



**TECHNICAL MEMORANDUM
for
PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN
W-N RAMP (FORMERLY RAMP 'Q')
HWY 403/HWY 6 INTERCHANGE
WP 2357-09-00, SITE NO. 36-30
CENTRAL REGION, ONTARIO**

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**TECHNICAL MEMORANDUM for
PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN**

W-N Ramp (formerly Ramp 'Q')
Highway 403 – 6 Interchange
WP 2357-09-00, Site No. 36-30
City of Hamilton, Ontario

1. INTRODUCTION

The Foundation Engineering Services for this assignment involve the preliminary foundation investigation and design for rehabilitation/replacement of the West-North Ramp (previously referred to as Ramp Q) over Highway 403 west-bound lane, near Hamilton, Ontario.

The study was carried out for Morrison Hershfield Ltd. on behalf of Ministry of Transportation of Ontario (MTO).

The purpose of this Technical Memorandum for Preliminary Foundation Investigation and Design is to provide a preliminary design level summary of the subsurface and groundwater conditions based on available foundation reports in order to address the foundation aspects of the proposed structural rehabilitation or replacement strategy and to update the foundation design recommendations provided in the available reports to limit state design terminology in conformance with the requirements of the Canadian Highway Bridge Design Code (CHBDC). Further, this report comments on the current relevance and adequacy of the foundation design recommendations provided in the available reports and updates the recommendations for bearing resistance to the current standard for design.

This Technical Memorandum is based on desk top level review of available foundation reports in the MTO GEOCREST Library that are related to these sites. No additional subsurface investigations were carried out. The subsurface description is inferred from the information in the Foundation Investigation Report referenced in Section 2 of this technical memorandum. The foundation assessment is inferred from the recommendations in the Foundation Design Report referenced.



Axial bearing resistance was assessed as an indicator of the adequacy of the foundations for the proposed rehabilitation. The original recommendations are summarized and translated to limit state design terminology per the "Highway Bridge Design Code" (CHBDC). In addition, Foundation Design recommendations in accordance with the requirements of the current CHBDC, based on assessment of subsurface conditions described in the previous Foundation Investigation Report, are provided.

2. SOURCES OF INFORMATION

The following report and drawings were available for review and information for the Hwy 403 – Hwy 6 Interchange W-N Ramp:

- Foundation Investigation Report, Proposed Crossing, Hwy 403 and Hwy 6, District No. 4 (Hamilton), W.P. 200-60, Hamilton, Ontario, Geocon Ltd., June 1960. In Geocon's investigation, 27 boreholes were drilled for four structures – 6 boreholes were carried out for W-N ramp structure. Locations and Soil Strata (Drawing No. S7033-4) dated April 1960.
- General Arrangement (Drawing No. 151-17-1) dated August 1960.
- Foundation Plan and Details (Drawing No. 151-17-2) dated August 1960.
- Bridge Deck Rehabilitation (Drawing No. 1, Sheet 372) dated February 1994.

3. SITE BACKGROUND AND GEOLOGY

The Hwy 403/Hwy 6 interchange W-N Ramp is located near Hamilton, Ontario. A key plan based on Google Map is shown in Figure 1.

The topography of the area is hilly and several ravines provide drainage into Hamilton harbour. The bedrock at the site consists of red shale of the Queenston formation of Ordovician age. The bedrock is overlain by glacial drift that is generally thin at this site.

The W-N ramp carries the traffic over Highway 403. The general layout drawing, Underpass at Ramp "Q" - General Arrangement, Highway 403, District No.4, W.P. 264-60, Departments of Highway Ontario, August 1960 is shown in Appendix D.



A mass excavation of the natural ground, inferred from the differences in elevation between the original ground elevation at boreholes and the base of constructed footings, is in the order of 17 and 22 m in depth at the abutments and piers respectively. This mass excavation appears to have been carried out for the construction of the Hwy 403/Hwy 6 Interchange and the W-N Ramp (Ramp Q).

The ramp is a three-span bridge with north and south abutments and two piers. The span arrangement for the ramp is 17m, 31.7m, and 22.5m. From available information, it is inferred that the abutments are founded on spread footings on the shale bedrock. The north and south abutment footings are assumed to be founded at elevations 103.2 and 102.5 m respectively.

Piers are also founded on spread footings the shale bedrock. The corresponding elevations of the bases of at the north and south pier footings are 99 and 98.4 m respectively.

It has been reported that the bridge was previously rehabilitated in 1994.

4. SITE RECONNAISSANCE

As part of the current foundation engineering assessment study, a site reconnaissance of the Hwy 403/Hwy 6 Interchange was carried out in spring 2013. A photographic record of the site visit is attached in Appendix C. It is understood that a preliminary foundation investigation and design will be carried out as a subsequent phase of this project and include a more comprehensive foundation inspection.

The following observations are based on the photographic record. The observations and assessments are limited to performance of the foundations. They are not intended to represent a structural assessment of the bridges.

The site photos illustrate conditions at the north and south abutments and piers of the W-N ramp at the time of photography. They refer to the appearance of the structure, visual conditions relating to slope stability, bridge deck condition, expansion joint condition, drainage and



vegetation (photographs 1 to 10). No cracks or discontinuities observed that indicated foundation distress. The surface of the slope appeared to be in stable condition.

5. FOUNDATION INVESTIGATIONS AND SUBSURFACE CONDITIONS

Based on the foundation report completed by Geocon Ltd. in February 1960 for the proposed W-N Ramp (referred to as Ramp Q within the Hwy 403/Hwy 6 Interchange (Reference 1), a general description of the foundation investigation and the subsurface conditions encountered at the site at the time of the 1960 foundation investigation follows:

- Six (6) boreholes, numbered 22 to 27, accompanied by dynamic penetration tests, were advanced. Additional bedrock core holes 24A and 27A were put down adjacent to boreholes 24 and 27. Boreholes were advanced up to 9 m deep. The borehole locations and Soil Strata plan are illustrated in Appendix A.
- The subsoil at the site at the time of the 1960 investigation generally consisted of 0.6 to 0.9 m silty topsoil overlying shale bedrock. The upper 0.6 to 1.2 m of the shale was weathered, the next 2.1 m was semi-weathered while the shale below 2.1 m was sound (although also described as soft). It should be noted that shale tends to disintegrate soon after exposure to the atmosphere.
- During the 1960 investigation, the water levels in the boreholes were influenced by surface water. Due to the very low permeability of the till and shale, accurate information regarding groundwater could not be obtained. Although more information was obtained by long term observations of piezometers installed at various elevations, the groundwater level information was considered to be inconclusive. (Refer to Appendix B for more information).
- Refer to the Appendix A for a borehole location plan and stratigraphical profile for the 1960 foundation investigation. The Record of Borehole sheets and groundwater information of the 8 boreholes are presented in Appendix B.

It should be noted that the 1960 era boreholes terminated some 15 m above the current structure foundation elevations. From this information, it is surmised there was a mass excavation or some 15 m deep or more over the entire Hwy 403/Plains Road interchange including the W-N Ramp (Ramp Q).

Although unproven by subsurface investigation, it is inferred that the foundations for the W-N ramp structure are in shale bedrock and that the groundwater is perched near surface.



6. DISCUSSION AND FOUNDATION RECOMMENDATIONS

6.1 1960 Report

The foundation report (Reference 1) recommended and the contract documents indicated that spread footings were used for the foundations for both abutments and all piers.

The report also recommended that exposed shale in excavations should immediately be covered by lean concrete and that measures should be taken to protect the foundation surface from exposure to water.

The report recommended that the temporary cut slopes in the shale or glacial till overburden should be no steeper than 1H:1V. It was further recommended that, due to the susceptibility of the shale to deterioration under weathering, the duration of exposure of the steep slopes be minimized by backfilling behind walls as construction progressed.

The report noted that permanent slopes in till and shale would be subject to deterioration with time and that local failures could be caused by weathering and erosion. Therefore, it was recommended that a 2H:1V grade or flatter be used for permanent cut slopes where the vertical height did not exceed 6 m. It was further recommended that the cut slopes should be benched as necessary so that no uninterrupted 2H:1V slope would be higher than 6m. Benches were to be in the order of 3 to 6 m in width and back-sloped away from the road at a slope of about 15H:1V towards an interceptor drain at the toe of the higher slope tier (at the inner end of each bench).

6.2 Current Foundation Assessment

With regard to the assessment of the existing structure foundations, axial bearing resistance was used as the indicator of the adequacy of the foundations for the proposed rehabilitation. Table 1 provides the original foundation design axial bearing recommendations in the original working stress format and converted to the Limit State Design Format along with preliminary PML recommendations for upper level bearing resistance values updated to reflect current industry practice.



It should be noted that the referenced foundation report recommended an allowable bearing pressure for spread footings of 1000 kPa. However, it is considered unlikely that the actual bearing resistance used for design was as high as 1000 kPa. The actual bearing pressures imposed on footings were not available at the time of reporting. It is recommended that the Structural Designer should confirm that the actual bearing pressures imposed are less than the bearing resistances recommended in this report.

In consideration of this uncertainty and in order to determine the acceptability of the existing foundations for the proposed rehabilitations, the loads imposed by the rehabilitation design should be less than whichever of the following 2 criteria that provides the lesser resistance value in conformance with the requirements of the CHBDC:

1. The PML recommended upper limit 'updated to current industry practice' values indicated in Table 1.
2. One hundred ten percent (110%) of the actual bearing resistances (that should be discovered by the Structural Engineer) used for design of the existing structure design.

The bearing resistances used for design of the rehabilitated structure should not exceed either lesser value from criteria 1 and 2 above.

It is understood that bridge rehabilitation will include lowering the grade of Hwy 406 by 0.29 m at the WBL only. No foundation issues are anticipated regarding the planned grade lowering provided that excavations do not encroach upon a 1H:1V plane projecting down from the edge of existing footings and provided that permanent slopes in bedrock are protected from weathering.

As there was a comprehensive Foundation Investigation and Design Report available along with relatively detailed contract documents, it is considered that the information from these references is of reasonably high reliability and that the recommendations for assessment of the suitability of the existing foundations for the proposed rehabilitation are reasonably reliable subject to the conditions noted above.



7. CLOSURE

This Technical Memorandum for Preliminary Foundation Investigation and Design was prepared by Ms. Marzieh Kamranzadeh, MSc, Project Supervisor (EIT) and reviewed by Mr. David Dundas, P.Eng., Senior Engineer. Mr. C.M.P. Nascimento, P.Eng., Project Manager, MTO Designated Principal Contact, conducted an independent review of the report.

Yours very truly,

Peto MacCallum Ltd.

A handwritten signature in blue ink, appearing to read "Marzieh", is positioned above the name of the Project Supervisor.

Marzieh Kamranzadeh, MSc
Project Supervisor (EIT), Geotechnical Services



David Dundas, P.Eng.
Senior Engineer



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

MK/DD/CN:mk-mi-nk

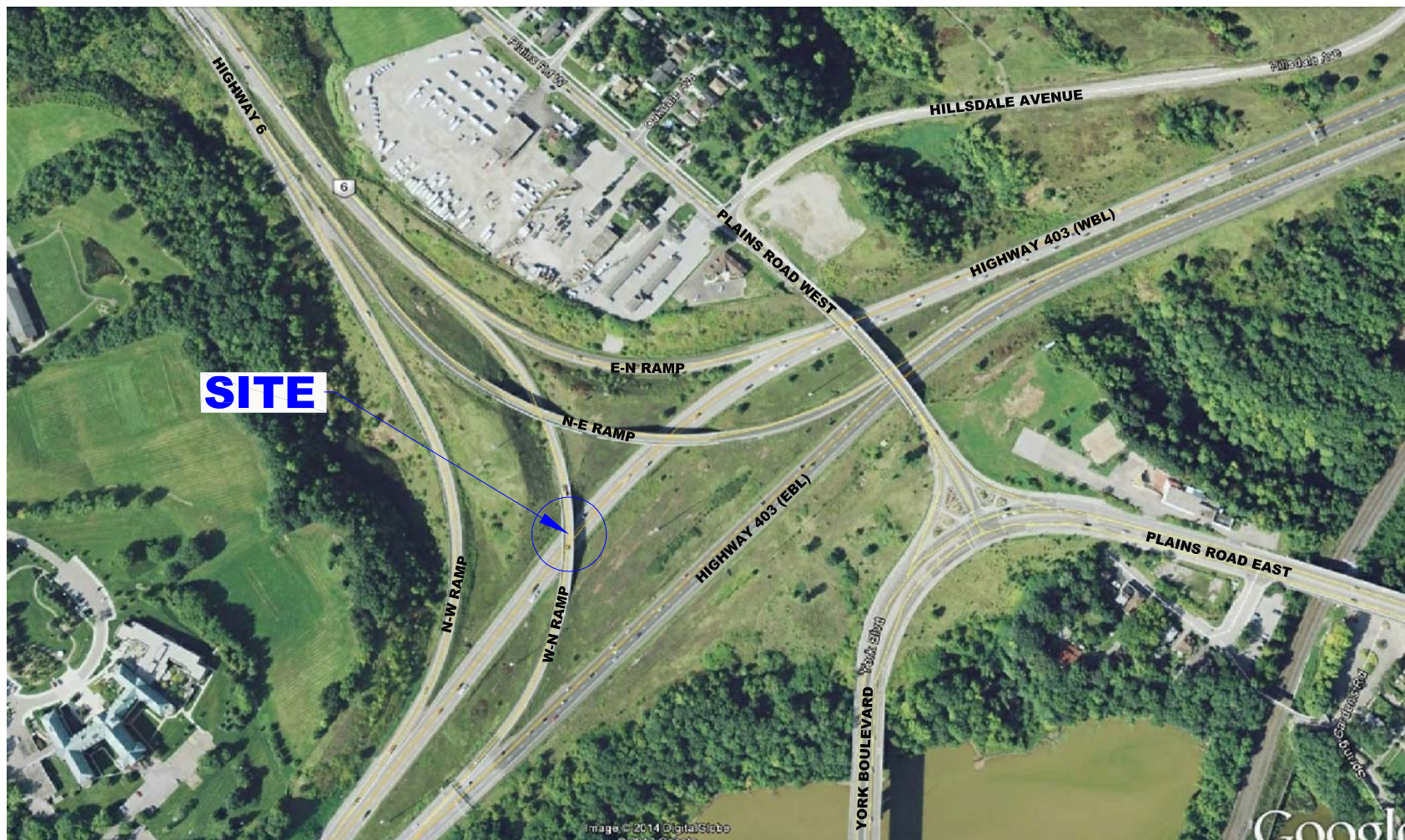




TABLE 1
FOUNDATION DESIGN ASSESSMENT
(Preliminary Recommendations)

Foundation	Foundation Type	Founding Elevation		Previous Working Stress Values		Previous Equivalent Limit State Design Values*				PML upper limit Limit State Design Values updated to current industry practice**			
		(ft)	(m)	Safe Bearing Resistance (tons/sf)	Safe Load Resistance (tons)	Bearing Resistance (kPa)		Load Resistance (kN)		Bearing Resistance (kPa)		Load Resistance (kN)	
						SLS	Factored ULS	SLS	Factored ULS	SLS	Factored ULS	SLS	Factored ULS
North Abutment	Spread footing	341.5	104	10	N/A	1000	1500	N/A	N/A	1000	1500	N/A	N/A
North Pier	Spread footing	329.5	100.4	10	N/A	1000	1500	N/A	N/A	1000	1500	N/A	N/A
South Pier	Spread footing	327.5	99.8	10	N/A	1000	1500	N/A	N/A	1000	1500	N/A	N/A
South Abutment	Spread footing	339.0	103.3	10	N/A	1000	1500	N/A	N/A	1000	1500	N/A	N/A

Notes: * The converted Ultimate Limit State design values are based on these working stress values.

** Refer to Section 6 DISCUSSION AND RECOMMENDATION – Current Foundation Assessment for conditions of use.
No field verifications were made.



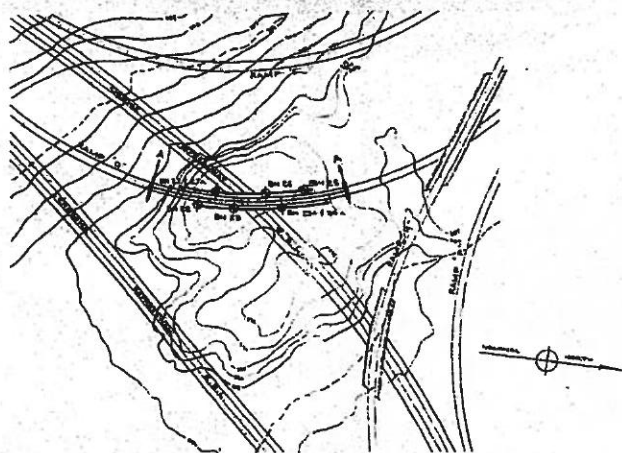
PRELIMINARY FOUNDATION INVESTIGATION AND DESIGN	<div></div>				
HIGHWAY 403 / HIGHWAY 6 INTERCHANGE W-N RAMP UNDERPASS HAMILTON, ONTARIO					
KEY MAP	DRAWN: N.A.	DATE	SCALE	JOB NO.	FIGURE NO.
	CHECKED: M.K.	NOV. 2014	1 : 4,000	13TF017A	1
	APPROVED: C.N.				

REFERENCE:
THIS FIGURE WAS PREPARED FROM THE GOOGLE MAP - MAPDATA @ 2013 GOOGLE.

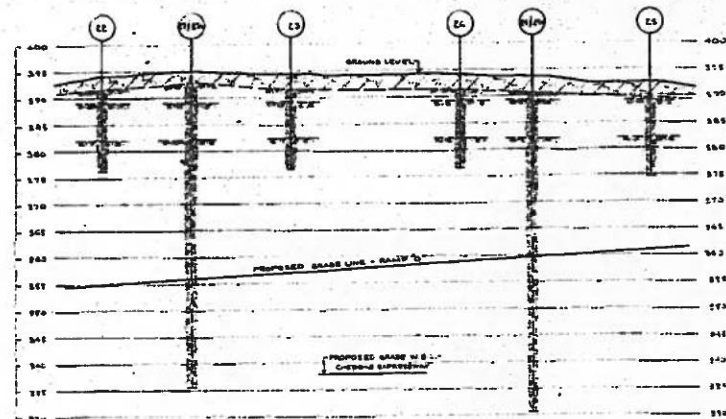


APPENDIX A

Borehole Location and Soil Stratigraphy



PLAN
Scale 1"=20'-0"



SECTION A-A

Horizontal Scale 1"=20'-0"
Vertical Scale 1"=10'-0"

REFERENCE: L. C. CHURCH & PARTNERS, ENGINEERS LTD.
DESIGN OF CHEDOK EXPRESSWAY RAMP OVER CHEDOKE CREEK
DATE: JAN. 9, 1964

LEGEND

- ◆ BORING WITH INTERMITTENT SAMPLING IN PLAN
- ◆ BORING WITH INTERMITTENT SAMPLING AND ALACANT CONTINUOUS SOIL SAMPLING IN PLAN
- BORING WITH INTERMITTENT SAMPLING IN ELEVATION
- BORING WITH INTERMITTENT SAMPLING AND ALACANT CONTINUOUS SOIL SAMPLING IN ELEVATION

STRATIGRAPHY

- SALT TUFFS
- WEATHERED BEDROCK - GRANITE SHALES
- SEMI-WEATHERED BEDROCK - GRANITE SHALES
- SOFT SANDY BEDROCK - GRANITE SHALES BEDROCK

DEPARTMENT OF HIGHWAYS, ONTARIO
PROPOSED CHEDOK EXPRESSWAY
RAMP OVER CHEDOK CREEK
BORING PLAN AND SOIL STRATIGRAPHY

GEOCON LTD.

DATE APRIL 1964 SCALE AS SHOWN
DRAWN BY J.H. No. 37033-A



APPENDIX B

Relevant Record of Borehole Sheets

APPENDIX IV

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS



DISTURBED
FAIR
GOOD
LOST


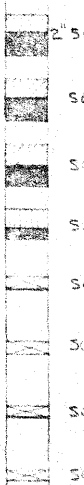
A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE-OPEN
D.F. - DRIVE-FOOT VALVE
C.S. - CHUNK SAMPLE

F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
R.C. - ROCK CORE

V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW

U - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE															OTHER TESTS												
ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLT	ELEVATION SCALE	WATER CONTENT W ₁					Q	NAT.	LL	W	Δ	P _w	OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS PER FOOT							
					DYNAMIC PENETRATION TEST BLOWS PER FOOT																						
394.0 0.0	SEE REPORT	GROUND LEVEL		394.0																		1	50	6			
391.5 2.5		SILTY TOPSOIL		391.5																					2	40	40
389.0 5.0		WEATHERED REDDISH-BROWN SHALE		389.0																					3	58	58
		SEMI-WEATHERED REDDISH-BROWN SHALE		385																					4	80	80
382.0 12.0				380																					5	>100	>100
																									6	>100	>100
																									7	>100	>100
376.1 17.9		END OF HOLE		375																					8	>100	>100

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

APPENDIX IV

CONTRACT 57033 BORING # 23 DATUM SEQUETIC CASING
 BORING DATE JAN. 29, 1960 REPORT DATE FEB. 18, 1960 COMPILED BY M.W. CHECKED BY
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION

DISTURBED
 FAIR
 GOOD
 LOST

A.S. - AUGER SAMPLE
 S.T. - SLOTTED TUBE
 W.S. - WASHED SAMPLE
 D.O. - DRIVE-OPEN
 D.F. - DRIVE-FOOT VALVE
 C.S. - CHUNK SAMPLE

SAMPLE TYPES

F.S. - FOIL SAMPLE
 S.O. - SLEEVE-OPEN
 S.F. - SLEEVE-FOOT VALVE
 T.O. - THIN WALLED OPEN
 R.C. - ROCK CORE

ABBREVIATIONS

V. - IN-SITU VANE TEST
 M. - MECHANICAL ANALYSIS
 U. - UNCONFINED COMPRESSION
 Q.C. - TRIAXIAL CONSOLIDATED QUICK
 Q. - TRIAXIAL QUICK
 S. - TRIAXIAL SLOW
 γ - WET UNIT WEIGHT
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL

SOIL PROFILE

ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W%			OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
						○ NAT	△ PW					
DYNAMIC PENETRATION TEST BLOWS PER FOOT												
394.3 0.0		GROUND LEVEL		395								
391.4 2.9		SILTY TOPSOIL										
389.3 5.0		WEATHERED REDDISH-BROWN SHALE		390								
		SEMI-WEATHERED REDDISH-BROWN SHALE		385								
382.3 12.0	SEE REPORT.	SOFT SOUND REDDISH-BROWN SHALE BEDROCK		380								
376.5 17.8		END OF HOLE		375								
				</								

OFFICE REPORT ON SOIL EXPLORATION

W - WET UNIT WEIGHT
 K - PERMEABILITY
 C - CONSOLIDATION
 WL - WATER LEVEL IN CASING
 WT - WATER TABLE IN SOIL

SOIL PROFILE										SAMPLES			
ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W%			OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS / FT	
					DYNAMIC PENETRATION TEST BLOWS PER FOOT								
				395									
392.5 0.0		GROUND LEVEL											
		SILTY TOPSOIL											
389.5 3.3				390									
	SEE REPORT	SEMI-WEATHERED REDDISH-BROWN SHALE		385									
382.2 10.3				380									
		SOFT SOUND REDDISH-BROWN SHALE BEDROCK											
374.7 17.8		END OF HOLE		375									
				370									

OFFICE REPORT ON SOIL EXPLORATION

OFFICE REPORT ON SOIL EXPLORATION

APPENDIX IV

CONTRACT 57033 BORING # 26 DATUM GEODETIC CASING
BORING DATE JAN. 27, 1960 REPORT DATE FEB. 18, 1960 COMPILED BY M.W. CHECKED BY 
SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN. LBS. ENERGY)

SAMPLE CONDITION



DISTURBED
FAIR
GOOD
LOST

SAMPLE TYPES

A.S. - AUGER SAMPLE	F.S. - FOIL SAMPLE
S.T. - SLOTTED TUBE	S.O. - SLEEVE-OPEN
W.S. - WASHED SAMPLE	S.F. - SLEEVE-FOOT VALVE
D.O. - DRIVE-OPEN	T.O. - THIN WALLED OPEN
D.F. - DRIVE-FOOT VALVE	R.C. - ROCK CORE
C.S. - CHUNK SAMPLE	

ABBREVIATIONS

V - IN-SITU VANE TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
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Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW

Y - WET UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION

WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL





SOIL PROFILE															OTHER TESTS	SAMPLES			
ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W%										OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT.
					O NAT. Lw Δ Pw														
					DYNAMIC PENETRATION TEST BLOWS PER FOOT														
394.2		GROUND LEVEL		395															
0.0		SILTY TOPSOIL															SO	1	5
391.3		WEATHERED REDDISH-BROWN SHALE		390													SO	2	47
2.9																	SO	3	93
389.2		SEMI-WEATHERED REDDISH-BROWN SHALE		385													SO	4	>100
5.0																	SO	5	>100
	SEE REPORT			380													DO	6	>100
382.2		SOFT SOUND REDDISH-BROWN SHALE BEDROCK															DO	7	>100
12.0																	DO	8	>100
376.5		END OF HOLE		375															
17.7																			

OFFICE REPORT ON SOIL EXPLORATION

SAMPLE CONDITION

SAMPLE TYPES

ABBREVIATIONS

	DISTURBED
	FAIR
	GOOD
	LOST

A.S. - AUGER SAMPLE
S.T. - SLOTTED TUBE
W.S. - WASHED SAMPLE
D.O. - DRIVE OPEN
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C.S. - CHUNK SAMPLE

F.S. - FOIL SAMPLE
S.O. - SLEEVE-OPEN
S.F. - SLEEVE-FOOT VALVE
T.O. - THIN WALLED OPEN
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- K. PERMEABILITY
- C. CONSOLIDATION

WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL

SOIL PROFILE										OTHER TESTS	SAMPLES					
ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W _p %						CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS/FT		
					DYNAMIC PENETRATION TEST BLOWS PER FOOT											
395.0		GROUND LEVEL		395												
0.0		SILTY TOPSOIL														
393.0																
2.0		WEATHERED REDDISH-BROWN SHALE		390												
387.0																
6.0		SEMI-WEATHERED REDDISH-BROWN SHALE		385												
382.0																
13.0		SOFT SOUND REDDISH-BROWN SHALE BEDROCK		380												
377.2		END OF HOLE														
17.8				375												

GEOCON

OFFICE REPORT ON SOIL EXPLORATION

APEX-IV

CONTRACT 57032 BORING # 27 A DATUM GEODETIC Casing 11/11/60
 BORING DATE FEB. 17, 1960 REPORT DATE MARCH 27, 1960 COMPILED BY MMW CHECKED BY
 SAMPLER HAMMER WT. 140 LBS. DROP 30 INCHES (PENETRATION RESISTANCES CONVERTED TO BLOWS OF 4200 IN LBS. ENERGY)

SAMPLE CONDITION

☐ DISTURBED
☐ FAIR
☐ GOOD
☐ LOST

SAMPLE TYPES

AS AUGER SAMPLE
 ST SLOTTED TUBE
 VS WASHED SAMPLE
 DO DRIVE-OPEN
 DF DRIVE-FOOT VALVE
 CS CHUNK SAMPLE
 FS SOIL SAMPLE
 SO SLEEVE-OPEN
 SF SLEEVE FOOT VALVE
 TO THIN WALLED OPEN
 RC ROCK CORE

ABBREVIATIONS

V IN-SITU VANE TEST
 M MECHANICAL ANALYSIS
 U UNCONFINED COMPRESSION
 QC TRIAXIAL CONSOLIDATED QUICK
 Q TRIAXIAL QUICK
 S TRIAXIAL SLOW
 W WET UNIT WEIGHT
 K PERMEABILITY
 C CONSOLIDATION
 WL WATER LEVEL IN CASING
 WT WATER TABLE IN SOIL

SOIL PROFILE

ELEV. DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W %			OTHER TESTS	CONDITION	TYPE	NUMBER	PENETRATION RESISTANCE BLOWS FT.
					G NAT.	LW	A PW					
DYNAMIC PENETRATION TEST BLOWS PER FOOT												
3450 30		GROUND LEVEL		3450								
3430 10		SILTY TO COR.		3430								
3410 10		WEATHERED REDDISH-BROWN SHALE		3410				20% RECOVERY	BXL RC	1		
3390 10				3390				95%	BXL RC	2		
3370 10		SEMI-WEATHERED REDDISH-BROWN SHALE		3370				100%	BXL RC	3		
3350 10				3350				80%	BXL RC	4		
3330 10				3330				60%	BXL RC	5		
3310 10				3310				92%	BXL RC	6		
3290 10				3290				98%	BXL RC	7		
3270 10				3270				98%	BXL RC	8		
3250 10				3250				95%	BXL RC	9		
3230 10				3230				80%	BXL RC	10		
3210 10				3210				100%	BXL RC	11		
3190 10				3190				100%	BXL RC	12		



APPENDIX C

Site Photographs from Field Reconnaissance



Photograph 1: North End Looking South.



Photograph 2: West Side Looking South.



Photograph 3: WBL Approach.



Photograph 4: North Slope Paving.



Photograph 5: North Bearings.



← **Photograph 6:** Rusted Deck Drain.



← **Photograph 7:** West Side Underside.

Photograph 8: West Side Underside. →





← **Photograph 9:** Looking South.



Photograph 10: South Slope Paving.



APPENDIX D

General Arrangement of Hwy 403/Hwy 6 Interchange W-N Ramp

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No 96-66
WP No 82-93-01

HWY. 403 / HWY. 6 INTERCHANGE
BRIDGE REHABILITATION
GENERAL ARRANGEMENT

SHEET
372



GENERAL NOTES:

- THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL RELEVANT DIMENSIONS, ELEVATIONS AND DETAILS OF EXISTING STRUCTURE AND IS TO REPORT ANY DISCREPANCIES TO THE ENGINEER BEFORE COMMENCING ANY FABRICATION OR CONSTRUCTION. ALL EXPOSED CONCRETE SURFACES FOR REMOVALS SHALL BE SAWCUT 25 mm DEEP UNLESS OTHERWISE NOTED.
- ALL CONCRETE SHALL BE 30 MPa UNLESS OTHERWISE SPECIFIED.
- CLEAR COVER TO REINFORCING STEEL
DECK BOTTOM 50 ± 10 mm
ABUTMENTS AND WINGWALLS 75 ± 20 mm
PIERS 80 ± 20 mm
REMAINDER UNLESS NOTED OTHERWISE 70 ± 20 mm
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS. BAR MARKS WITH SUFFIX 'T' DENOTES BARS THREADED AT ONE END.
- NO FIELD SPICE FOR EXPANSION JOINTS IS ALLOWED.
- ALL CROSS SLOPES ON DECK TO MATCH EXISTING UNLESS OTHERWISE NOTED.
- DETAILS AND DIMENSIONS OF EXISTING BRIDGE HAVE BEEN DERIVED FROM THE ORIGINAL CONTRACT DRAWINGS TWP-151-30-1A TO TWP-151-30-25A.

SUGGESTED WORK SEQUENCE:

- REMOVE EXISTING ASPHALT ON DECK AND APPROACH SLABS.
- SCARIFY CONCRETE DECK.
- REMOVE DETERIORATED AND LOOSE CONCRETE FROM THE DECK INCLUDING CONCRETE WITH CORROSION POTENTIAL MORE NEGATIVE THAN -0.35V.
- WORK NEAR OR AT BOTH ABUTMENTS CAN BE CARRIED OUT SIMULTANEOUSLY (EXCEPT JACKING).
- MAKE ACCESS OPENINGS IN THE TOP SLAB.
- REMOVE AND REPLACE THE BOTTOM SLAB IN AREAS FOR JACKING.
- JACK UP THE BRIDGE.
- REMOVE AND RECONSTRUCT EXISTING BEARING SEATS AND REMOVE EXISTING ROCKER BEARINGS.
- REMOVE THE REMAINING PART OF THE BOTTOM SLAB. FOR STAGING SEE DWG. 2.
- PLACE NEW ELASTOMERIC BEARINGS.
- REPLACE THE REMAINING PART OF THE BOTTOM SLAB. FOR STAGING SEE DWG. 2.
- LOWER THE BRIDGE.
- REPAIR UNDERSIDE OF WEST CURB OUTSIDE BOX BEAM, ABUTMENT FACE AND OTHER DELAMINATED AREAS.
- BRIDGE DECK REPAIRS SHALL BE STAGED AS OUTLINED.
- REMOVE OLD FORMWORK FORM WITHIN BOXES.
- CAST CONCRETE IN ACCESS OPENINGS IN THE TOP SLAB.
- REMOVE EXISTING LIGHT POLES, STEEL RAILINGS, POSTS, END POSTS AND GUIDE RAIL.
- REMOVE CONCRETE AT CURB FACE TOGETHER WITH EXISTING EMBEDDED ELECTRICAL CONDUIT, JUNCTION BOXES ETC.
- GROUT EXISTING VOIDS.
- MODIFY EXISTING DRAINS.
- REMOVE EXISTING DECK JOINTS, PARTS OF BALLAST WALLS AND APPROACH SLABS.
- REMOVE AND REPLACE ENDS OF THE EAST WINGWALLS.
- REBUILD PARTS OF BALLAST WALLS AND APPROACH SLABS.
- INSTALL NEW BARRIER WALLS, PEDESTRIAN INFILL PANELS AND LIGHT POLES.
- PLACE NORMAL CONCRETE OVERLAY TOGETHER WITH CONCRETE IN DECK REPAIR AREAS.
- INSTALL NEW ASPHALT DRAIN.
- PLACE WATERPROOFING AND NEW ASPHALT.
- INSTALL NEW EXPANSION JOINTS.
- RECONSTRUCT GUIDE RAIL.
- REPAIR PIERS, ABUTMENTS, SOFFIT AND SLOPE PAVING

CONSTRUCTION STAGING

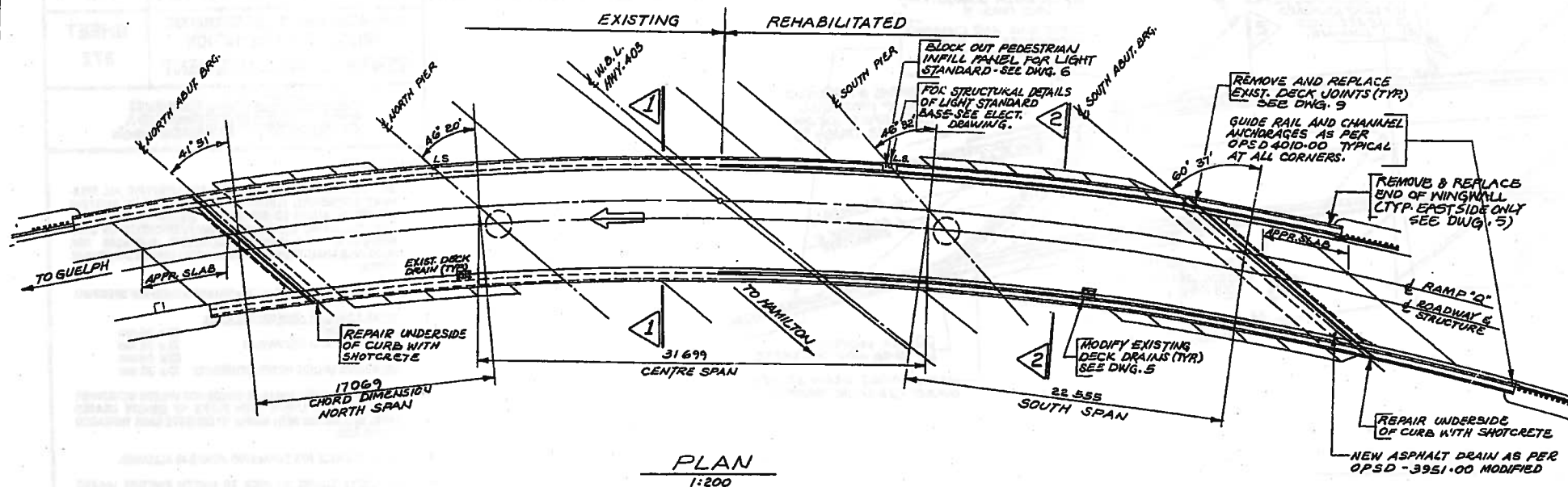
REFER TO GRADING DRAWINGS FOR STAGING AND SEQUENCE OF CONSTRUCTION.

ELECTRICAL

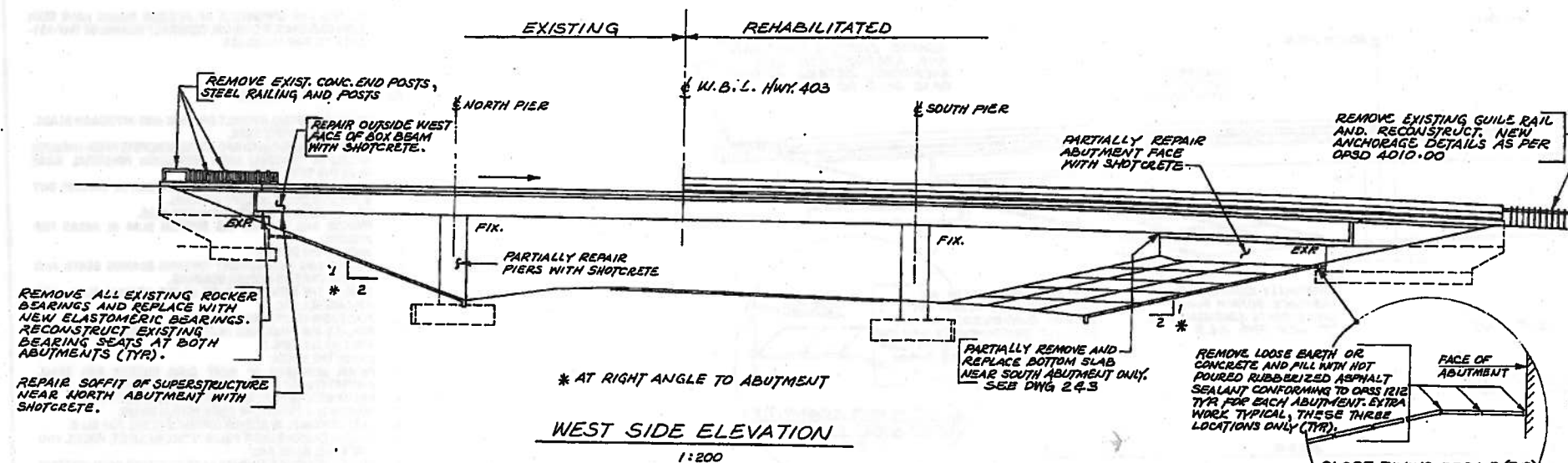
SEE ELECTRICAL DRAWINGS FOR LAYOUT OF LIGHT STANDARDS.

LIST OF DRAWINGS

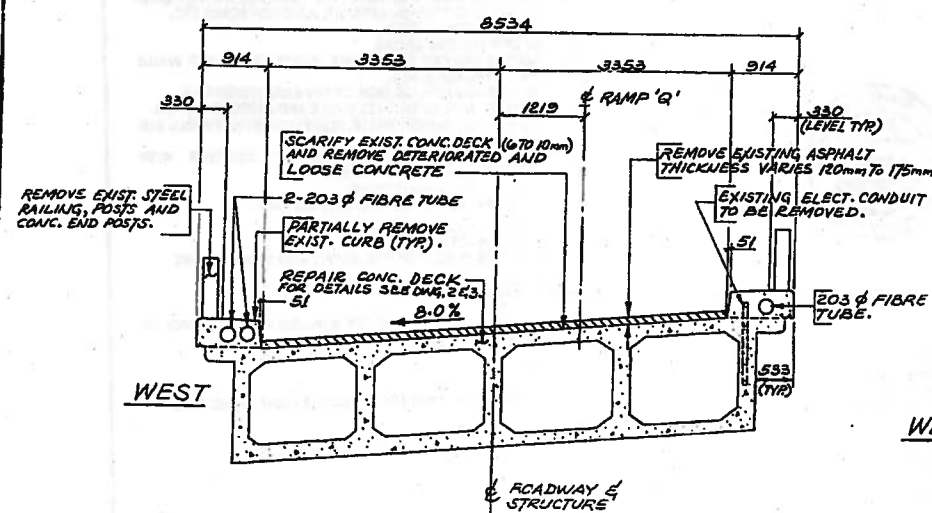
- GENERAL ARRANGEMENT.
- BOTTOM SLAB REPLACEMENT.
- BOTTOM SLAB REPLACEMENT DETAILS.
- ACCESS OPENINGS - TOP SLAB.
- DECK DRAIN MODIFICATION AND WINGWALL REPAIR.
- BARRIER WALL.
- BEARING REPLACEMENT.
- JOINT ANCHORAGE AND ARMOURING.
- DECK JOINT REPLACEMENT.
- STANDARD DETAILS.
- ELECTRICAL EMBEDDED WORK
- QUANTITIES - STRUCTURE.
- QUANTITIES - STRUCTURE.
- QUANTITIES - STRUCTURE.



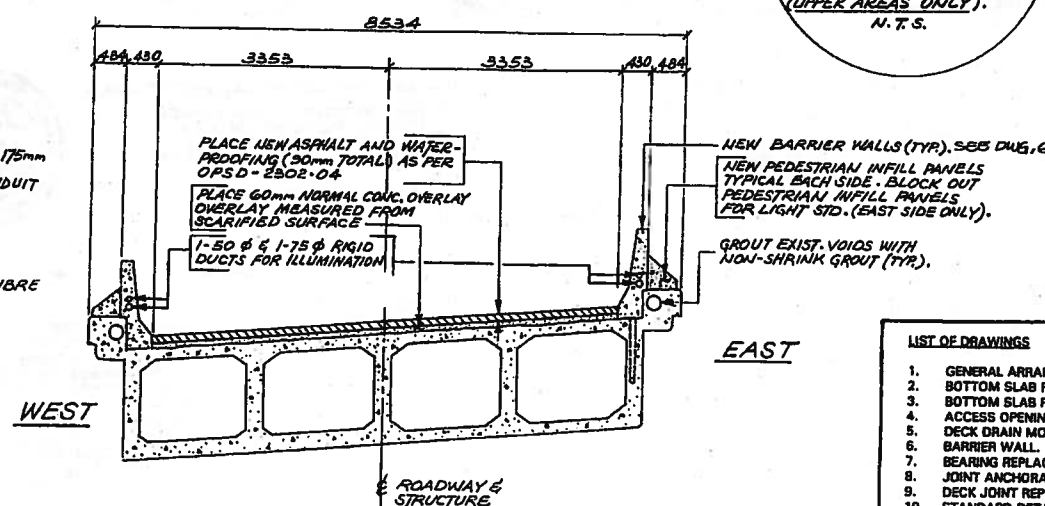
PLAN
1:200



WEST SIDE ELEVATION
1:200



TYPICAL EXISTING SECTION
1:50



TYPICAL REHABILITATED SECTION
1:50



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION	23323

DESIGN P.C. (CHK G.B.) CODE OHB0C-1991(LOAD) DATE FFR 1994