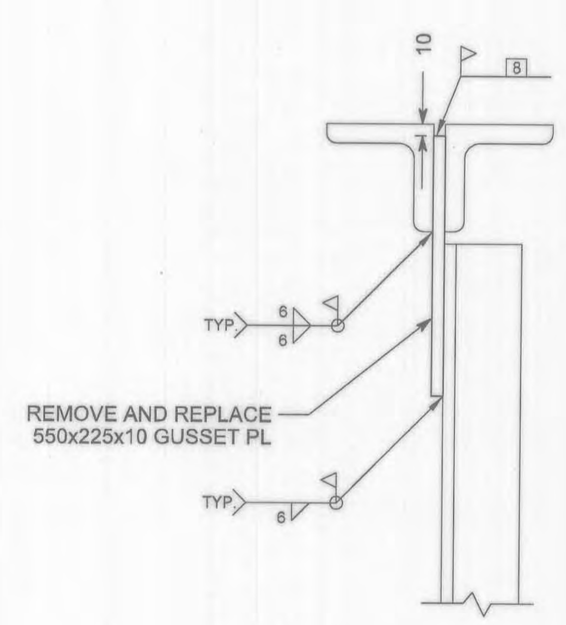
7 - TRUSS DIAGONAL REPLACEMENT
1:20



8 - TRUSS VERTICAL REPLACEMENT
1:20



9 - TRUSS GUSSET PLATE REPLACEMENT
1:20



10 - TRUSS GUSSET PLATE WELD
1:5

CONSULTANTS
Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13118det.dgn
UTILITY	N/A
MAPPING	N/A
STREETLINE	N/A
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A.M. LAWS 100183187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.S. MONKMAN 100127743 PROVINCE OF ONTARIO

TONY PAGNANELLI, P.ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

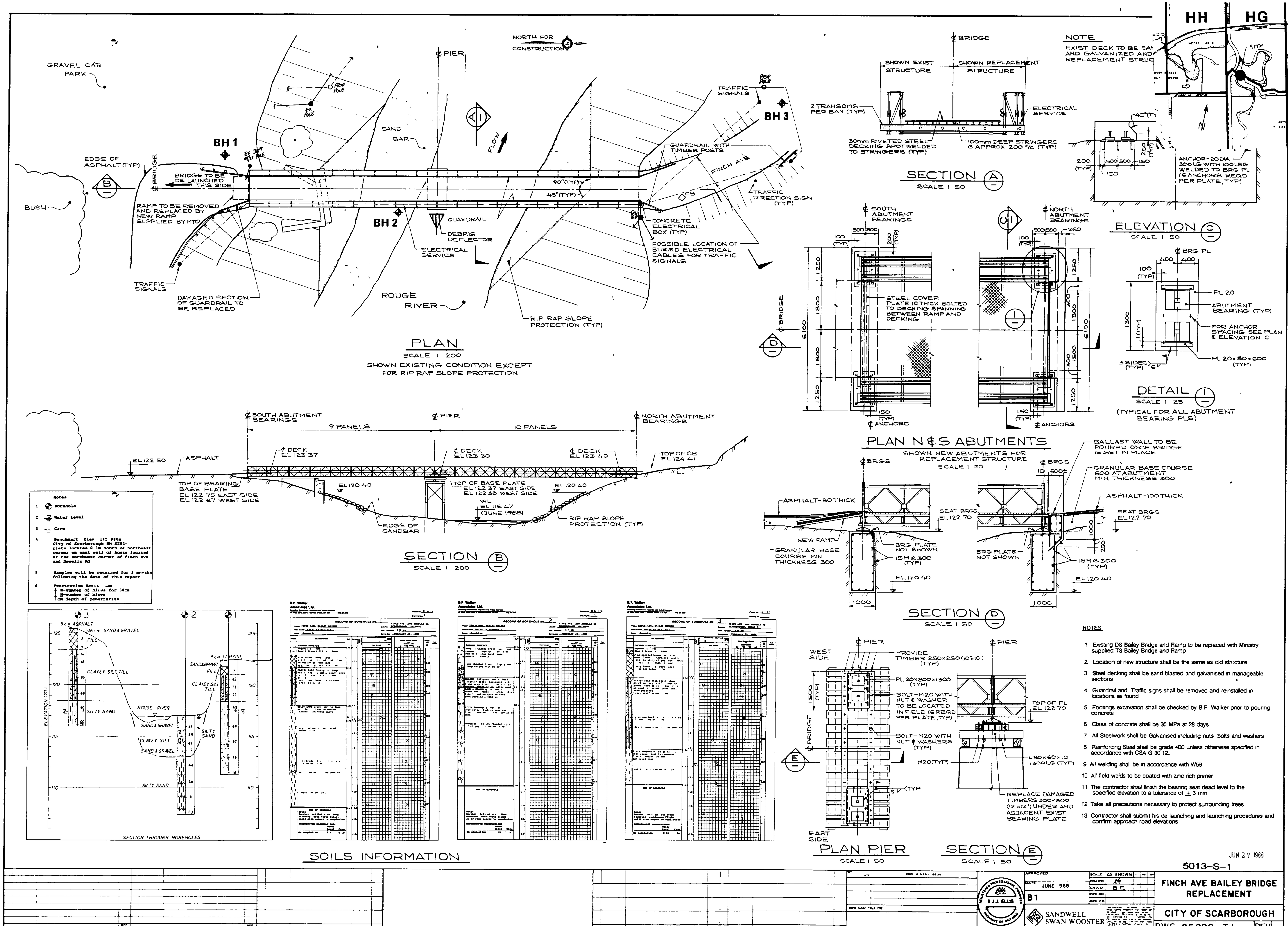
JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND CONSTRUCTION

812 SEWELLS ROAD OVER ROUGE RIVER

DETAILS
BRIDGE REPAIRS

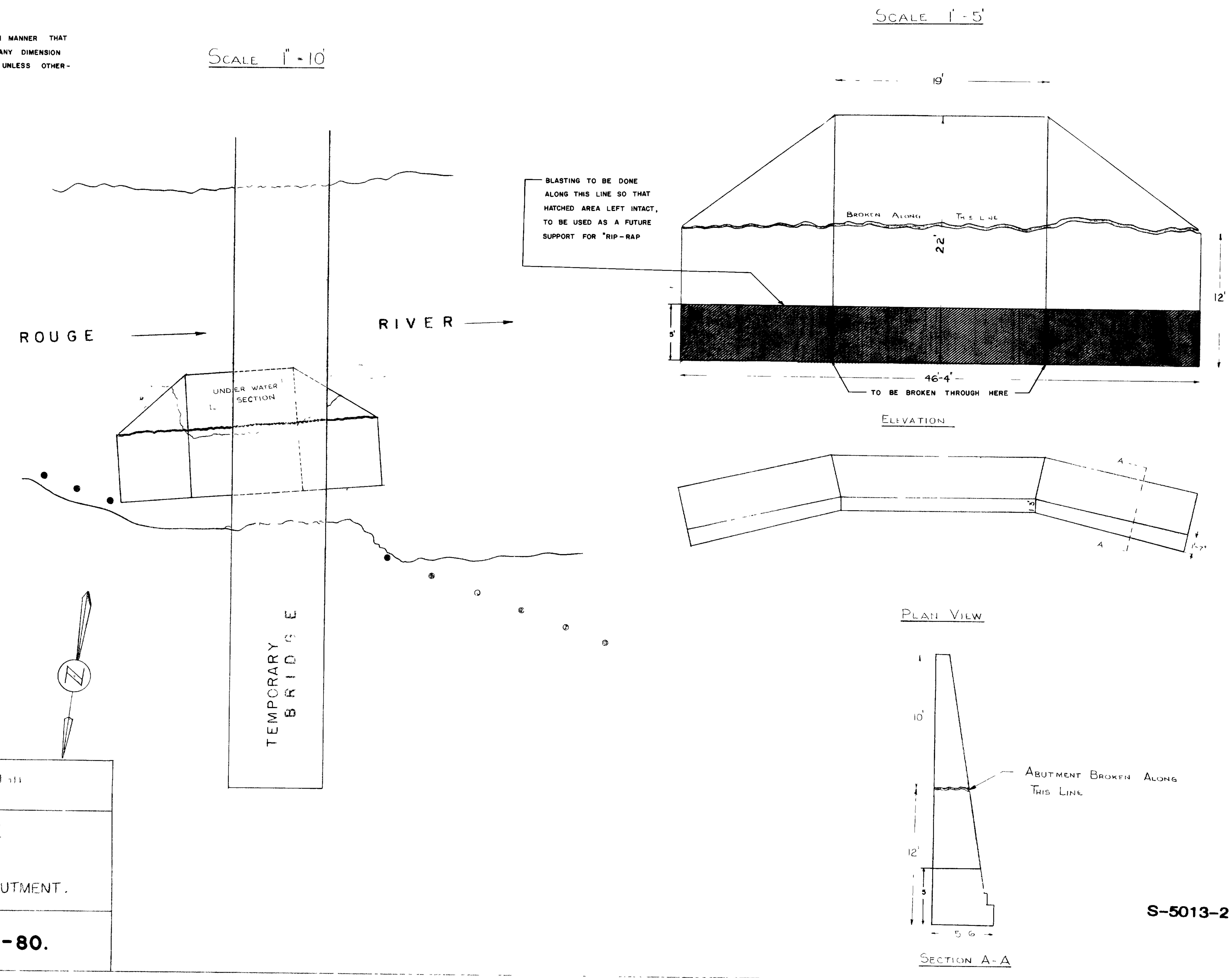
DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS NOTED			DRAWING NUMBER	812-S5012-8	SHEET S2
DATE:	JULY 3, 2013					

Mo.Day.Yr $$FILE$$



PLAN
SCALE 1 200
SHOWN EXISTING CONDITION EXCEPT FOR RIP RAP SLOPE PROTECTION
NORTH FOR CONSTRUCTION
GRAVEL CAR PARK
BUSH
BH 1
BH 2
BH 3
SAND BAR
FLOW
ROUGE RIVER
EDGE OF ASPHALT (TYP)
BRIDGE TO BE DE LAUNCHED THIS SIDE
RAMP TO BE REMOVED AND REPLACED BY NEW RAMP SUPPLIED BY MTO
TRAFFIC SIGNALS
DAMAGED SECTION OF GUARDRAIL TO BE REPLACED
GUARDRAIL
DEBRIS DEFLECTOR
ELECTRICAL SERVICE
RIP RAP SLOPE PROTECTION (TYP)
GUARDRAIL WITH TIMBER POSTS
FINCH AVE
TRAFFIC DIRECTION SIGN (TYP)
CONCRETE ELECTRICAL BOX (TYP)
POSSIBLE LOCATION OF BURIED ELECTRICAL CABLES FOR TRAFFIC SIGNALS
SECTION B
SCALE 1 200
℄ SOUTH ABUTMENT BEARINGS
℄ PIER
℄ NORTH ABUTMENT BEARINGS
9 PANELS
10 PANELS
EL 122 50
ASPHALT
℄ DECK EL 123 37
℄ DECK EL 123 30
℄ DECK EL 123 43
TOP OF CB EL 124 41
TOP OF BEARING BASE PLATE EL 122 75 EAST SIDE EL 122 67 WEST SIDE
TOP OF BASE PLATE EL 122 37 EAST SIDE EL 122 38 WEST SIDE
EL 120 40
WL EL 116 47 (JUNE 1988)
EDGE OF SANDBAR
RIP RAP SLOPE PROTECTION (TYP)
Notes-
1 Borehole
2 Water Level
3 Cave
4 Benchmark Elev 145 880m City of Scarborough BM 3203-plate located 0 1m south of northeast corner on east wall of house located at the northwest corner of Finch Ave and Sewells Rd
5 Samples will be retained for 3 months following the date of this report
6 Penetration Resis ...
SECTION THROUGH BOREHOLES
SOILS INFORMATION
B.P. Walker Associates Ltd.
RECORD OF BOREHOLE No. 1
RECORD OF BOREHOLE No. 2
RECORD OF BOREHOLE No. 3
SECTION A
SCALE 1 50
℄ BRIDGE
SHOWN EXIST STRUCTURE
SHOWN REPLACEMENT STRUCTURE
2 TRANSOMS PER BAY (TYP)
ELECTRICAL SERVICE
30mm RIVETED STEEL DECKING SPOTWELDED TO STRINGERS (TYP)
100mm DEEP STRINGERS @ APPROX 200 C/C (TYP)
NOTE
EXIST DECK TO BE SA... AND GALVANIZED AND ... REPLACEMENT STRUC...
HH
HG
SITE
ELEVATION C
SCALE 1 50
ANCHOR-20 DIA 300 LG WITH 100 LEG WELDED TO BRG PL (6 ANCHORS REQD PER PLATE, TYP)
PLAN N & S ABUTMENTS
SHOWN NEW ABUTMENTS FOR REPLACEMENT STRUCTURE
SCALE 1 50
℄ SOUTH ABUTMENT BEARINGS
℄ NORTH ABUTMENT BEARINGS
STEEL COVER PLATE 10 THICK BOLTED TO DECKING SPANNING BETWEEN RAMP AND DECKING
℄ ANCHORS
DETAIL 1
SCALE 1 25
(TYPICAL FOR ALL ABUTMENT BEARING PLS)
℄ BRG PL
PL 20
ABUTMENT BEARING (TYP)
FOR ANCHOR SPACING SEE PLAN & ELEVATION C
PL 20 x 80 x 600 (TYP)
SECTION D
SCALE 1 50
ASPHALT-80 THICK
NEW RAMP
GRANULAR BASE COURSE MIN THICKNESS 300
BRG PLATE NOT SHOWN
15M @ 300 (TYP)
SEAT BRGS EL 122 70
EL 120 40
BALLAST WALL TO BE POURED ONCE BRIDGE IS SET IN PLACE
GRANULAR BASE COURSE 600 AT ABUTMENT MIN THICKNESS 300
ASPHALT-100 THICK
PLAN PIER
SCALE 1 50
SECTION E
SCALE 1 50
WEST SIDE
EAST SIDE
PROVIDE TIMBER 250 x 250 (10"x10") (TYP)
PL 20 x 800 x 1300 (TYP)
BOLT-M20 WITH NUT & WASHER TO BE LOCATED IN FIELD (6 REQD PER PLATE, TYP)
BOLT-M20 WITH NUT & WASHERS (TYP)
M20 (TYP)
TOP OF PL EL 122 70
L 80 x 60 x 10 1300 LG (TYP)
REPLACE DAMAGED TIMBERS 300 x 300 (12"x12") UNDER AND ADJACENT EXIST BEARING PLATE
NOTES
1 Existing DS Bailey Bridge and Ramp to be replaced with Ministry supplied TS Bailey Bridge and Ramp
2 Location of new structure shall be the same as old structure
3 Steel decking shall be sand blasted and galvanised in manageable sections
4 Guardrail and Traffic signs shall be removed and reinstalled in locations as found
5 Footings excavation shall be checked by B P Walker prior to pouring concrete
6 Class of concrete shall be 30 MPa at 28 days
7 All Steelwork shall be Galvanised including nuts bolts and washers
8 Reinforcing Steel shall be grade 400 unless otherwise specified in accordance with CSA G 30 12.
9 All welding shall be in accordance with W59
10 All field welds to be coated with zinc rich primer
11 The contractor shall finish the bearing seat dead level to the specified elevation to a tolerance of ± 3 mm
12 Take all precautions necessary to protect surrounding trees
13 Contractor shall submit his de launching and launching procedures and confirm approach road elevations
JUN 27 1988
5013-S-1
DATE JUNE 1988
SCALE AS SHOWN
B1
B J J ELLIS
SANDWELL SWAN WOOSTER
FINCH AVE BAILEY BRIDGE REPLACEMENT
CITY OF SCARBOROUGH
DWG 26200-T1
REV
1905 E
1902 E

NOTE: ALL BLASTING TO BE DONE IN SUCH MANNER THAT NO PIECE SHALL EXCEED 2 IN ANY DIMENSION AFTER BLASTING IS COMPLETED UNLESS OTHERWISE NOTED



09326 V01

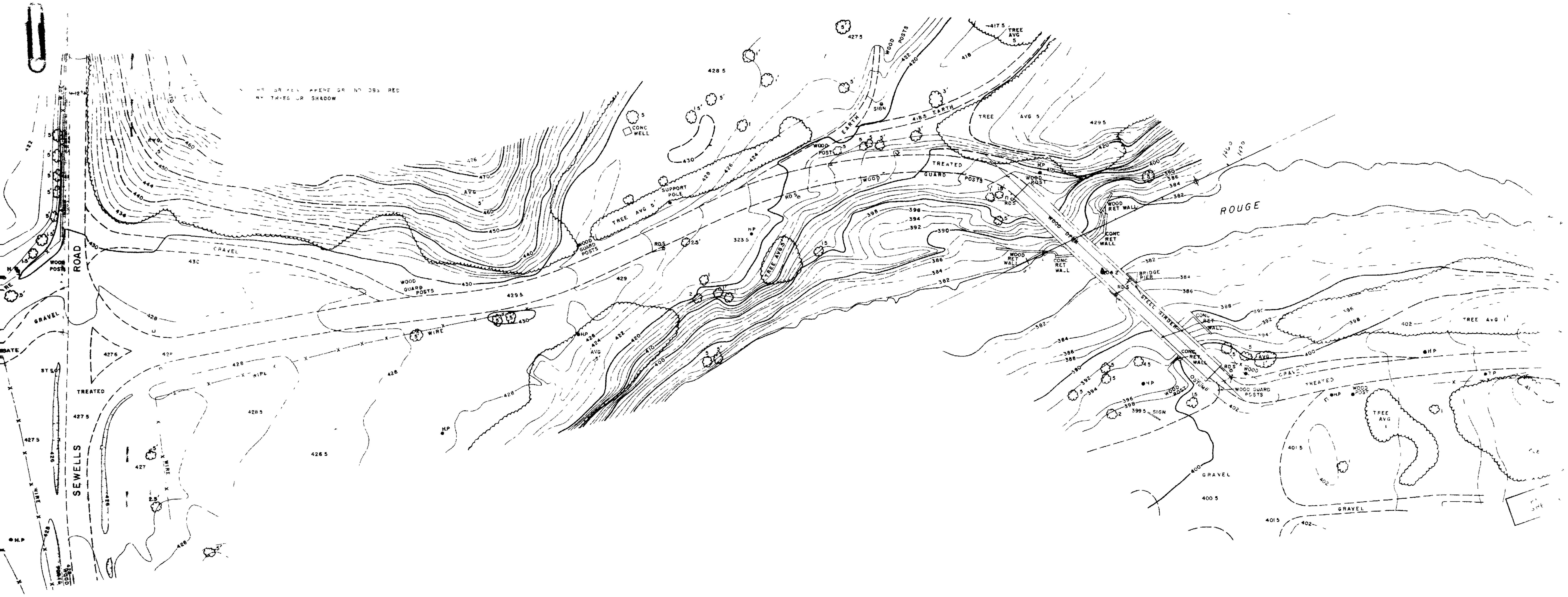
MILNES BRIDGE
FINCH AVE

DETAILS OF CONC BRIDGE ABUTMENT.

WAS FILE No. B-80.
Now File 3351

S-5013-2

3351



NO	REVISION	DATE	BY	SURVEY INSP	CHK D

UTILITIES		
NAME	SENT	RECEIVED
S PU C water hydro		
CON GAS		
BELL TEL		
HE P C		

S-5013-3

TOWNSHIP OF SCARBOROUGH
WORKS DEPARTMENT

PROP RIVER GABIONS
MILNE'S BRIDGE
at
ROUGE RIVER

SCALES		
VERT 1' = 10	DRAWN BY JOHN RISTICH	DIRECTOR of ENG ________
HOR 1 = 40'	DATE ____________	CONSTRUCTION ENG ______
	CHECKED BY ________	DATE
	DATE ____________	

PLAN NO 3351 A

S-5013-4

NO	Letter Code of Size	SIZE Length	Width	Depth
I	A	6	3	3
II	B	9	3	3
36	C	12	3	3
48				

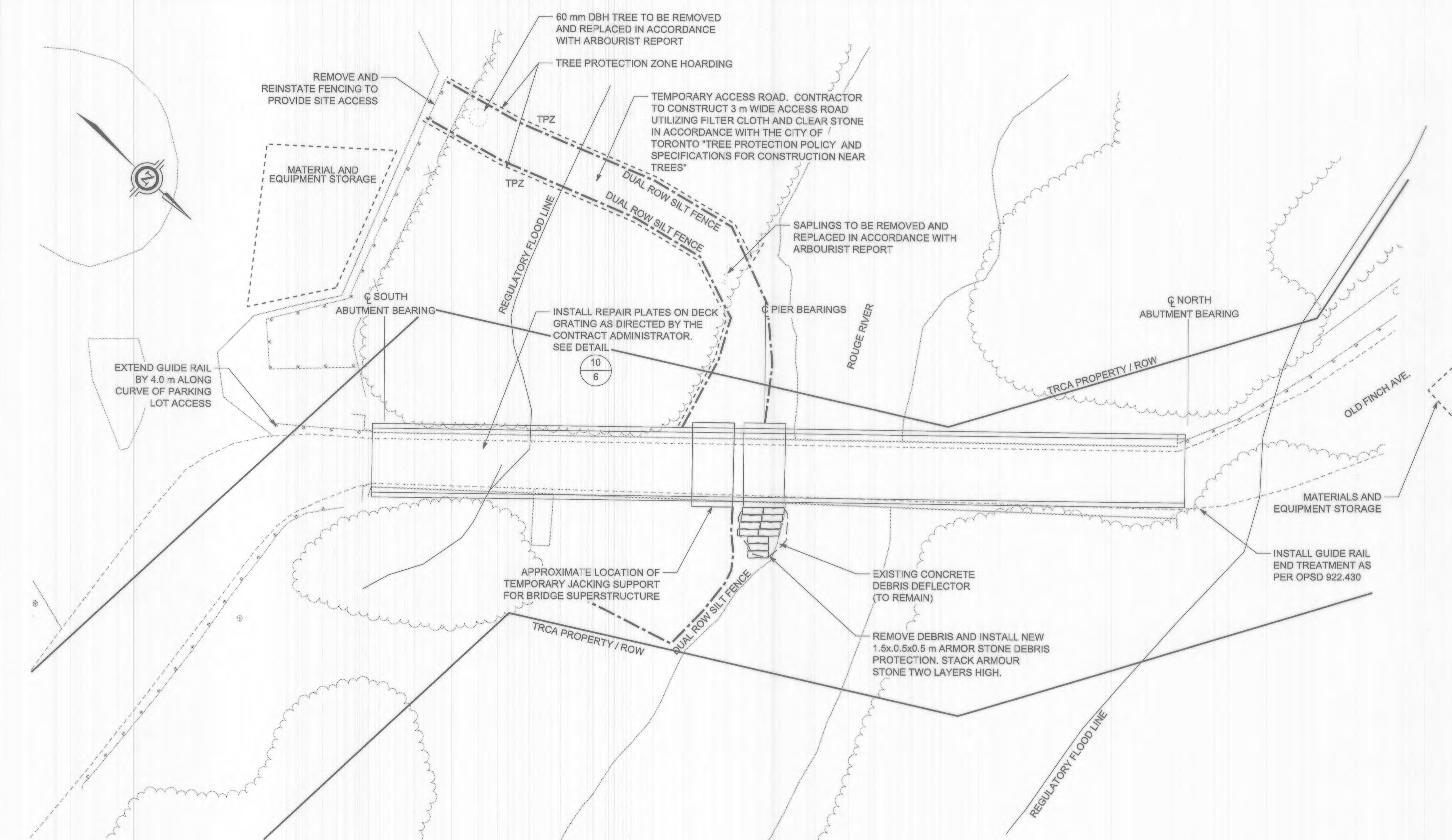
BOROUGH OF SCARBOROUGH
WORKS DEPARTMENT

PROP GABION WALL
ROUGE RIVER
AT FINCH AVE.

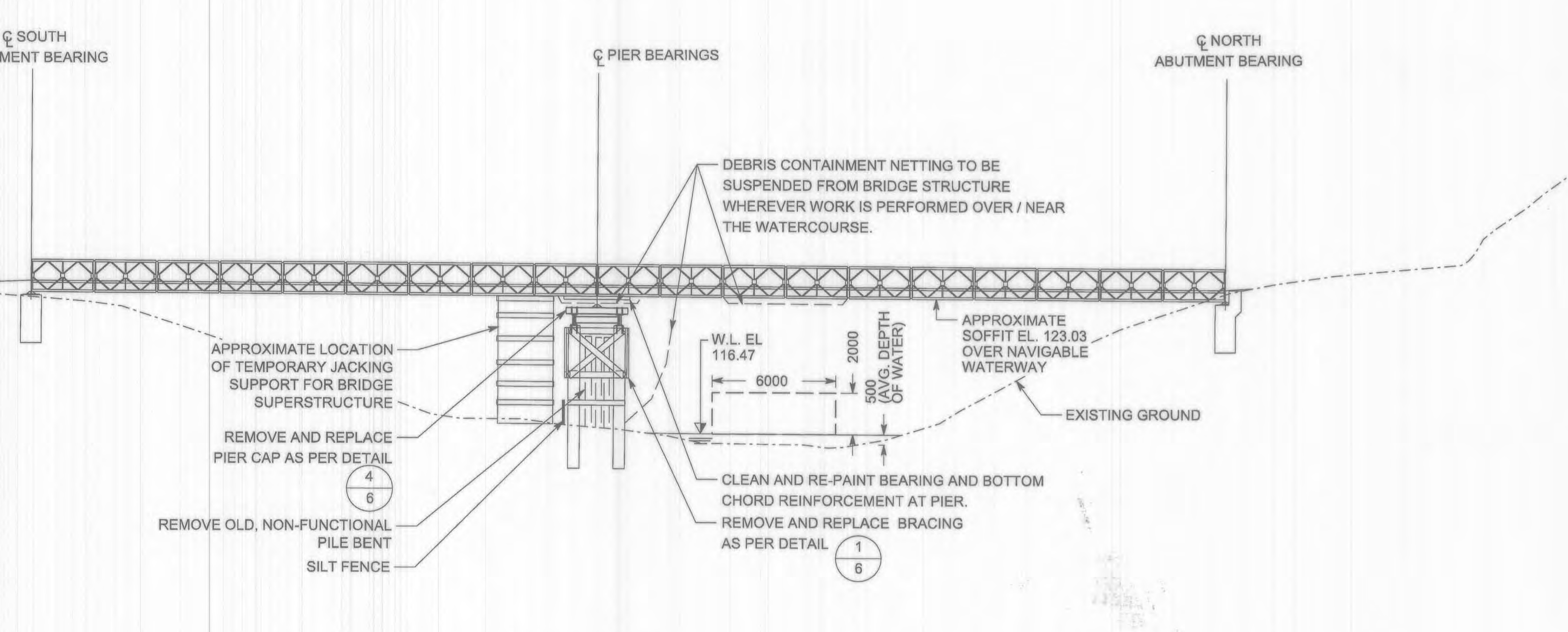
SCALES
VERT 1=10
HOR 1=10

DRAWN BY J. RISTICH
DATE DEC 14/66
CHECKED by ______
DATE ______

DIRECTOR of OPS ______
RD MAINTENANCE ENG ______
DATE ______ FILE NO 3351



PLAN
1:200



ELEVATION
1:200

STRUCTURAL NOTES

STRUCTURAL STEEL

1. ALL STEEL WORK SHALL BE IN ACCORDANCE WITH OPSS 906, CAN/CSA S6-06, AND CAN/CSA G 40.21.

2. STRUCTURAL STEEL TO BE CAN/CSA G 40.21 GRADE 350 WT.

3. HIGH STRENGTH BOLTS, NUTS, AND WASHERS TO ASTM A325, INSTALL SNUG TIGHT.

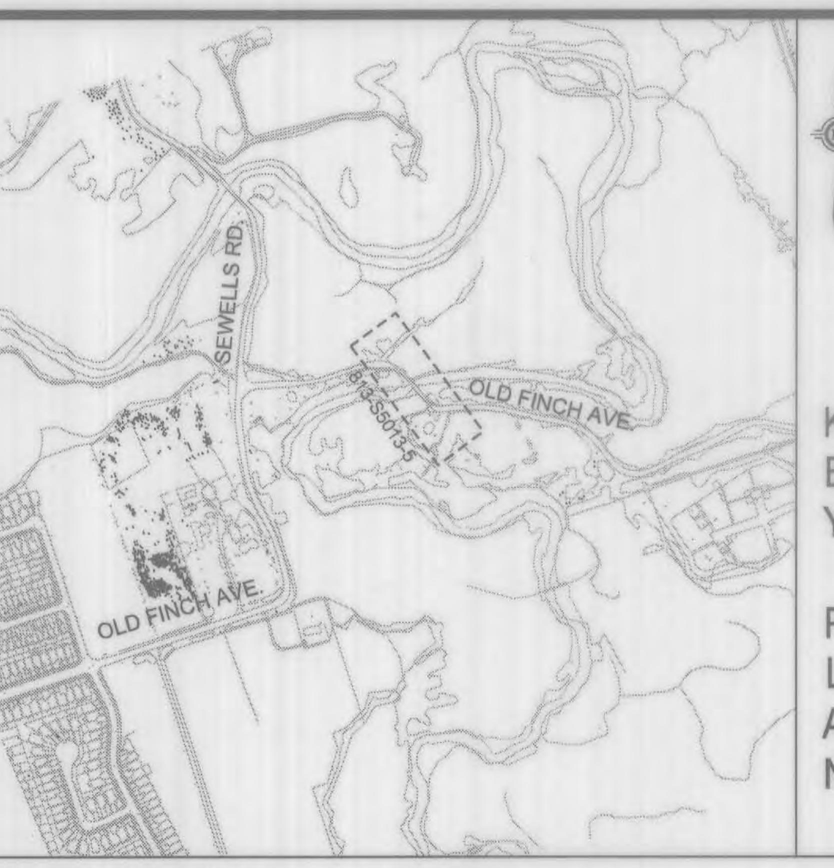
4. WELDING ELECTRODES TO CSA W48 SERIES.

STRUCTURAL TIMBER

1. ALL TIMBER WORK SHALL BE IN ACCORDANCE WITH OPSS 907, CAN/CSA S6-06 AND CAN/CSA-O86.

2. TIMBER FOR BRACING SHALL BE CAN/CSA-O86 DOUGLAS FIR, STRUCTURAL JOISTS AND PLANKS GRADE SS.

3. TIMBER FOR PIER CAP SHALL BE CAN/CSA-O86 DOUGLAS FIR, POST AND TIMBER GRADE SS.



RELATED DRAWINGS: P-/U- NOT TO SCALE

GENERAL NOTES:

DESIGN CODE

1. THE STRUCTURE REHABILITATION IS DESIGNED IN ACCORDANCE WITH CANADIAN HIGHWAY BRIDGE DESIGN CODE CAN/CSA-S6-06 (CHBDC).

2. ALL WORK SHALL CONFORM TO THE LATEST REVISIONS OF THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD) AND SPECIFICATIONS (OPSS) UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THE SPECIFICATIONS.

3. ASSOCIATED ENGINEERING LTD. DOES NOT ASSUME ANY RESPONSIBILITY FOR LOSSES, DAMAGES, OR COSTS ARISING FROM THE USE OR REUSE OF THESE DRAWINGS BY PERSONS, FIRMS, OR CORPORATIONS WITHOUT PRIOR WRITTEN CONSENT.

CONSTRUCTION NOTES

1. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, DETAILS AND ELEVATIONS OF THE EXISTING STRUCTURE THAT ARE RELEVANT TO THE WORK SHOWN ON THE DRAWINGS PRIOR TO COMMENCEMENT OF THE WORK. ANY DISCREPANCIES SHALL BE REPORTED TO THE CONTRACT ADMINISTRATOR AND THE PROPOSED ADJUSTMENT OF THE WORK REQUIRED TO MATCH THE EXISTING STRUCTURE SHALL BE SUBMITTED FOR APPROVAL.

2. DRAWINGS ARE NOT TO BE SCALED.

3. THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.

4. ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING UTILITIES AND ADJACENT PROPERTIES SHALL BE REPAIRED BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AT NO COST TO THE CITY.

5. THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORM AND NECESSARY CONTAINMENT MEASURES DURING CONSTRUCTION TO COLLECT CONSTRUCTION DEBRIS AND ENSURE THAT NO DEBRIS OR MATERIALS RESULTING FROM WORK FALL IN THE RIVER OR ON OTHER AREAS BELOW THE BRIDGE.

6. BRIDGE WILL BE CLOSED TO ALL THROUGH TRAFFIC DURING CONSTRUCTION.

7. ALL IN-WATER AND NEAR WATER WORKS WILL BE CONDUCTED IN THE DRY WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS IN ACCORDANCE WITH THE TRCA EROSION AND SEDIMENT CONTROL GUIDELINES FOR URBAN CONSTRUCTION (2006).

8. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING, THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.

9. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED 30 METRES FROM THE WATER.

10. ALL GRADES WITHIN THE REGIONAL STORM FLOOD PLAIN WILL BE MAINTAINED OR MATCHED.

11. THE PROPONENT/CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVOURABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE PROPONENT/ CONTRACTOR SHALL REMOVE ALL ITEMS FROM THE REGIONALSTORM FLOOD PLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (I.E. FUEL TANKS, UNFIXED EQUIPMENT, ETC.).

12. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/ AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF THE PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, THEN ALTERNATIVE MEASURES SHOULD BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS.

GENERAL NOTES CONT'D:

13. TO PROTECT LOCAL FISH POPULATIONS DURING THEIR SPAWNING, NURSERY AND MIGRATORY PERIODS, IN- AND NEAR-WATER ACTIVITIES MAY ONLY OCCUR DURING THE WARM WATER CONSTRUCTION TIMING WINDOW OF JULY 1 TO MARCH 31.

14. TO AVOID INTERFERENCE WITH THE EGGS, NESTS OR YOUNG OF BIRDS PROTECTED UNDER THE FEDERAL MIGRATORY BIRDS CONVENTION ACT, REMOVALS SHOULD NOT OCCUR FROM MAY 1 TO AUGUST 1 OF ANY GIVEN YEAR. IDEALLY, REMOVALS SHOULD OCCUR FROM AUGUST THROUGH DECEMBER TO AVOID INTERFERENCE WITH ALL NESTING BIRDS. SHOULD REMOVALS BE REQUIRED WITHIN THE MAY 1 TO AUGUST 1 BREEDING PERIOD, A QUALIFIED AVIAN BIOLOGIST SHOULD CONDUCT A THOROUGH SURVEY IMMEDIATELY PRIOR TO THE DESIRED TREE REMOVAL DATE TO CONFIRM PRESENCE OR ABSENCE OF PROTECTED SPECIES. IF PROTECTED SPECIES ARE PRESENT, REMOVALS CANNOT OCCUR WITHOUT A PERMIT FROM THE CANADIAN WILDLIFE SERVICE.

15. ROOT PROTECTION SHALL BE INSTALLED WHERE REQUIRED IN CONSTRUCTION ACCESS LOCATIONS TO THE SATISFACTION OF URBAN FORESTRY IN ORDER TO PROTECT TREE ROOTS FROM COMPACTION DURING CONSTRUCTION. ROOT PROTECTION SHALL CONSIST OF A COMBINATION OF FILTER FABRIC, CLEAR CRUSHED STONE (HALF TO THREE QUARTER INCH DIAMETER) PLACED IN A LAYER 15 cm DEEP, AND STEEL PLATING OR OTHER MATERIAL, AS APPROVED BY URBAN FORESTRY.

16. ONCE ALL TREE/SITE PROTECTION MEASURES HAVE BEEN INSTALLED CONTRACTOR MUST NOTIFY URBAN FORESTRY STAFF TO ARRANGE FOR AN INSPECTION OF THE SITE AND APPROVAL OF THE SITE PROTECTION REQUIREMENTS.

17. IF ANY DEBRIS IS TO BYPASS THE CONTAINMENT AREA AND ENTER THE WATERCOURSE, THE CONTRACTOR SHALL COLLECT IT BY HAND.

18. SITE RESTORATION OF ALL DISTURBED AREAS SHALL BE IN ACCORDANCE WITH TRCA POST-CONSTRUCTION RESTORATION GUIDELINES (2004), INCLUDING BUT NOT LIMITED TO REMOVAL OF TEMPORARY FILL MATERIALS, SEEDING USING TRCA APPROVED NATIVE SEED MIXTURE AND PLANTING OF NATIVE SPECIES TREES.

19. VEHICULAR ACCESS BELOW THE BRIDGE STRUCTURE WILL NOT BE PERMITTED.

20. NO VEGETATION IS TO BE REMOVED.

SCOPE OF REHABILITATION WORK

THE GENERAL SCOPE OF THE BRIDGE REPAIR WORK OF THE CONTRACT SHALL INCLUDE THE FOLLOWING:

1. REMOVE EXISTING PIER CAP AND NON-FUNCTIONING PILE BENT.

2. INSTALL NEW PIER CAP AND BRACING.

3. REPAIR GUIDE RAIL AND INSTALL END TREATMENTS.

4. CLEAN AND REPAINT BEARINGS AND BOTTOM CHORD REINFORCEMENT AT PIER.

5. REPAIR DAMAGED DECK GRATING.

6. INSTALL DEBRIS / ICE PROTECTION UPSTREAM OF PIER.

CONSULTANTS
Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13113pd.dgn, y13113pf.dgn, Y13113det.dgn
UTILITY	Y13113ugs.dgn
MAPPING	Y13113top.dgn, Y13113top_2.dgn
STREETLINE	Y13113psl.dgn
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A. M. LAWS 100183187 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 PROVINCE OF ONTARIO

TONY PAGNANELLI, P. ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND CONSTRUCTION SERVICES

JOHN P. KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

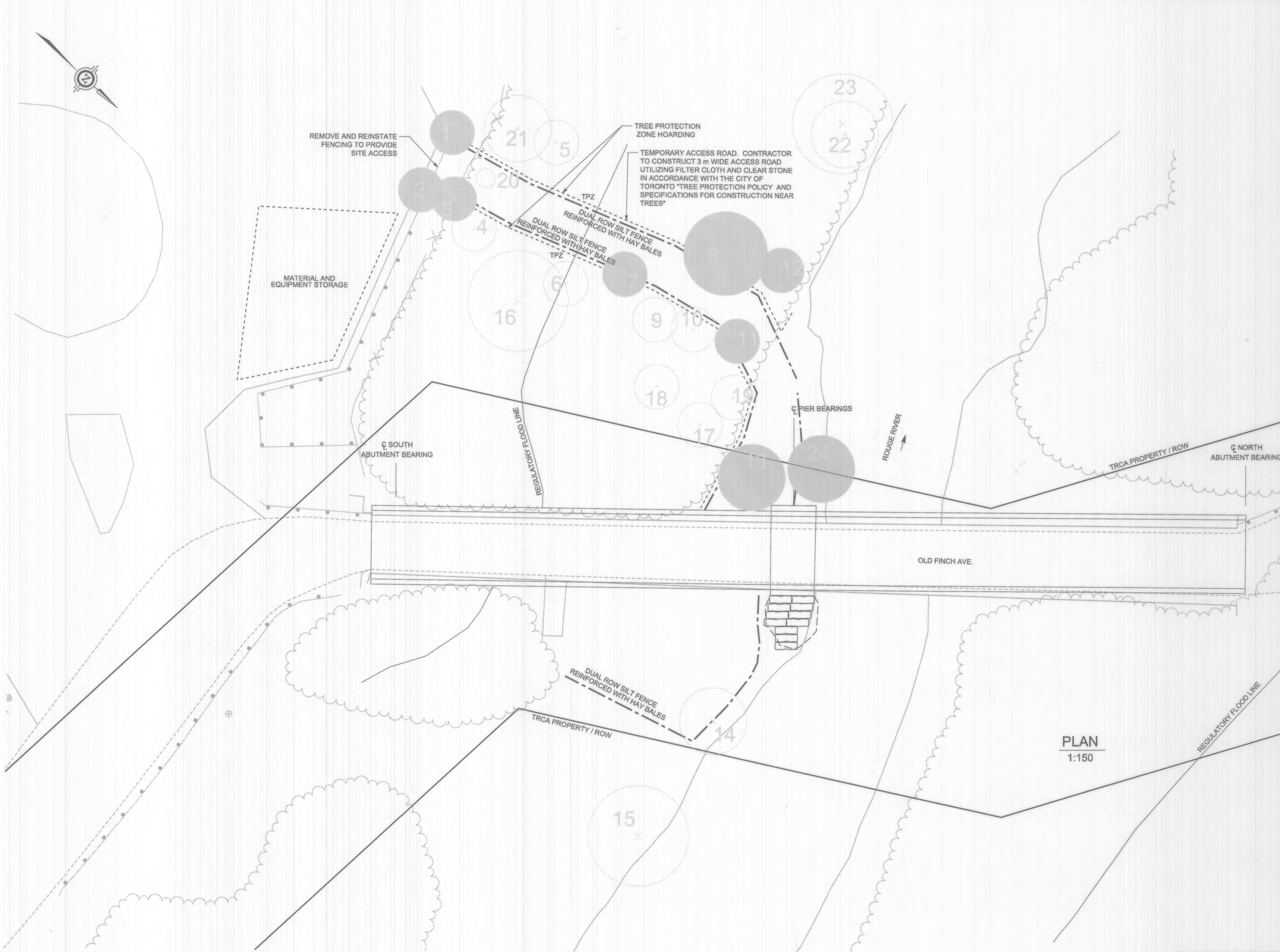
JIM SCHAFFNER, P. ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

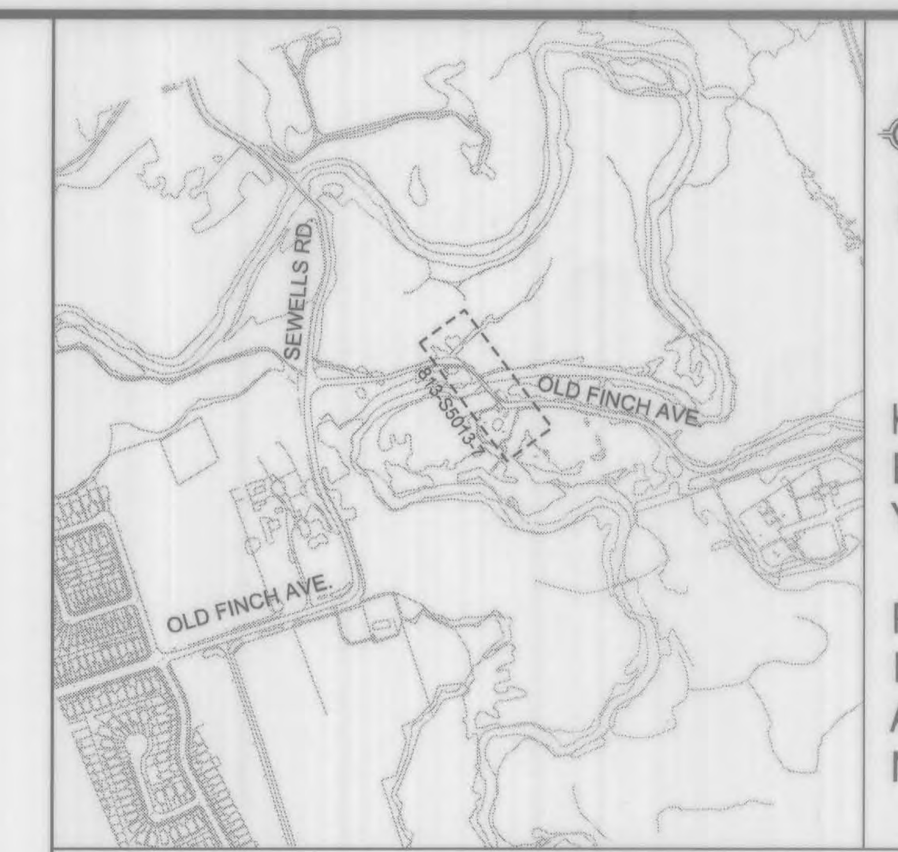
813 OLD FINCH AVE OVER ROUGE RIVER

GENERAL ARRANGEMENT
BRIDGE REPAIR

DESIGN	A.L.	DRAWN	J.S.	CHECKED	J.M.	CONTRACT No. 12SE-10S	
SCALE:	AS SHOWN			DRAWING NUMBER	813-S5013-5	SHEET	S1
DATE:	JULY 3, 2013						

4.16.2013 813-S5013-5.dgn





RELATED DRAWINGS: P-/U- NOT TO SCALE

REMOVALS GENERAL NOTES:

1. INSTALL HEAVY DUTY SILT FENCE ALONG THE PATH.
2. INSTALL TREE AND ROOT PROTECTION AS PER SPECIFICATION FOR CONSTRUCTION NEAR TREES.
3. TREE IS TO BE COMPLETELY REMOVED INCLUDING ROOTS.
4. ONLY TREES MARKED FOR REMOVAL SHALL BE REMOVED ANY OTHERS WILL BE PROHIBITED.

LEGEND

TREES THAT HAVE INJURY RISK BUT NOT TO BE REMOVED AS PER THE ARBORIST REPORT

TREES THAT SHALL BE REMOVED AND REINSTATED AS PER ARBORIST REPORT

CONSULTANTS

Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13113pd.dgn, y13113ssc.dgn
UTILITY	Y13113ugs.dgn
MAPPING	Y13113top.dgn, Y13113top_2.dgn
STREETLINE	Y13113psl.dgn
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A.M. LAWS 100183187 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.S. MONKMAN 100127743 PROVINCE OF ONTARIO

TONY PAGNANELLI, P. ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P. KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

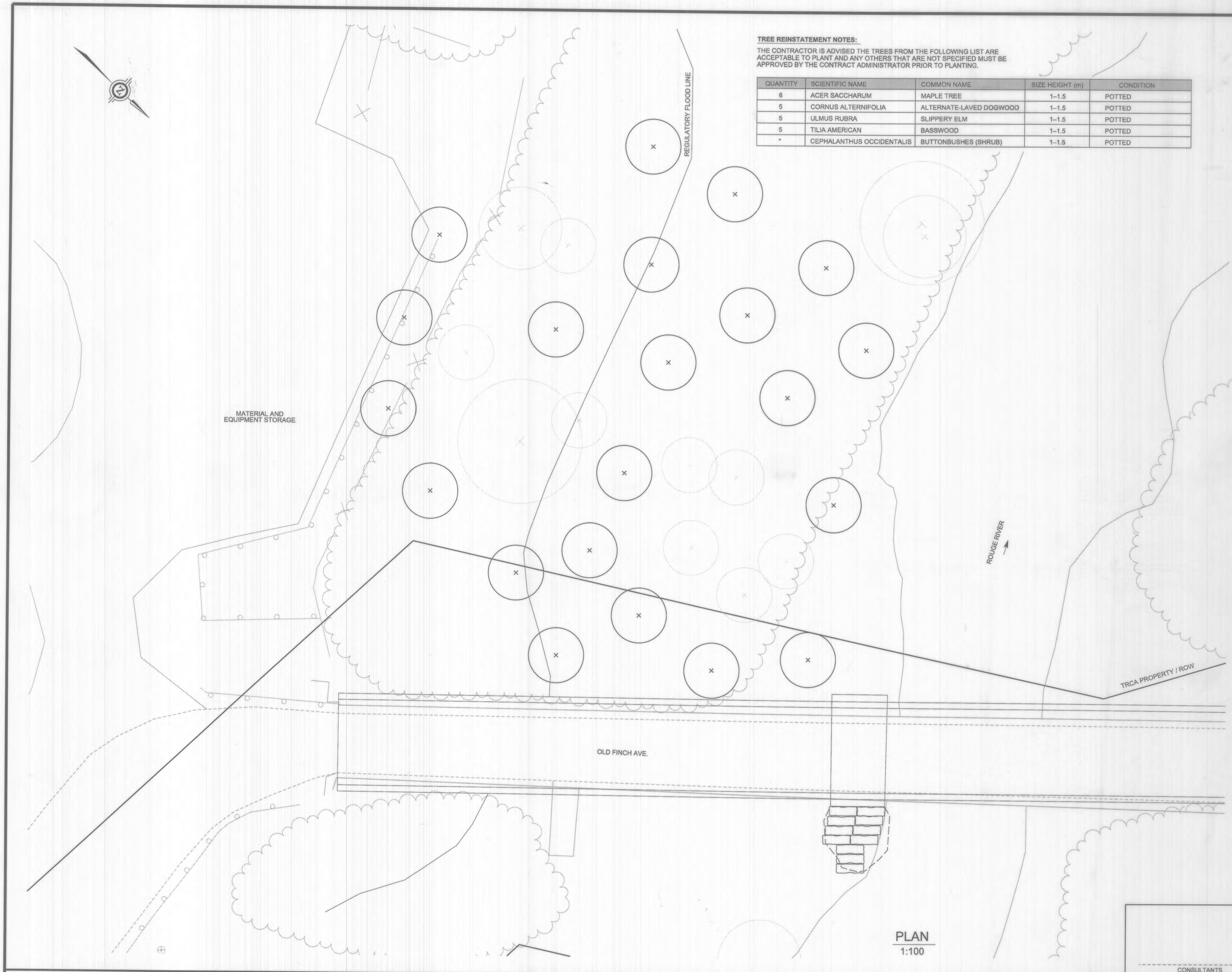
813 OLD FINCH AVE OVER ROUGE RIVER

ACCESS ROAD AND TREE REMOVAL PLAN

BRIDGE REPAIR

DESIGN	A.L.	DRAWN	J.W.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS SHOWN	DRAWING NUMBER	813-S5013-7	SHEET	L1	
DATE:	JULY 3, 2013					

7.3.2013 813-S5013-7.dgn

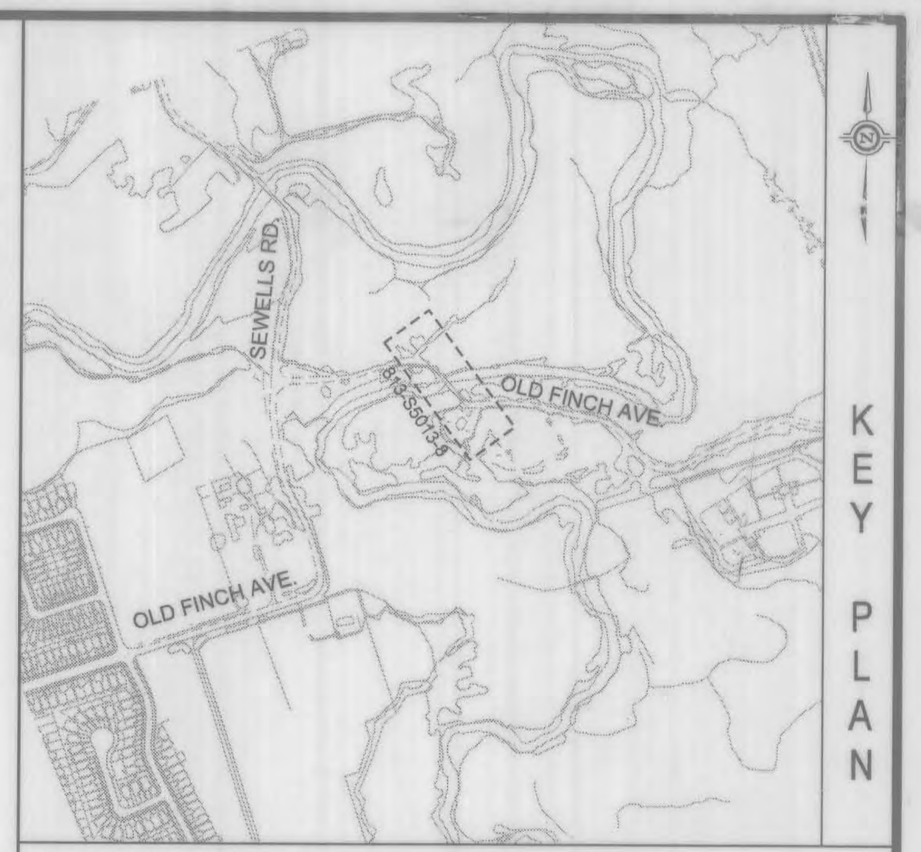


PLAN
1:100

TREE REINSTATEMENT NOTES:

THE CONTRACTOR IS ADVISED THE TREES FROM THE FOLLOWING LIST ARE ACCEPTABLE TO PLANT AND ANY OTHERS THAT ARE NOT SPECIFIED MUST BE APPROVED BY THE CONTRACT ADMINISTRATOR PRIOR TO PLANTING.

QUANTITY	SCIENTIFIC NAME	COMMON NAME	SIZE HEIGHT (m)	CONDITION
6	ACER SACCHARUM	MAPLE TREE	1–1.5	POTTED
5	CORNUS ALTERNIFOLIA	ALTERNATE-LAVED DOGWOOD	1–1.5	POTTED
5	ULMUS RUBRA	SLIPPERY ELM	1–1.5	POTTED
5	TILIA AMERICAN	BASSWOOD	1–1.5	POTTED
*	CEPHALANTHUS OCCIDENTALIS	BUTTONBUSHES (SHRUB)	1–1.5	POTTED



RELATED DRAWINGS: P-/U- NOT TO SCALE

GENERAL NOTES:

1. TREES TO BE PLANTED IN ACCORDANCE WITH CITY OF TORONTO URBAN FORESTRY SERVICES DETAIL PD-101, JUNE 2002.

2. ALL PLANTING SHALL BE PREFORMED IN THE FALL.

3. CONTRACTOR IS RESPONSIBLE FOR THE GENERAL MAINTENANCE OF NEW PLANTINGS DURING THE WARRANTY PERIOD AND SHALL COMPLY WITH TRCA FOREST EDGE MANAGEMENT PLAN GUIDE LINES, JULY 2004 FOR THE RESPONSIBILITY REGARDING NEWLY PLANTED TREES.

LAND REINSTATEMENT NOTES:

UPON COMPLETING ALL THE NECESSARY REPAIRS AT OLD FINCH AVE. THE CONTRACTOR WILL BE RESPONSIBLE FOR RESTORING THE LAND BACK TO ITS ORIGINAL CONDITIONS. THIS WILL INCLUDE BUT NOT BE LIMITED TO THE FOLLOWING:

1. REMOVING TREE AND ROOT PROTECTION BARRIERS

2. RE-PLANTING NEW TREES FOR EACH TREE REMOVED, NOTE THAT THE TREES SHALL BE SPACED 5m CENTRE TO CENTRE FROM EXISTING TREES. BUTTONBUSHES MAY BE SUBSTITUTED IF 5 m SEPARATION BETWEEN EXITING AND NEW PLANTS IS NOT OBTAINABLE. BUTTONBUSHES MAY BE SUBSTITUTED ON A 2 FOR 1 BASES PROVIDED NO MORE THEN 40% OF THE TOTAL TREES PLANTED ARE SUBSTITUTED AND NO MORE THE 50% OF ANY SINGLE VARIETY IS SUBSTITUTED. BUTTONBUSHES MAY BE PLANTED WITH A REDUCED OFFSET OF 3 m CENTRE TO CENTRE.

3. PRUNING TO REMOVE ANY DAMAGED BRANCHES FROM THE RESULT OF CONSTRUCTION,

4. SEEDING THE AREAS WHERE THERE HAS BEEN A DISTURBANCE TO THE LAND DUE TO CONSTRUCTION. REFER TO THE SEED MIXTURE GIVEN IN SECTION 4A, SPECIAL SPECIFICATIONS, OF THE CONTRACT DOCUMENTS.

LEGEND

× REINSTATED TREES

CONSULTANTS

Associated Engineering

SURVEY(Year)	N/A
DESIGN	y13113pd.dgn, y13113ssc.dgn,
UTILITY	Y13113ugs.dgn
MAPPING	Y13113top.dgn, Y13113top_2.dgn
STREETLINE	Y13113psl.dgn
DIGITAL INFORMATION	

No.	DATE	REVISIONS	INITIAL	SIGNED
	07-03-2013	ISSUED FOR TENDER		

TORONTO Engineering and Construction Services

LICENSED PROFESSIONAL ENGINEER A. M. LAWS 100183167 Jul 3, 13 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J. S. MONKMAN 100127743 July 3/13 PROVINCE OF ONTARIO

TONY PAGNANELLI, P. ENG.
ACTING EXECUTIVE DIRECTOR
ENGINEERING AND
CONSTRUCTION SERVICES

JOHN P. KELLY, P.ENG.
ACTING DIRECTOR
CAPITAL WORKS DELIVERY

JIM SCHAFFNER, P.ENG.
ACTING MANAGER
PROJECT DELIVERY
LINEAR AND STRUCTURES

813 OLD FINCH AVE OVER ROUGE RIVER

TREE REINSTATEMENT PLAN

BRIDGE REPAIR

DESIGN	A.L.	DRAWN	J.W.	CHECKED	J.M.	CONTRACT No. 12SE-10S
SCALE:	AS SHOWN			DRAWING NUMBER	813-S5013-8	SHEET L2
DATE:	JULY 3, 2013					

6.27.2013 813-S5013-8.dgn

THURBER

Appendix D

MECP Water Well Records

MECP Well Record Summary Table

Well ID	UTM Coordinates Easting	UTM Coordinates Northing	Date Completed	Depth to Bedrock (m)	Well Depth (m)	Static Level (m)	Well Use
6905360	646417.7	4854337	1959-03-09	46.6	53.6	10.7	Abandoned
7210288	646165	4854580	2013-05-24	-	0	0	Abandoned
6923130	646152	4854543	1993-04-06	-	30.5	6.7	Supply Wells
6911174	648094.8	4852463	1972-08-10	11.3	59.1	0	Abandoned
6909829	646374.7	4854503	1970-03-14	-	33.2	20.7	Supply Wells
6927554	646351	4854285	2003-11-26	-	8.4	4.9	Supply Wells
6905367	644482.7	4854638	1963-11-02	-	10.7	7	Supply Wells
6909941	646454.7	4854463	1970-04-16	45.7	48.8	0	Abandoned
7234364	646359	4854568	2014-08-21	-	0	0	Supply Wells
6927557	646351	4854285	2003-12-09	-	7.6	0	Unknown
6911175	648054.8	4852463	1972-06-19	12.2	55.8	0	Abandoned
6927553	646341	4854772	2003-12-16	-	0	0	Abandoned
6927559	646373	4854747	2003-12-15	-	15.2	9.9	Supply Wells
6927919	644764	4854499	2004-06-02	-	0	0	Abandoned
6927921	644857	4854053	2004-06-11	-	0	0	Abandoned
6927662	644775	4854276	2004-02-23	-	23.6	13.1	Supply Wells
6929072	644745	4853898	2005-04-07	42.4	48.1	26.4	Supply Wells
6927560	644967	4854138	2003-12-23	-	15.7	0	Supply Wells
6905359	646429.7	4854374	1959-04-13	-	35.7	11.3	Supply Wells
6909731	646374.7	4854583	1969-10-09	-	24.4	7.6	Supply Wells
6929071	644698	4853647	2005-04-06	43.6	48.1	26.1	Supply Wells