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G.I.-30 SEPT. 1976

GEOCRES No. 40P1-91

DIST. 4 REGION

W.P. No. 116-87-00

CONT. No. 96-38

W. O. No.

STR. SITE No.

HWY. No. 403

LOCATION Hwy 403 & Shaver Rd.

No. of PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

FILE COPY

FOUNDATION INVESTIGATION REPORT
For
Three Concrete Culverts at Highway 403 and Shaver Road
W.P. 116-87-00, Central Region
GEOCRES # 40P1-91

CONT 96-38

Introduction

This report summarizes the results of a foundation investigation carried out for three culverts proposed in the vicinity of Highway 403 and Shaver Road. They are identified as follows:

Culvert 7	Highway 403 Crossing at Sta 27+615
Culvert 24	Shaver Road Crossing at Sta 10+072
Culvert 26	Shaver Road Crossing at Sta 10+165

Site Description

The site is located at the existing Shaver Road between Highway 2 and Jerseyville Road in the Town of Ancaster, Regional Municipality of Hamilton-Wentworth. The terrain is generally hilly, with wetlands present in low lying areas. Land use is agricultural and residential.

Physiographically, the site is located in the region known as the Haldimand Clay Plain. Lacustrine and deltaic deposits of clays and silts are typical of this depositional environment.

Field Investigation

The fieldwork for this project was carried out between 95 05 24 and 95 05 30. Six borings were conducted using a track-mounted auger machine. The boreholes were advanced with hollow stem augers, solid stem augers, and washboring techniques.

Two boreholes were advanced at each culvert location:

		Borehole No.
Culvert 7	Highway 403 Crossing at Sta 27+615	106A and 107A
Culvert 24	Shaver Road Crossing at Sta 10+072	102A and 105A
Culvert 26	Shaver Road Crossing at Sta 10+165	103A and 104A

The soil samples were recovered by means of a 50 mm O.D. split spoon sampler driven into the soil according to the specifications outlined in ASTM D-1586 for the Standard Penetration Test.

Borehole elevations and coordinates were provided by MTO Central Region Surveys and Plans Office.

Laboratory testing was carried out on representative samples to identify and determine the physical properties of the recovered material. Tests included the grain size distribution analyses, natural moisture content and Atterberg Limits.

The results of the field and laboratory tests are plotted on the Record of Borehole sheets appended to this report. Borehole locations and stratigraphical sections of the subsurface conditions are shown on Drawing No. 1168700-A, Sheet No. 230-1, of the Contract Drawings.

Subsurface Conditions

The subsurface conditions encountered at boreholes 102A through 107A are generally uniform and consist largely of non-cohesive sandy silt to silt. The sandy silt to silt deposit was present from ground surface (El. 229.3 to 231.3) to the depth at which the boreholes were terminated (El. 218.2 to 218.7). Some organic material was present within 1.3 m of ground surface. Random layers of clayey silt to silty clay were encountered ranging in thickness up to 1.8 m.

The N values obtained in the sandy silt to silt deposit vary from 0 to 32, but more typically from 4 to 15. Based on these N values, the denseness ranges from very loose to dense, but more typically from loose to compact.

Groundwater levels observed in the boreholes during the investigation were found to be close to ground surface, from 0.1 to 0.9 m below surface elevations.

The high water table together with the non-cohesive nature of the subsurface material result in subsurface conditions that are highly sensitive to disturbance created by unbalanced hydrostatic head.

Miscellaneous

The fieldwork was conducted in May 1995 under the supervision of K. Ahmad, Foundation Engineer and Deanna Brooker, Engineering Student, utilizing drilling equipment owned and operated by K & S Drilling. The factual portion of the report was prepared by B.Bennett, Foundation Engineer.

D.H. Dundas, P.Eng.
Sr. Foundation Engineer

APPENDIX

RECORD OF BOREHOLE No 102A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 211.0; E 262 885.8 ORIGINATED BY DB
DIST CR HWY 403 BOREHOLE TYPE SS Auger, NX Casing COMPILED BY DB
DATUM Geodetic DATE 1995 05 24 CHECKED BY KA

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 (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
229.5	Ground Surface										
0.0			1	SS	4				o		0 17 80 3
			2	SS	5		228				
	Sandy Silt to Silt with random layers of Silty Clay		3	SS	6						
			4	SS	5		226				0 0 96 4
			5	SS	13						
	Silty Clay Greyish-Brown		6	SS	11				⊢o⊣		
			7	SS	18		224				
	Brown		8	SS	25						
	loose to dense						222				
			9	SS	22						0 3 91 6
	Silty Clay Greyish-Brown		10	SS	10		220				
218.4			11	SS	32						
11.1	End of Borehole										

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

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

RECORD OF BOREHOLE No 103A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 128.9; E 262 910.0 ORIGINATED BY DB

DIST CR HWY 403 BOREHOLE TYPE SS Auger, HS Auger COMPILED BY DB

DATUM Geodetic DATE 1995 05 25 CHECKED BY KA

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/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
229.3	Ground Surface										
0.0			1	SS	7	▼	228				
			2	SS	8						0 0 94 6
			3	SS	7						
			4	SS	10		226				0 2 93 5
	Silt with random layers		5	SS	9						
	of Silty Clay		6	SS	5						
			7	SS	7		224				
	Brown		8	SS	17						0 1 84 15
	loose to compact										
			9	SS	25		222				
			10	SS	23		220				0 0 88 12
218.2											
			11	SS	11						
11.1	End of Borehole										

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

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

RECORD OF BOREHOLE No 104A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 133.7; E 262 930.8 ORIGINATED BY DB

DIST CR HWY 403 BOREHOLE TYPE HS Auger COMPILED BY DB

DATUM Geodetic DATE 1995 05 26 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	NATURAL MOISTURE CONTENT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)		
229.4	Ground Surface										
0.0	Organic-Clayey Silt (Fill)		1	SS	4	▼	228		w=48		
			2	SS	7						
	Silt with some sand		3	SS	16						0 0 95 5
	with random layers of Clayey Silt		4	SS	5		226				
			5	SS	4						
			6	SS	4						0 0 92 8
			7	SS	6		224				
	Clayey Silt		8	SS	15						
							222				
	Brown		9	SS	15						
	loose to compact										
			10	SS	7		220				0 7 86 7
218.3			11	SS	18						
11.1	End of Borehole										

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

UNIT WEIGHT γ kN/m^3

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

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

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

RECORD OF BOREHOLE No 105A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 232.4; E 262 917.9 ORIGINATED BY DB
DIST CR HWY 403 BOREHOLE TYPE HS Auger COMPILED BY DB
DATUM Geodetic DATE 1995 05 29 CHECKED BY KA

ELEV / DEPTH	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 (o UNCONFINED, + FIELD VANE, • QUICK TRIAXIAL, x 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
230.9	Ground Surface										
0.0			1	SS	9	▼	230				
			2	SS	4						
	Sandy Silt to Silt		3	SS	8						0 21 74 5
			4	SS	3		228				
	with random layers of Silty Clay		5	SS	6						
			6	SS	10		226				0 0 95 5
			7	SS	12						
	Silty Clay moist, brown		8	SS	9		224				
			9	SS	25						
	Brown						222				
	very loose to compact		10	SS	26						0 2 90 8
			11	SS	7		220				
218.3			12	SS	0						
12.6	End of Borehole										

+³, x⁵ : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 106A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 258.9; E 262 932.1 ORIGINATED BY DB

DIST CR HWY 403 BOREHOLE TYPE HS Auger COMPILED BY DB

DATUM Geodetic DATE 1995 05 30 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 (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
231.3	Ground Surface										
0.0						▼					
			1	SS	12		230				
			2	SS	10						0 3 93 4
	Silt with random layers of Silty Clay		3	SS	15						
			4	SS	16		228				
			5	SS	8						
			6	SS	6						
			7	SS	9		226				
	Silty Clay, Brown		8	SS	6						0 0 55 45
							224				
			9	SS	18						
	Brown										
			10	SS	17		222				0 0 95 5
	very loose to compact										
			11	SS	0		220				
218.7											
			12	SS	12						
12.6	End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 107A 1 OF 1 METRIC

W.P. 116-87-00 LOCATION Coords: N 4 785 310.0; E 262 921.0 ORIGINATED BY DB
DIST CR HWY 403 BOREHOLE TYPE HS Auger COMPILED BY DB
DATUM Geodetic DATE 1995 05 30 CHECKED BY KA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (o 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)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						GR SA SI CL
231.3	Ground Surface										
0.0						▼*					
			1	SS	9		230				
			2	SS	9						0 13 84 3
			3	SS	12						
	Sandy Silt to Silt		4	SS	13		228				
	with random layers of Silty Clay		5	SS	13						0 4 93 3
			6	SS	13						
	Silt, some Clay		7	SS	11		226				
			8	SS	13						
	Brown						224				
	loose to compact		9	SS	24						
			10	SS	13		222				
			11	SS	5		220				
218.7			12	SS	10						0 16 78 6
12.6	End of Borehole * approx., hole caving in										

+³, ×⁵ : Numbers refer to Sensitivity

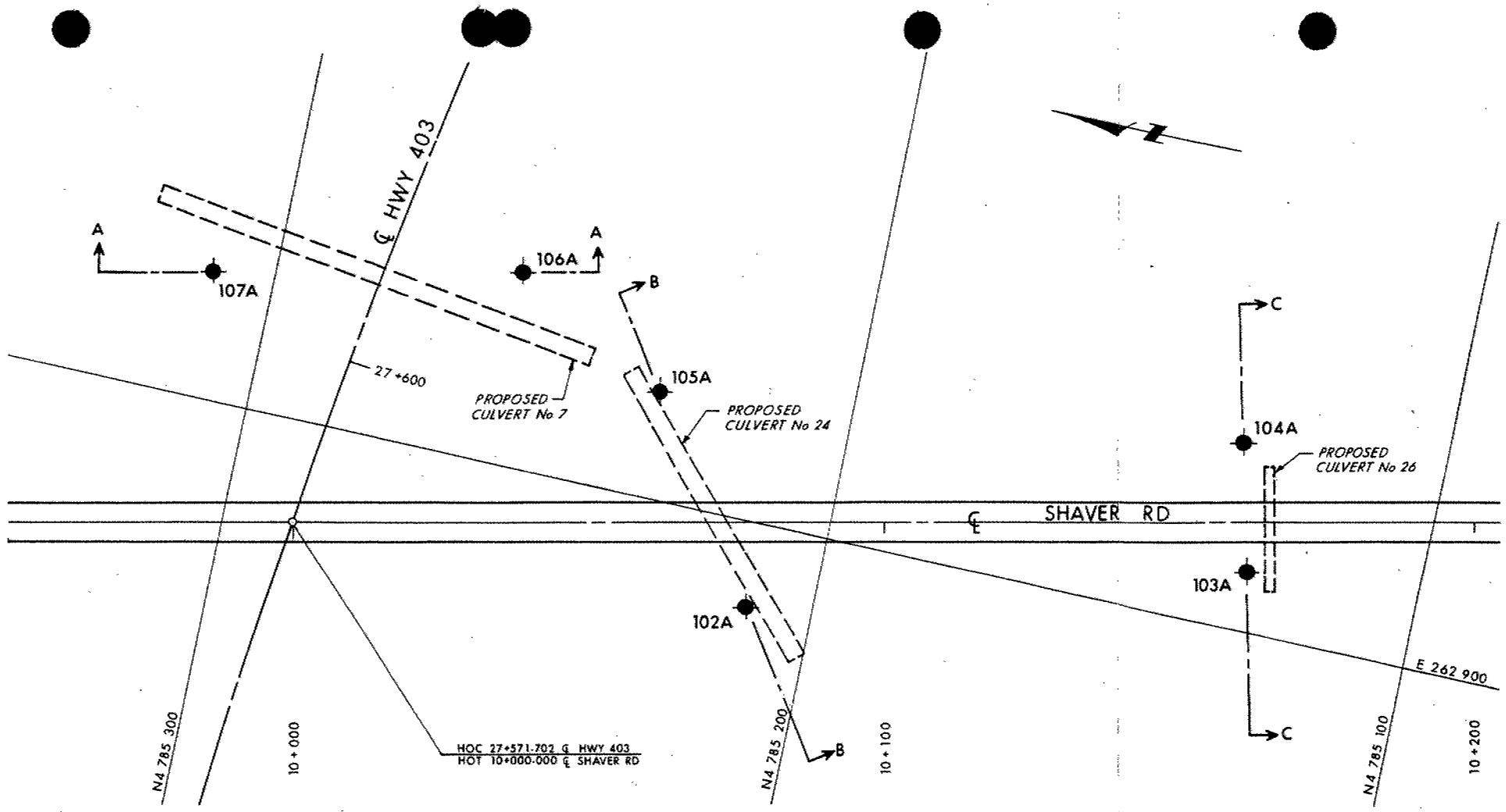
15 20/10 5 (%) STRAIN AT FAILURE

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

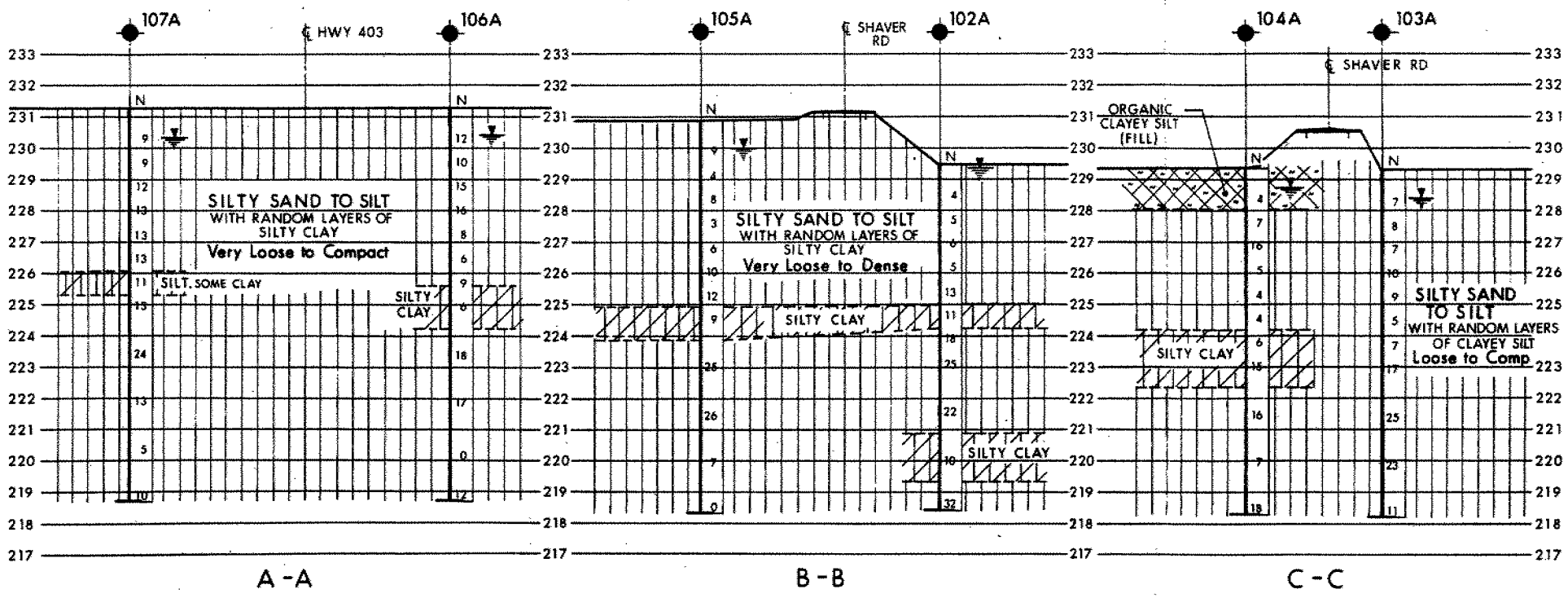
CONT No 96-38
WP No 116-87-00

CULVERTS AT SHAVER RD UNDERPASS
BORE HOLE LOCATIONS & SOIL STRATA

SHEET 230-1

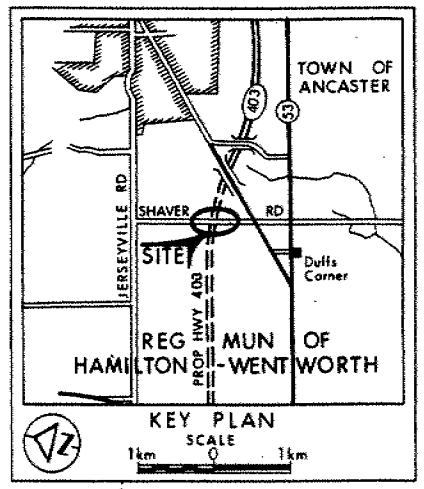


PLAN
SCALE
10m 0 10m



A-A B-B C-C

SECTIONS
SCALE
10m 0 10m Hor
2m 0 2m Vert



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 1995 05

No	ELEVATION	CO-ORDINATES NORTH	EAST
102A	229.5	4 785 211.0	262 885.8
103A	229.3	4 785 128.9	262 910.0
104A	229.4	4 785 133.7	262 930.8
105A	230.9	4 785 232.4	262 917.9
106A	231.3	4 785 258.9	262 932.1
107A	231.3	4 785 310.0	262 921.0

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 40P1-91

HWY No 403			DIST CR
SUBM'D KA	CHECKED	DATE 1995 08 29	SITE
DRAWN DT	CHECKED	APPROVED	DWG 1168700-A

REF No The Greer Galloway Group Inc. FILE 9950-FEB 07 1995

RIC

IN METRES
.IMETRES
WISE SHOWN

CONT No 96-38
WP No 116-87-00

CULVERT No. 26
SHAVER ROAD STA. 10+165
NON-RIGID FRAME BOX CULVERT

SHEET
233

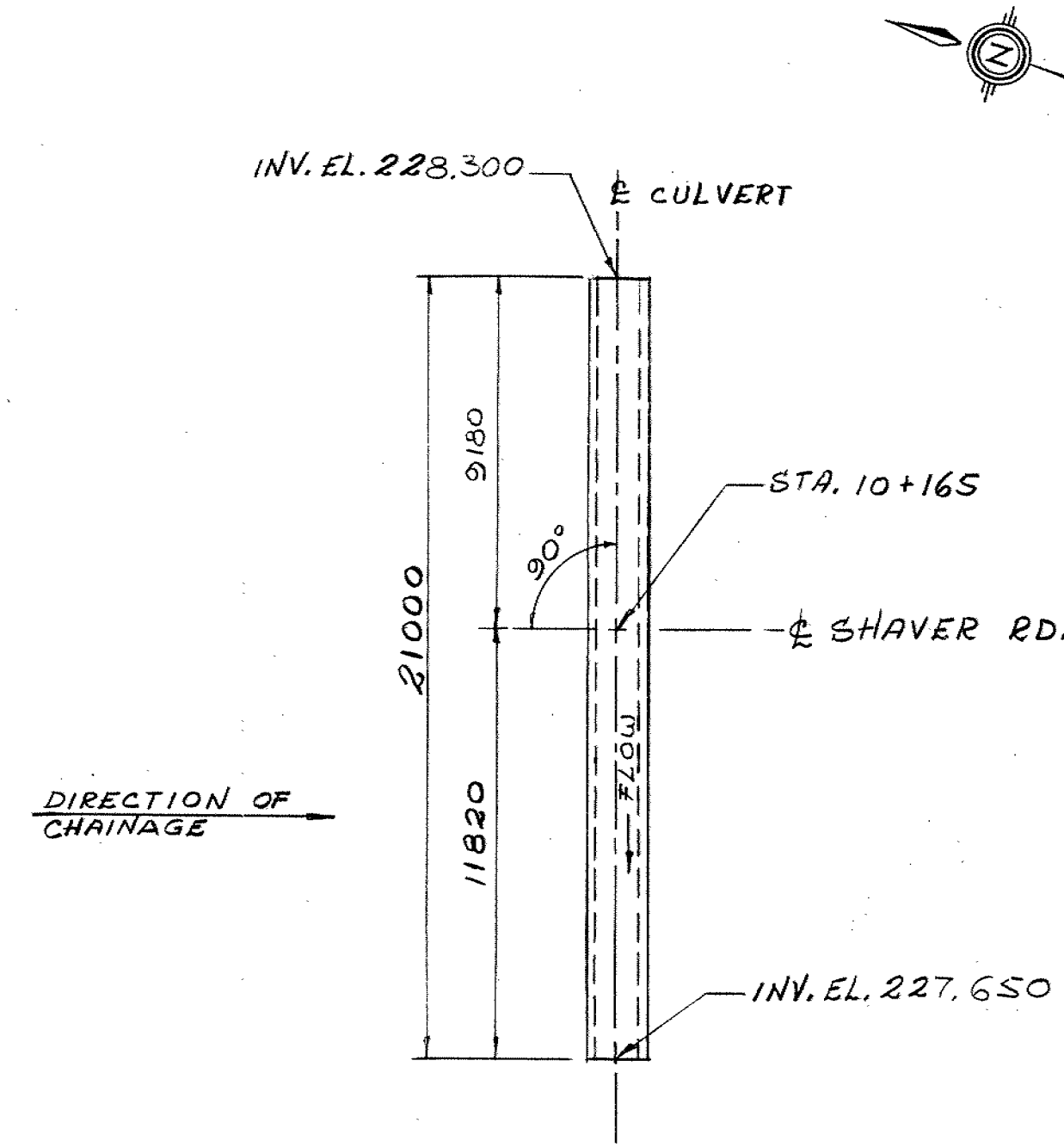
GENERAL NOTES

1 CLASS OF CONCRETE TO BE 30MPa
2 CLEAR COVER TO REINFORCING STEEL
BOTTOM OF TOP SLAB 40 ± 10 FOR SLABS ≤ 300 THICK
50 ± 10 FOR SLABS > 300 THICK
REMAINDER 70 ± 20 UNLESS OTHERWISE NOTED
3 REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BARS MARKED WITH SUFFIX C DENOTE COATED BARS.
4 LEGEND
IF DENOTES INSIDE FACE

CONSTRUCTION NOTES

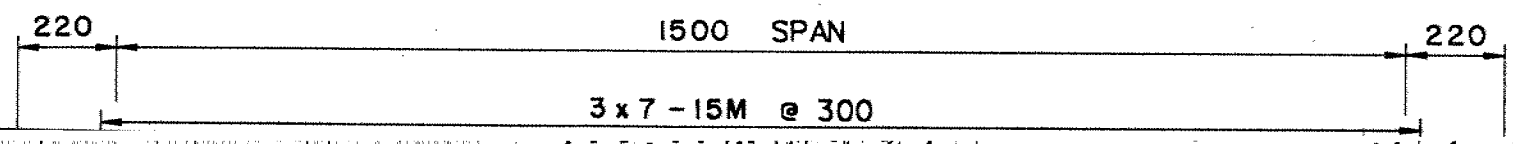
1 BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
2 NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE ENGINEER.

75mm DIA WALL DRAIN @ 3000mm C/C
FORMED WITH NON-METALLIC MATERIAL



SITE PLAN

N.T.S.



METRIC

ONS ARE IN METRES
OR MILLIMETRES
OTHERWISE SHOWN

CONT No 96-38
WP No 116-87-00

CULVERT No. 24
SHAVER ROAD STA. 10+072
RIGID FRAME BOX CULVERT

SHEET
232

GENERAL NOTES

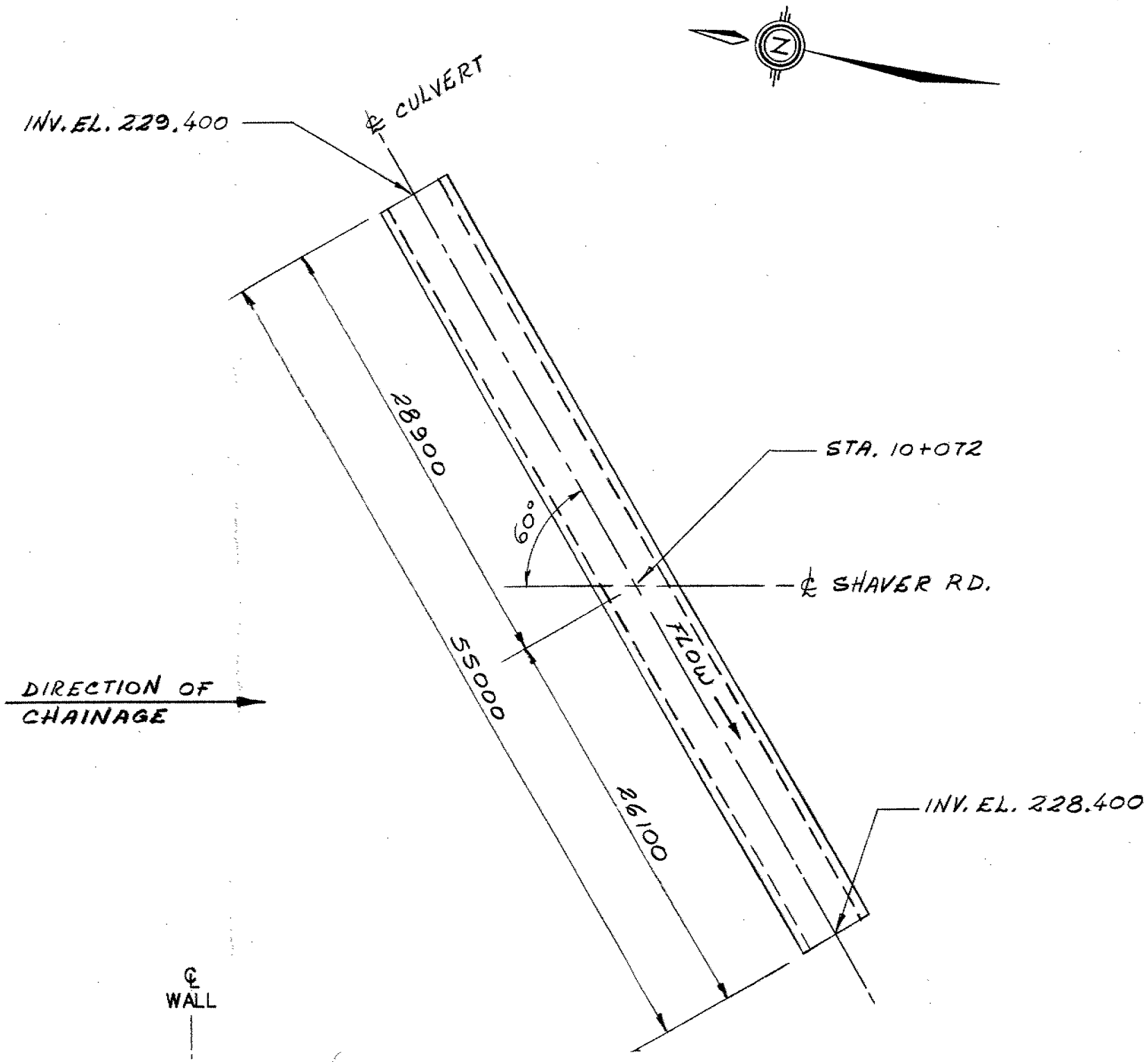
1 CLASS OF CONCRETE TO BE 30MPa
2 CLEAR COVER TO REINFORCING STEEL
BOTTOM OF TOP SLAB 40 ± 10 FOR SLABS ≤ 300 THICK
50 ± 10 FOR SLABS > 300 THICK
BOTTOM OF BOTTOM SLAB 100 ± 25
REMAINDER 70 ± 20 UNLESS OTHERWISE NOTED
3 REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BARS MARKED WITH SUFFIX C DENOTE COATED BARS.
4 LEGEND

ALT	DENOTES ALTERNATE
IF	DENOTES INSIDE FACE
OF	DENOTES OUTSIDE FACE
EF	DENOTES EACH FACE

CONSTRUCTION NOTES

1 BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
2 NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE ENGINEER.
3 SITE No. AND DATE FIGURES SUPPLIED BY MTO.

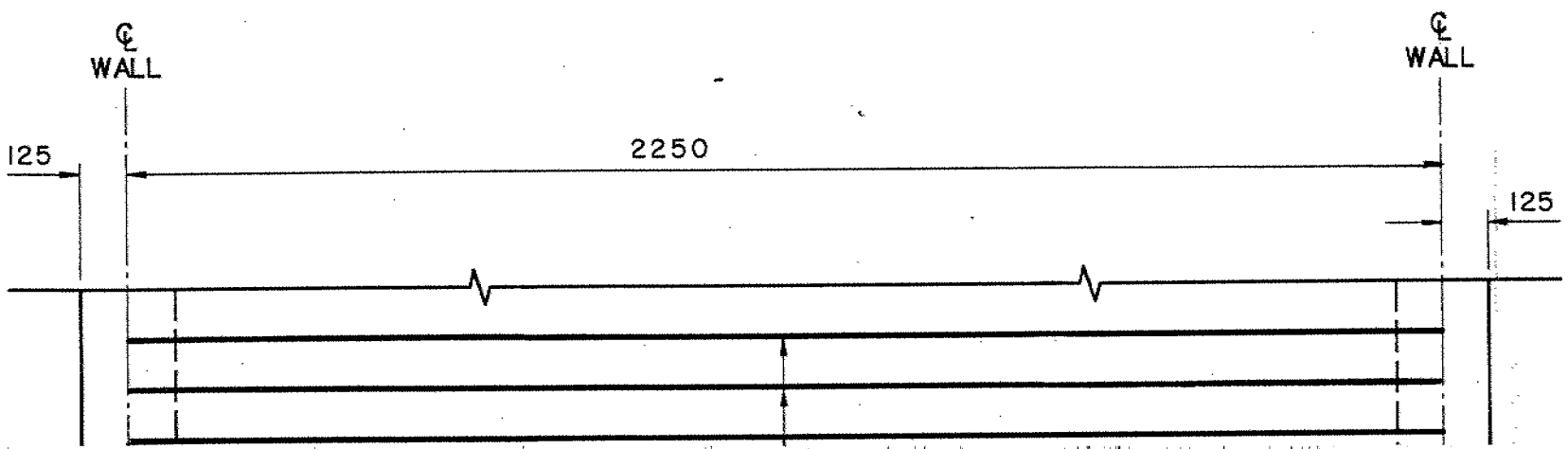
25 CLEAR SPACING



SITE PLAN

N.T.S.

DIRECTION OF CHAINAGE



METRIC

DNS ARE IN METRES
/OR MILLIMETRES
OTHERWISE SHOWN

CONT No 96-38
WP No 116-87-00

CULVERT No. 7
HWY. 403 STA. 27+615
RIGID FRAME BOX CULVERT

SHEET
231

GENERAL NOTES

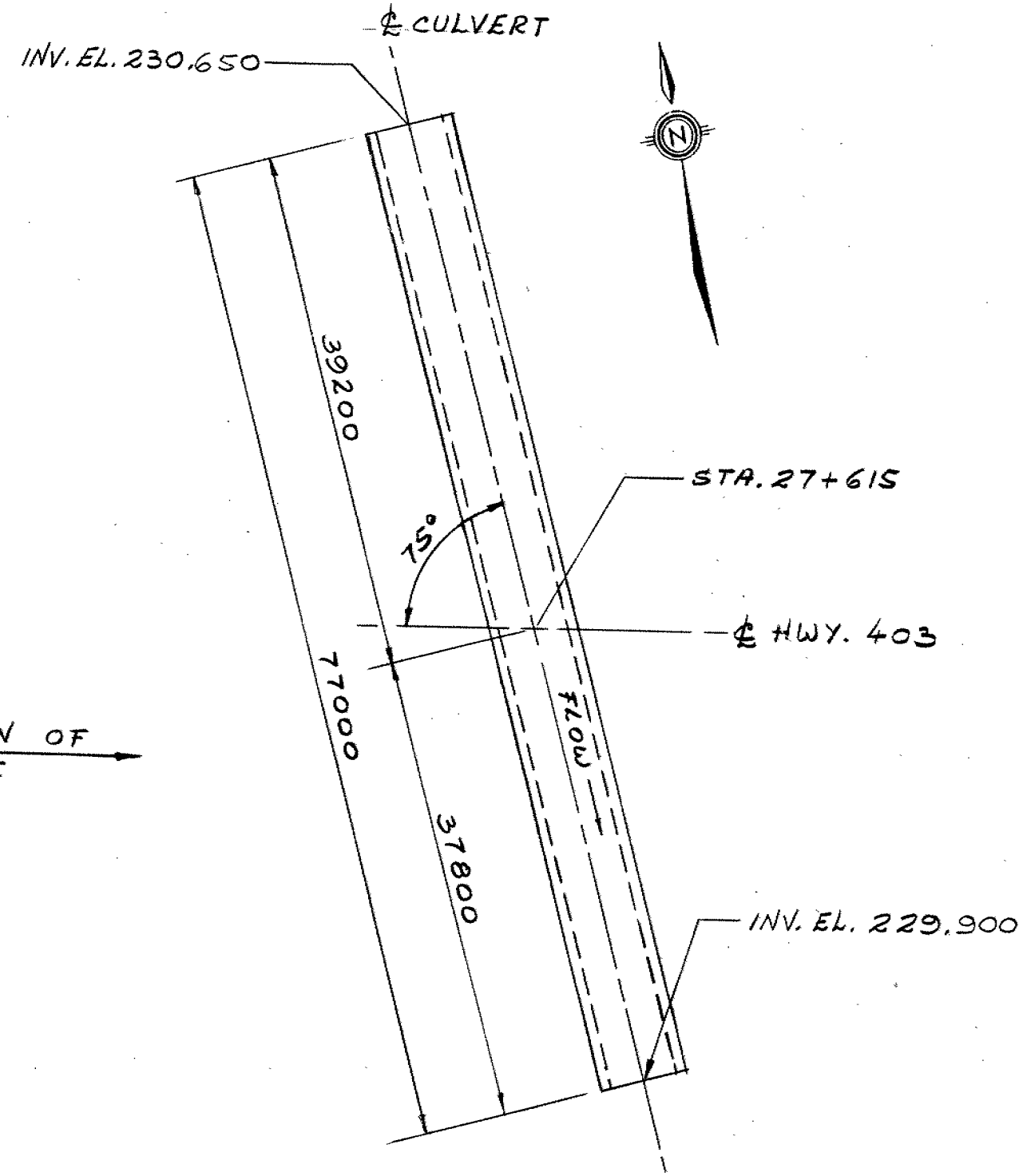
1 CLASS OF CONCRETE TO BE 30MPa
2 CLEAR COVER TO REINFORCING STEEL
BOTTOM OF TOP SLAB 40 ± 10 FOR SLABS ≤ 300 THICK
50 ± 10 FOR SLABS > 300 THICK
BOTTOM OF BOTTOM SLAB 100 ± 25
REMAINDER 70 ± 20 UNLESS OTHERWISE NOTED
3 REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BARS MARKED WITH SUFFIX C DENOTE COATED BARS.
4 LEGEND

ALT	DENOTES ALTERNATE
IF	DENOTES INSIDE FACE
OF	DENOTES OUTSIDE FACE
EF	DENOTES EACH FACE

CONSTRUCTION NOTES

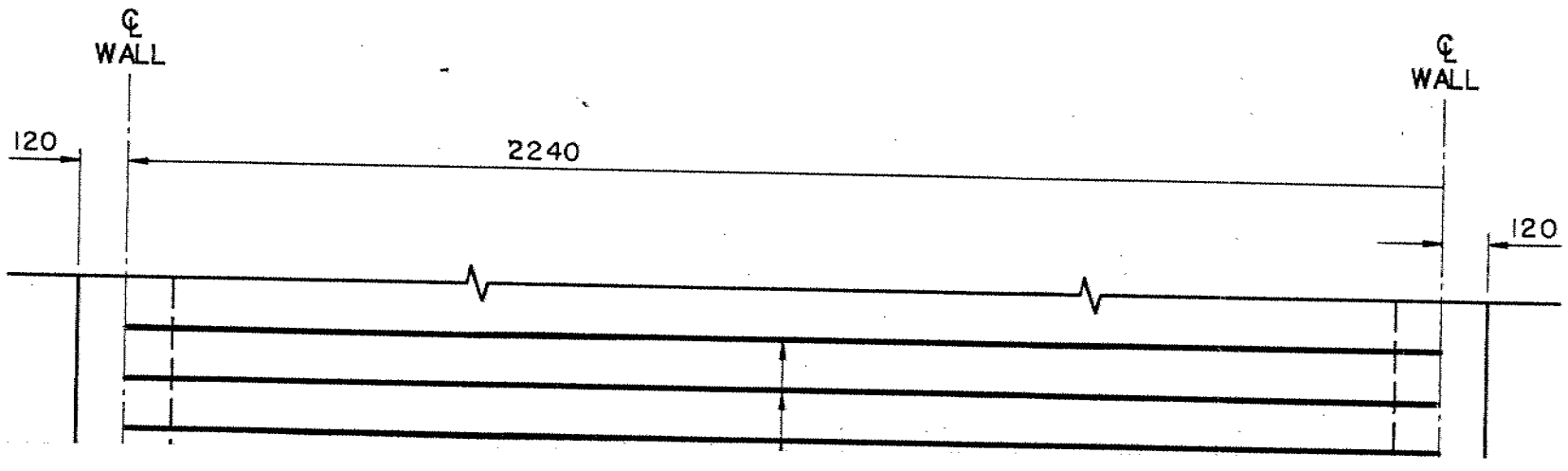
1 BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH SIDES OF CULVERT KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
2 NO CONCRETE SHALL BE PLACED UNTIL THE DEPTH OF THE EXCAVATION AND THE CHARACTER OF THE FOUNDATION HAVE BEEN APPROVED BY THE ENGINEER.
3 SITE No. AND DATE FIGURES SUPPLIED BY MTO.

25 CLEAR SPACING



SITE PLAN
N.T.S.

DIRECTION OF CHAINAGE →



Ministry of Transportation
Ontario

FAXGRAM

PLEASE TYPE DATE 96 07 08 PAGE 1 OF 6

TO:	FROM:
ROY ALEXANDER DOCUMENT REVIEW FAX 325-8070	BETTY BENNETT PAVEMENTS & FOUNDATIONS SECTION Ph: -4333

SUBJECT: CONTRACT 96-38 Hwy 403
Specifically → Shaver Road Underpass.

The contract package being prepared for Highway 403 includes the Shaver Road Underpass and three large culverts in the vicinity of the new structure. The contract documents include OPSS 517 for Dewatering, OPSS 518 for Control of Water and an NSSP for dewatering. The following ERS have been developed in the last month to replace the existing standards: MTOS 517 for Dewatering
MTOS 518 for Control of Water

In addition, the NSSP for Dewatering should be revised to reflect the change.

If possible and if time permits, please arrange to have these changes made.

Thanks
B Bennett

If there are any questions, please advise.

ADM-S-481 91-05

M E M O R A N D U M

Ontario

To: A. Burgess
Structural Engineer
Structural Office - 7th Floor Atrium Tower

Date: 95 09 28

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

Tel: (416) 235-3731
Fax: (416) 235-5240

Re: NSSP - Dewatering
Shaver Rd & Hwy 403
W.P. 65-67-03, Site 36-259
District 4, Burlington

Further to our telephone conversation regarding the dewatering requirement to facilitate the foundation construction at the above mentioned site, it is recommended that a NSSP be included in the Contract Documents should the excavation be required within the surficial submerged cohesionless sandy silt to silt deposit. The NSSP should read as follows:

> "The surficial native deposit at the site consists of a cohesionless sandy silt to silt material. The groundwater table at the time of investigation was within 1 metre of the existing ground surface(El 230 m to 233.2m)
>
> The Contractor is alerted that the surficial sandy silt to silt deposit submerged below the groundwater table is susceptible to conditions of unbalanced head and hence can slough and boil into the excavation.
>
> The Contractor shall carry out a dewatering scheme that ensures foundation construction in the dry and prevention of sloughing and boiling. Dewatering shall be carried out in accordance with OPSS 517.
>
> The Contractor's proposal for excavation and dewatering shall be submitted to the Contract Administrator fro review 15 working days prior to commencement of work."

If your require additional information regarding this NSSP, please do not hesitate to contact this office.

T. Sangiuliano, P. Eng.
Foundation Engineer
for
D. Dundas, P. Eng.
Sr. Foundation Engineer