

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-94

DIST. 6 REGION

W.P. No. 88-78-26

CONT. No.

W. O. No.

STR. SITE No. 37-1339

HWY. No. 407

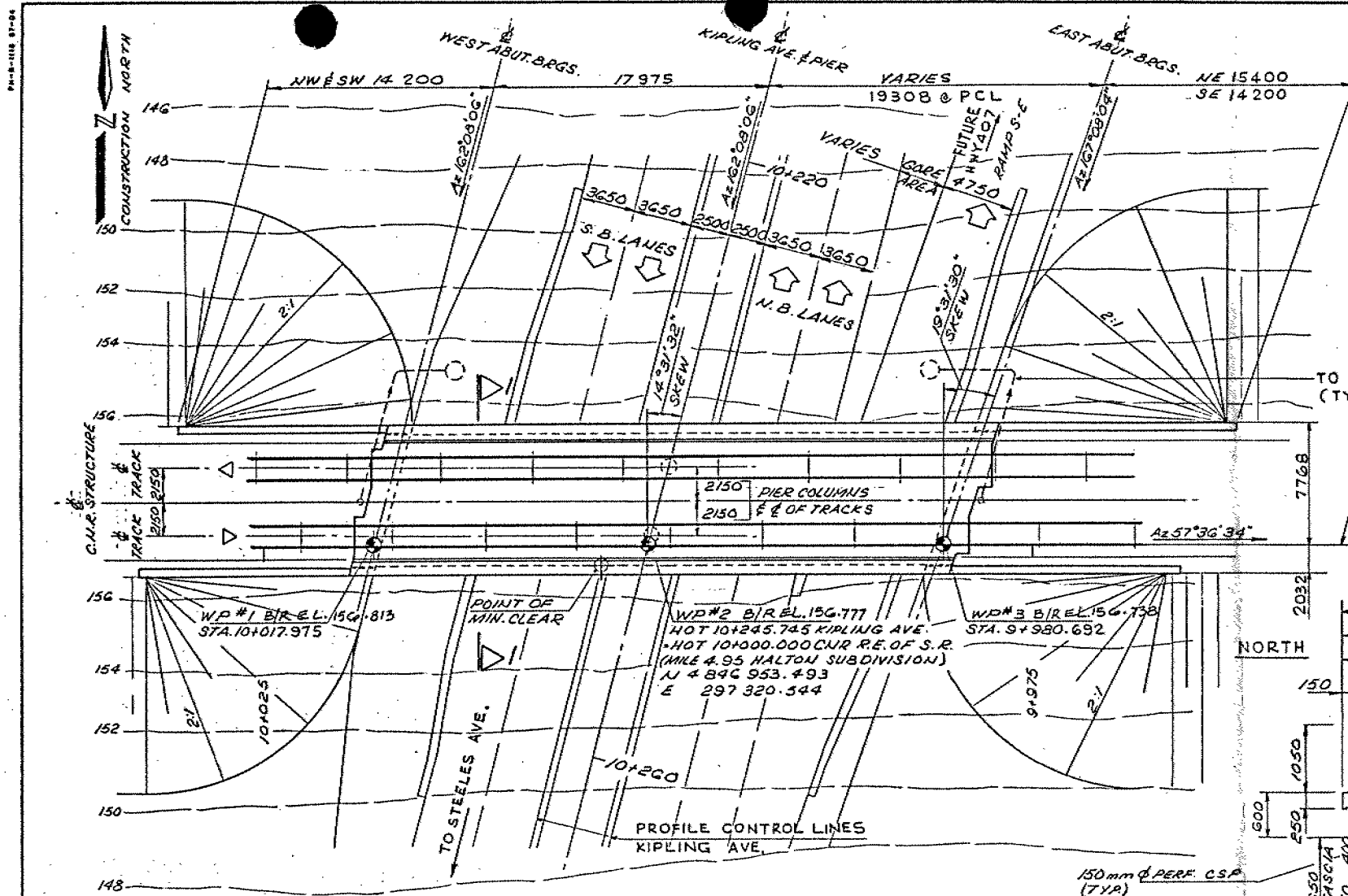
LOCATION CNR / KIPLING AVE

No of PAGES -

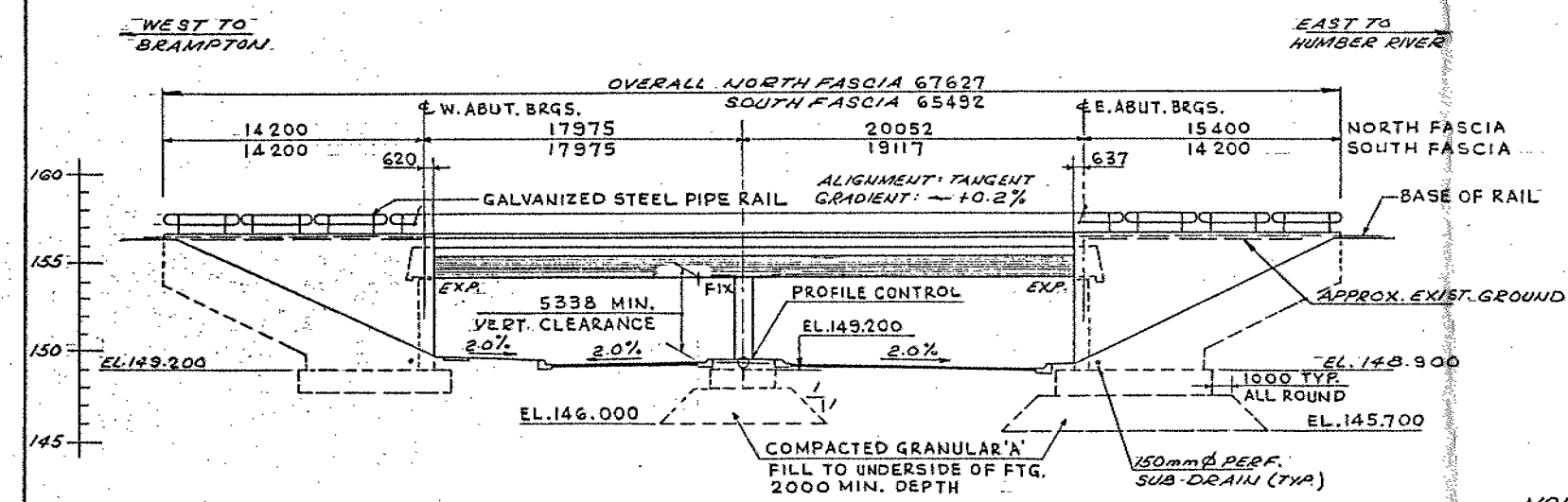
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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

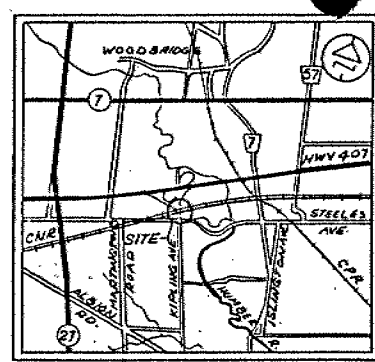
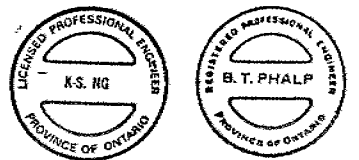


PLAN
1:200



ELEVATION
1:200

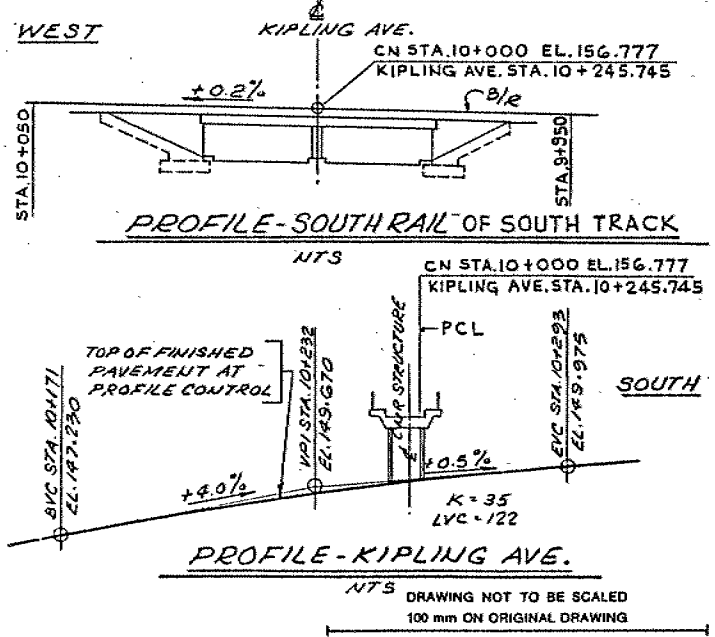
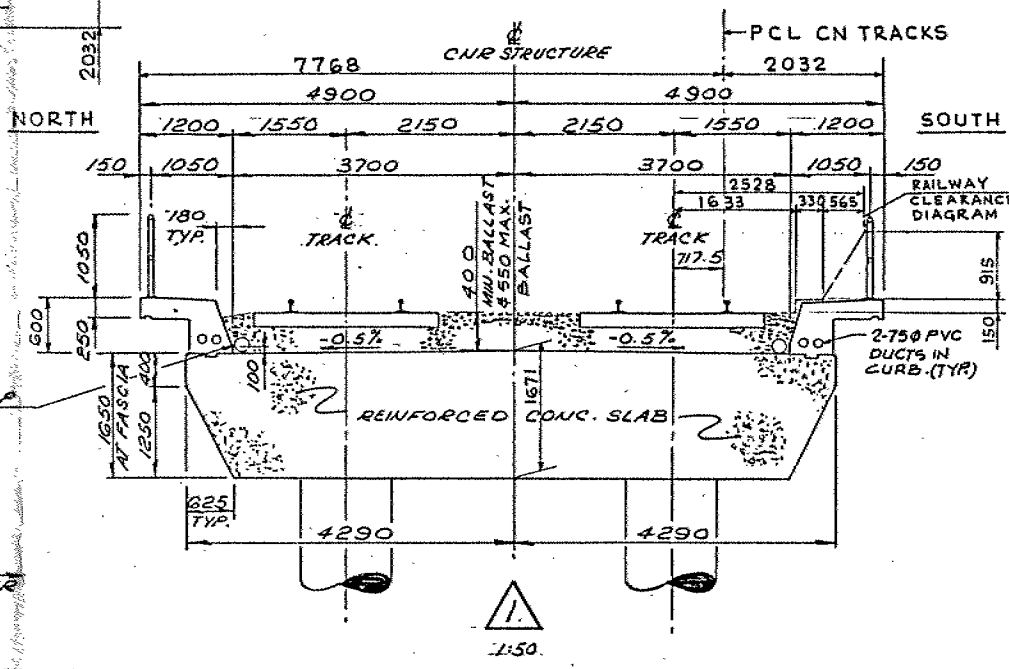
BM 160.949
GEODETIC DATUM
N. & W. IN O. 4 CEDAR
186.0 RT. 10+067.8
PROP. KIPLING AVE.



KEY PLAN

TO BE CONNECTED TO STORM SEWER SYSTEM
(TYP. BOTH SIDES)

PROFILE CONTROL LINE - CN TRACKS
RUNNING EDGE OF S. RAIL OF S. TRACK



PROFILE-KIPLING AVE.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

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

DIST. No. 6
CONT No
WP No 88-78-26
KIPLING AVENUE CNR SUBWAY
MI 4.95 MALTON SUB
GENERAL ARRANGEMENT



Fenco
FENCO ENGINEERS INC.

GENERAL NOTES

- CLASS OF CONCRETE**
Footings, Abutments, Piers and Deck 30 MPa
- CLEAR COVER TO REINFORCING STEEL**
Footings 100 ± 25
- Abutments, Wingwalls and Retaining Walls**
Front Face 70 ± 20
Back Face 60 ± 20
- Piers**
Deck Top 80 ± 20
Bottom and sides 70 ± 20
Remainder (unless otherwise noted) 60 ± 10

REINFORCING STEEL

Reinforcing steel shall be grade 400 unless otherwise specified.
Bar marks with the suffix "C" denote coated bars.

CONSTRUCTION NOTES

If the actual bearing heights are different from the assumed bearing heights given with the bearing design data, the contractor shall adjust the bearing seat elevations and the reinforcing steel to suit the actual heights.

DESIGN LIVE LOAD

Cooper's E-85 plus diesel impact.

SPECIFICATIONS

AREA. Manual for Railway Engineering (except for Impact).
Impact CSA S-29-1978 Code for concrete railway bridges.

MILEAGE

Mile 4.95 Halton Subdivision

SAFE BEARING PRESSURES

The safe bearing pressures shall be as follows:

- West Abutment on natural ground
S.L.S. 11 350 KPa U.L.S. 525 KPa
- East Abutment and pier on compacted granular "A" fill.
S.L.S. 11 300 KPa U.L.S. 750 KPa

NEAREST STATION

Humber Mile 4.30

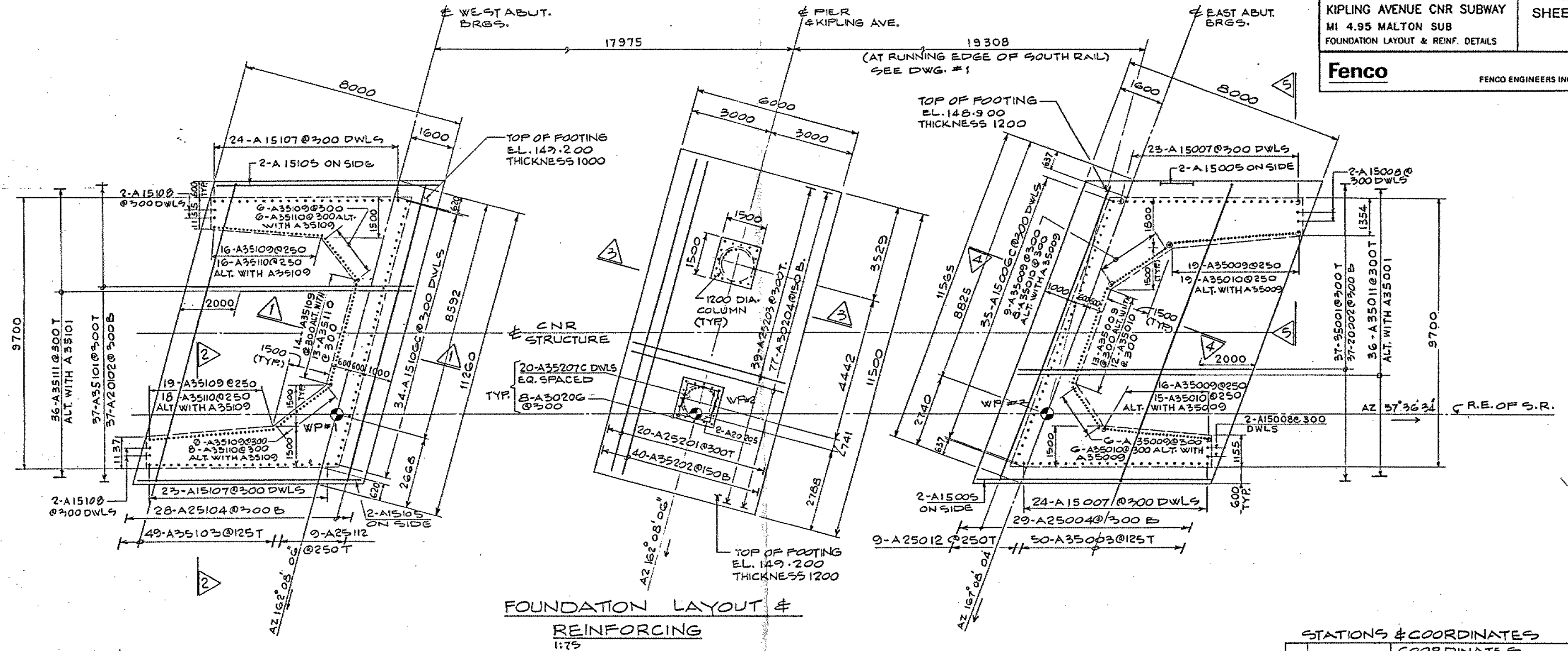
List of Drawings

1. General Arrangement
2. Borehole Location and Soil Strata
3. Foundation Layout and Reinforcing Details
4. East Abutment and Wingwalls
5. West Abutment and Wingwalls
6. Deck Dimensions and Details
7. Deck Reinforcements
8. Pier and Drainage at Structure
9. Handrails

ESTIMATED QUANTITIES

- CONCRETE 1371 m³
- REINFORCING STEEL NON COATED 149990 kg
EPOXY COATED 8938 kg
- GALVANIZED STEEL PIPE RAIL 133 m

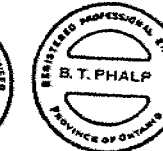
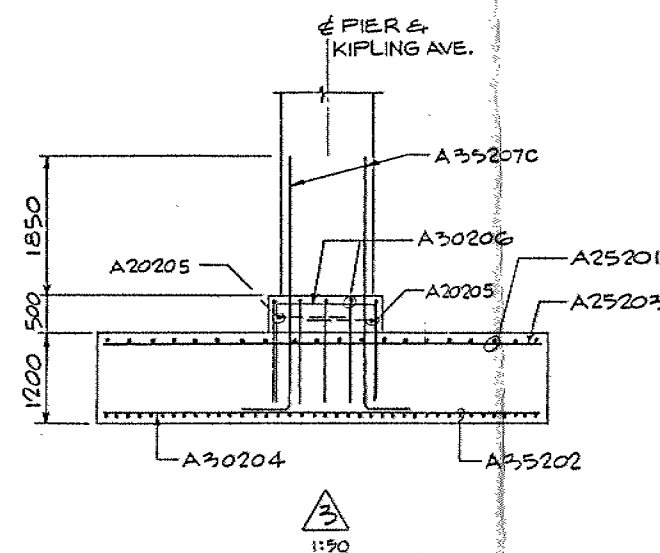
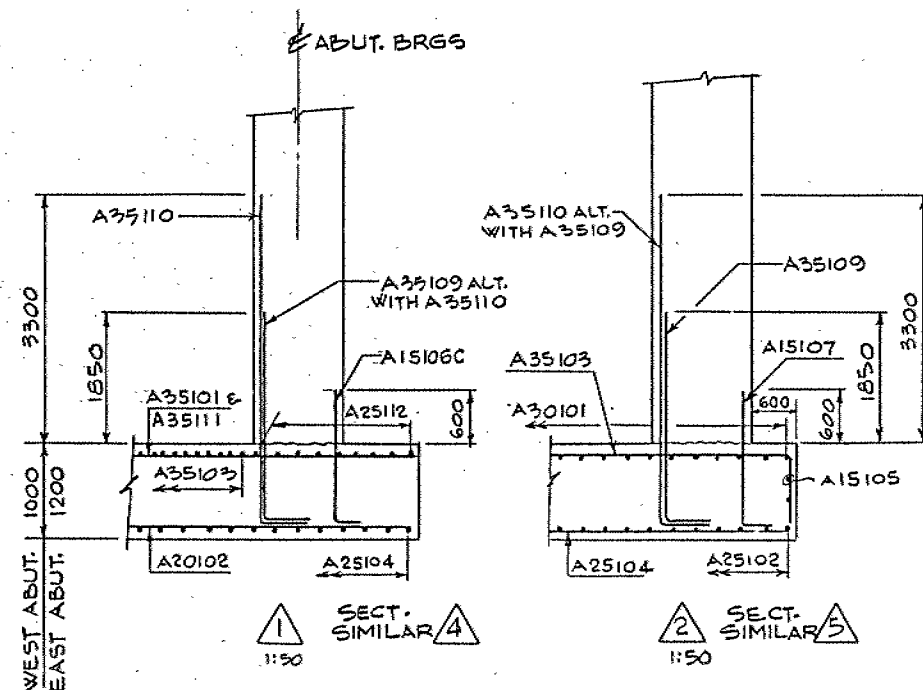
REVISIONS	DATE	BY	DESCRIPTION	DATE	BY	DESCRIPTION
DESIGN	12/1/90	CHK	7/1/90	CODE	A-R-E-A	LOAD
DRAWN	12/1/90	CHK	7/1/90	SITE	37-7339	STRUCT
						SCHEME
						DWG.



FOUNDATION LAYOUT &
REINFORCING
1:75

WP	PCL STA	COORDINATES	
		NORTHINGS	EASTINGS
1	10+017.975	4846943.864	297305.366
2	10+000.000	4846953.493	297320.544
3	9+980.692	4846963.838	297336.850

NOTES:
• FOR GENERAL NOTES SEE DWG. # 1



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION					
DESIGN'S KCD	CHK'L N/G	CODE	LOAD	DATE DEC-1980				
DRAWN M.H.	CHK'NS KC	SITE 37-1230	STRUCT	ISCHEME	IOWG 3			

B.P. WALKER Associates Limited

GEOCRE 30 M13-94

REPORT ON
FOUNDATION INVESTIGATION
FOR PROPOSED CROSSING AT
CANADIAN NATIONAL RAILWAYS
AND PROPOSED KIPLING AVENUE
WP 88-78-26: SITE 73-1339
TOWN OF VAUGHAN DIST. 6 REG. CENTRAL

Consulting Geotechnical
Inspection and
Testing Engineers

REPORT ON
FOUNDATION INVESTIGATION
FOR PROPOSED
CROSSING AT CANADIAN NATIONAL RAILWAYS
AND PROPOSED KIPLING AVENUE
WP 88-78-26: SITE 73-1339
TOWN OF VAUGHAN DIST. 6 REG. CENTRAL

Prepared for:
Ministry of Transportation
Foundation Design Section
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Project No. 2313-0190

July 5, 1990

Geo No. 30M 13-94

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DRAWINGS

	<u>Drawing</u>
Record of Boreholes	1 - 14, 101 - 103
Plasticity Charts	Fig. 1 - 3
Grain Size Distribution Curves	Fig. 4 - 12
Footings on Compacted Fill	Fig. 13
Drawing No. 88-78-26	A, B. & C

1. INTRODUCTION

B. P. Walker Associates Limited, Consulting Geotechnical, Inspection and Testing Engineers, was authorized by the Ministry of Transportation, Ontario to conduct a geotechnical investigation at the site of the proposed crossing of the Canadian National Railways and proposed Kipling Avenue in the Town of Vaughan, Ontario. The southbound lanes and northbound lanes of Kipling Avenue will be carried through a subway at the proposed CNR structure. Conceptual design data regarding the project were transmitted to us by M. Devata, P. Eng., Chief Foundation Engineer of the Ministry.

The purpose of the geotechnical investigation was to explore the subsurface conditions by means of boreholes for the design and construction of the foundations for the CNR bridge and earthworks for the temporary realignment of the CNR tracks. This report presents a brief account of the procedures followed in the investigation, the field and laboratory test results, and our interpretation of the findings.

2. THE SITE AND GEOLOGY

The site is located in the Town of Vaughan, just outside the northern boundary of Metropolitan Toronto, north of Steeles Avenue West, east of Highway 27 and west of Islington Avenue. The existing CNR tracks are located on an embankment. The height of the embankment over the original ground at the proposed crossing of Kipling Avenue varies from 7m at the west abutment to approximately 14m at the east abutment. The topography is gently rolling, sloping towards the east.

According to The Physiography of Southern Ontario (Chapman and Putnam, 1966) the site belongs to the Peel plain physiographic region which has flat to slightly rolling topography and is sloping uniformly towards Lake Ontario. The plain is scoured at intervals by valleys, tributaries to the Rouge, Don and Humber river systems. The prevalent soil types are tills and river deposits.

The site lies between two valleys. Rainbow creek flows immediately north of the proposed bridge location and a smaller creek flows south of the site. These creeks are tributaries of the Humber River which, at its closest point, flows east of the site at a distance of less than a kilometre.

3. FIELD AND LABORATORY WORK

Seventeen boreholes, numbered 1 to 14 and 101 to 103, were drilled as shown on the borehole location plans, drawings 887826-A and C. These borehole locations were selected in agreement with MTO on site plans transmitted to us. The site plan C shows the conceptual layout of the proposed temporary realignment of the CNR tracks during the construction of the bridge. Drawing A shows the proposed bridge location. The boreholes for the bridge were staked out in the field and the geodetic ground elevations were determined by the surveyors of M.T.O. The boreholes along the realignment were staked out and surveyed by B.P. Walker Associates' field representative.

The fourteen boreholes were drilled in the interim between December 21, 1989 and January 10, 1990, to depths ranging from 2.6m to 27.4m. Three additional boreholes BH101 to 103 were drilled on the north slope between May 14 and May 22, 1990. A bombardier mounted drilling rig, equipped with solid stem and hollow stem augers and 75mm casing for wash boring and tripod with continuous

sampling were used for advancing the holes. The drilling, sampling and field testing procedures were supervised and the borings were logged by an experienced geotechnical engineer from our office.

Dynamic cone penetration tests were performed adjacent to most boreholes.

Samples were taken with a 51mm o.d. split spoon (SS) in accordance with ASTM D 1586-84, Standard Method for PENETRATION TEST AND SPLIT BARREL SAMPLING OF SOILS. Although the recovered samples are disturbed, they are representative of the stratum from which they were obtained and the STANDARD PENETRATION RESISTANCE (N-values) indicates the relative density or consistency of the sampled soil. In the dynamic cone penetration test a 50mm diameter cone is driven with the same driving energy as in the Standard Penetration Test.

In each borehole the ground water conditions were observed during drilling and sampling and after completion of the borehole. For long-term observations, sealed PIEZOMETERS were installed in boreholes 2, 7 and 8. At borehole 6, where artesian conditions were encountered, a bentonite seal was installed between 1.2 and 2m from the ground surface to plug the borehole. At all other locations the boreholes were backfilled with auger cuttings.

4. SUBSURFACE CONDITIONS

(a) Temporary CNR Realignment

Based on the subsoil encountered at six boreholes along the proposed temporary realignment, the original ground comprised of organic silt/peat or an alluvial deposit indicating marshy

conditions. The alluvial deposit was not encountered at the borehole west of centerline of proposed Kipling Ave. The natural soil at the surface of this borehole is sand.

West of the centreline of proposed Kipling Ave., the subsoil under the alluvial deposits is silty clay. East of proposed Kipling Avenue the natural soils below the alluvial deposit consist of loose to compact sand at boreholes 12 and 13 and a glacial till composed of a heterogeneous mixture of sand, silt with trace clay and gravel at borehole 14.

At boreholes 9, 10, 11 and 12, a deposit of Glacial Till consisting of a heterogeneous mixture of sand, silt with trace clay and gravel, was encountered below the silty clay and sand deposits.

(b) CNR Subway (Bridge Location)

Fill varying from 1.2m to 8.6m in depth was encountered at the boreholes carried out for the proposed bridge. The original ground, under the fill, is glacial till and sand to gravelly sand. The glacial till consists of a very dense, heterogeneous mixture of sand, silt with trace to some clay, trace gravel. The sand and gravelly sand is also very dense with occasional compact surficial layers.

The lower boundary of the glacial till or sand and gravelly sand stratum was not found at any of the borings but this deposit was explored to a maximum depth of 27.6m below the existing ground surface. The existing CNR embankment fill is a borrow material composed of silty clay with sand, trace gravel.

A detailed description of the soil encountered in each borehole is given in the Record of Borehole drawings. The estimated

stratigraphic profile and sections shown on Drawings 887826 B and C are based on this information. From ground level downwards, the subsurface conditions in detail are as follows:

Fill Material (Boreholes 1 to 9, 12 to 14 and 101 to 103)

The boreholes carried out through the existing CNR embankment, at the toe of the embankment and along the proposed realignment of the CNR tracks encountered fill varying in depth from 1.2m to 8.6m below the existing ground surface. The fill material is composed of silty clay with sand, trace gravel. It contains occasional organic stained material. Standard Penetration Tests gave "N" values in the range of 4 to 78 blows per 30cm, generally less than 30 blows per 30cm. The shear strength of the fill, based on the unconfined compressive test varies from 90 to 215 kPa indicating that the fill material has a soft to very stiff consistency with occasional hard layers. The fill is a competent soil which we believe has been compacted under supervision and with care.

The physical properties of the fill, as determined from laboratory testing on representative samples, are summarised below:

	<u>Range</u>	<u>Average</u>
Liquid Limit (W _L) %	24 to 40	36
Plastic Limit (W _p) %	15 to 18	16
Plasticity Index (I _p) %	16 to 21	20
Moisture Content (W) %	12 to 26	19

The results of the Atterberg Limit Tests are shown on the Plasticity chart on Figures 1 and 1A. These results indicate that the matrix is inorganic of low to medium plasticity, (CL to CI zone).

The results of the grain size distribution testing performed on representative samples are shown in an envelope form on Figures 4 and 4A.

Clayey Silt/Peat and Alluvial Deposits

These deposits were encountered at all boreholes along the proposed realignment of the CNR tracks except at borehole 9.

Immediately under the fill at boreholes 11 and 12 are deposits of clayey silt/peat and organic silt/peat respectively. This deposit consists predominantly of clayey silt with thin peat layers randomly dispersed except at borehole 12 where the thickness of peat was approximately 1.0m. The thicknesses of these deposits varied from 1.3m at borehole 11 to 2.3m at borehole 12. Standard Penetration gave 'N' values in the range of 11 to 20 blows per 30cm indicating stiff to very stiff consistency.

The alluvial deposit consisting of silty sand with gravel, trace clay and containing thin seams of organics was encountered at the surface at borehole 10 and immediately under the fill at borehole 13. Standard Penetration gave 'N' values in the range of 7 to 45 blows for 30cm indicating loose to dense consistency.

The results of grain size distribution testing performed on representative samples from these deposits are shown on Figures 5 and 6.

Silty Clay

Immediately under the alluvial deposit in boreholes 10 and 11 and under the fill in borehole 101 is a deposit of silty clay varying in thickness from 3.0m to 4.2m and consisting of cohesive

silty clay with very fine to fine silt layers and trace sand and gravel. A similar deposit was encountered sandwiched between the glacial till and sand deposits at boreholes 3 and 5 and under the glacial till at borehole 14.

The physical properties of this deposit, as determined from laboratory testing, are summarized below:

	<u>Range</u>	<u>Average</u>
Liquid Limit (W _L) %	36 to 42	39
Plastic Limit (W _p) %	17 to 21	19
Plasticity Index (I _p) %	16 to 22	19
Moisture Content (W) %	19 to 23	21

The results of the Atterberg Limit Tests are shown on the Plasticity Chart on Figure 2. These results indicate that the deposit is inorganic of low to medium plasticity (CL to CI zone).

The results of grain size distribution testing performed on representative samples from the silty clay deposit are shown on Figures 7 and 7A.

The standard penetration tests gave 'N' values in the range of 21 to 50 in boreholes 11 and 12 and 42 blows per 30cm to over 100 blows per 30cm at boreholes 3, 5, 14 and 101. Based on these 'N' values the consistency of the stratum is estimated to be very stiff to hard at boreholes 10 and 11 and hard at boreholes 3, 5, 14 and 101.

Silty Sand to Sand

Underlying the fill at borehole 5, the alluvial deposit at boreholes 12 and 13 and from the surface at borehole 9 is a deposit

of silty sand to sand, varying in thickness from 1.8m to over 5.5m. At borehole 13, the lower boundary of this deposit was not established but the soil was proven to a maximum depth of 9.6m below the ground surface.

The results of grain size distribution testing performed on representative samples are shown on Figure 8. These results indicate that the silty sand to sand has trace to some clay and gravel.

The standard Penetration Tests gave 'N' values in the range of 5 to 56 at boreholes 12 and 13 indicating that the material has a very loose to dense consistency; mostly loose to compact. At boreholes 5 and 9, the N values vary from 31 to over 100 for 30cm indicating a dense to very dense consistency; mostly in the very dense range.

Glacial Till

A deposit of Glacial Till was encountered at all boreholes except at boreholes 7 and 13. The thickness of this stratum varies from 1.2m to over 8.1m at borehole 8 where the bottom of this deposit was not established. At borehole 4, split spoon sampling was extended to only 0.5m into this stratum. The deposit is composed of a heterogeneous mixture of sand and silt with some to trace clay and trace gravel. Although no boulders were encountered at the borehole locations, occasional boulders randomly dispersed within the Glacial Till are anticipated.

Generally the Glacial Till is non-cohesive. Some parts of the Glacial Till were found to be cohesive and the physical properties of the slightly cohesive glacial till, as determined from laboratory testing, are summarized below:

	<u>Range</u>	<u>Average</u>
Liquid Limit (Wl) %	19 to 23	21
Plastic Limit (Wp) %	13	13
Plasticity Index (Ip) %	6 to 10	8
Moisture Content (W) %	8 to 12	10

The results of the Atterberg Limit tests are shown on the Plasticity chart on Figure 3. These results indicate that the matrix is inorganic of low plasticity (CL-ML to CL zone).

The results of grain size distribution testing performed on representative samples from the overall glacial till deposit are shown in an envelope form on Figure 10. The results of grain size distribution testing performed on a sample from borehole 103 are shown on Figure 10A.

The Standard Penetration Test, gave 'N' values in the range of 21 to 49 at borehole 12 and from 24 to over 100 blows per 30cm at other locations. Based on these 'N' values the consistency of the glacial till at borehole 12 is compact to dense whereas over the rest of the site it is very dense except near the surface at BH 2 where it is compact.

Sand to Gravelly Sand

Underlying the till and fill at borehole 2 is a deposit of sand to sandy gravel. The deposit is composed of uniformly graded sand with trace to some gravel sizes and grades into gravelly sand. The boundaries between the sand and gravelly sand are difficult to define exactly.

The results of grain size distribution testing performed on representative samples from the overall sand and gravelly sand deposit are shown in an envelope form on Figure 11.

The Standard Penetration Tests gave 'N' values in the range of 16 to over 100 blows per 30cm.

Based on these 'N' values the consistency of the sand and gravelly sand stratum is estimated to be compact to very dense, generally in the very dense range. It is our opinion that the low 'N' values are due to loosening of the non-cohesive sand strata due to excess water pressure.

Silt to Sandy Silt

A silt to sandy silt deposit was encountered at boreholes 2, 5 and 7 at an average elevation of 130.5m (8.5m to 17m below the ground surface). The thickness of this stratum at borehole 7 is estimated to be 3.0m whereas the thickness at boreholes 2 and 5 was not established (Boreholes were terminated within this stratum).

The results of grain size distribution testing performed on representative samples from this stratum are shown on Figure 12.

The Standard Penetration Tests gave 'N' values of over 100 blows per 30cm. Based on these 'N' values the consistency of this stratum is estimated to be very dense.

Groundwater

The groundwater level conditions were observed by measuring in the open borehole during and after completion of the foundation

investigation. In addition, three piezometers were installed to estimate the stabilized water table. Water levels in the piezometers at boreholes 2 and 7 were found to be at an elevation varying from 141.3m to 141.0m respectively. Water in the piezometer at Borehole 8 was frozen at the ground surface at an elevation of 140.2m. Based on these observations it is our opinion that a continuous water table exists within the sand stratum and is under artesian pressure. The stabilized pressure head is at an elevation of 141.3m.

North of the existing embankment, the elevation of the sand seam varies from 139.2m to 137.2m indicating an artesian head varying from 2.1m to 4.1m at boreholes 7 and 8, respectively.

South of the existing embankment, the elevation of the sand seams vary from 137.2m to 135.7m indicating a pressure head varying from 4.1m to 5.6m at boreholes 2 and 5, respectively.

5. DISCUSSION AND RECOMMENDATIONS

5.1 Project

The proposed Kipling Avenue extension will run in a North-South direction and will pass through the proposed subway under the existing CNR tracks running in the East-West direction. According to the conceptual layout of the subway, Drawings E-73-407-3 obtained from MTO, the existing ground level at the centreline of proposed Kipling Avenue varies from 143.5m on the south of the CNR tracks to 156.8m on top of the CNR embankment to 139.5m north of the CNR tracks. The elevation of the CNR tracks on top of the embankment varies from 156.811m to 156.943m. The proposed top of pavement at the centreline of Kipling Avenue at the proposed subway is 149.4m.

The proposed structure carrying the east-west CNR tracks will be a two span structure with spans of 16.8m and 19.1m. The highest foundation base level is estimated to be about El. 148.0m. This will allow for 1.2m frost protection.

Prior to the construction of the subway the CNR tracks will be temporarily relocated approximately 50m south of the existing embankment, at the centreline of proposed Kipling Ave. This embankment is to be constructed prior to starting the construction of the bridge. The top of rails on the proposed embankment will be the same as the existing elevations. Upon completion of construction the tracks will be moved back to their existing location and the temporary embankment removed.

Our recommendations are based on this information.

5.2 Foundation Design

The soil conditions at the proposed founding elevation vary considerably over the site from very dense glacial till; heterogeneous mixture of sand and silt trace/some clay, trace gravel at the southwest quadrant of the proposed structure (BH4 location); to stiff and very stiff fill consisting of silty clay with sand, trace gravel at other locations. In view of these variable conditions we have considered different options for the foundations of the proposed structure and it is our opinion that spread footings on engineered fill will be the most viable option for the east abutment and the central pier. Spread footings for the west abutment can be founded on natural soils at or below an elevation of 148.0m.

The engineered fill should consist of Granular 'A' conforming to MTO Standard Form 1010. The advantage of placing footings on

engineered fill is to ensure the continuity and uniformity of the soil immediately beneath the footing. This can be done with greater certainty on compacted granular fill than on already existing clay fill. This design will require subexcavation to 2.0m and removal of all loose material; then backfilling with Granular 'A' fill. The engineered fill should be placed in 150mm thick lifts and each lift should be uniformly compacted at the optimum moisture content to at least 100% of its Standard Proctor Maximum Dry Density.

For footings on engineered fill, placed in accordance with the above requirements, the Factored Bearing Capacity at Ultimate Limit State is 750 kPa. The Bearing Capacity at Serviceability Limit States Type II (qs) is 300 kPa. Assuming a 6m X 12m footing and a 45 degree load distribution through the 2m Granular 'A' core, the bearing pressure on the existing fill will be less than 200 kPa at the Serviceability Limit States Type II (qs). The existing fill is capable of safely supporting this bearing pressure. The maximum total settlement should be limited to 25mm. The geometry of the outline of engineered fill is shown on Fig.13, included in this report.

The competence of the existing fill at an elevation of 146.0m - the proposed elevation of the bottom of the engineered fill - is estimated from boreholes 1, 102 and 103. It is our opinion that the number of boreholes is adequate to confirm the competence of the fill. No peat or soft layers were encountered below the founding elevation at these boreholes. However if localised soft fill material is encountered under the footings during excavation we recommend that it should be removed to its full extent and replaced with granular fill.

For the evaluation of the sliding resistance of footings on engineered fill consisting of granular 'A' the friction angle between the concrete and the granular 'A' should be taken as 35 degrees.

The natural soil at or below an elevation of 148.0m at the west abutment location is either a Glacial Till; heterogeneous mixture of sand, silt, trace to some clay, trace gravel at borehole 4; or silty clay, trace sand at borehole 101.

For footings on natural soils the Factored Bearing Capacity at Ultimate Limit State is 525 kPa. The Bearing Capacity at Serviceability Limit States Type II (qs) is 350 kPa.

For the evaluation of the sliding resistance of footings on the natural soils the cohesion between the footings and the silty clay should be taken as 85 kPa.

5.3 Backfill

Rigid walls of the bridge abutments should be designed to withstand the at-rest earth pressures which can be approximated using the following equivalent fluid pressures:

At Ultimate Limit State	10 kPa/m
At Serviceability Limit State, Type II	8.5 kPa/m

When using the above values, it is assumed that the slope of the backfill behind the retaining structure is approximately level.

As an alternative to the "equivalent fluid pressure method" the earth pressures can also be calculated using the analytical

approach, assuming that backfill to the abutments will consist of Granular 'A' or 'B' type aggregates.

In this case, backfill to the structures should consist of granular materials, in accordance with MTO Standard Special Provision No. 121, dated October, 1983. Earth pressures acting on the wall may be computed in accordance with Section 6.6.1.2.1 of the O.H.B.D.C. assuming a non-yielding foundation where the "at rest" condition applies. The physical properties to be assumed for the backfill are as follows:

Granular "A" - $\phi = 35^\circ$, $\gamma = 22.8 \text{ kN/m}^3$ $K_o = 0.43$

Granular "B" - $\phi = 30^\circ$, $\gamma = 21.2 \text{ kN/m}^3$ $K_o = 0.50$

Construction joints should be provided between those portions of structure which can yield and those which are rigidly restrained.

Care should be taken to avoid the development of large horizontal pressures when compacting the backfill behind the abutments. Vibratory compaction equipment, for use behind retaining structures, must be restricted in size as per current M.T.O. specifications.

5.4 Temporary C.N.R. Track Realignment

Prior to the start of construction of the bridge for the subway, the existing CNR tracks will have to be diverted onto a proposed embankment. The proposed realignment will be approximately 660m in length (330m on either side of the proposed Kipling Ave.) and approximately 50m, at the furthest point, south of the existing embankment. The top of the CNR rail at the

proposed embankment will be the same as the existing elevation, i.e. varying from 156.64m to 156.94m at north and south tracks respectively.

Based on the ground elevation of the boreholes carried out at the site, the height of the embankment over the existing ground surface at the borehole locations, will vary from 7.56m (B.H. 11 location) to 17.34m (B.H. 14 location). The natural surface material along the proposed alignment varies from soft alluvial deposits with some organics to peat/organic silt. The thickness of these deposits is estimated at 0.9m to 2.3m.

Minor settlement can be anticipated with the above depths of fill. It is our opinion that most of the settlement will take place within 6 to 8 weeks of completion of the construction of the embankment. The embankment should be left 8 weeks following construction before being put in use. Post construction settlement should be nominal.

In order to minimize the initial and post construction settlements, we recommend that the existing ground surface be proof rolled prior to the start of construction and any soft areas encountered during proof rolling should be subexcavated to firm ground. Localised excavation within the ditchline of the creek might also be required.

Shallow test pits along the proposed temporary realignment will also help to locate any areas where significant deposits of peat occur.

The fill for the proposed embankment may consist of inorganic materials and should be placed in accordance with MTO Standards.

We recommend that the side slopes of the embankment not be steeper than 2 horizontal to 1 vertical. MTO Standard details and procedures should be followed in material selection, placement of fill and when adjoining the new fill to the existing embankment fill.

The side slopes of the existing embankment are approximately 2 horizontal to 1 vertical and there are no signs of failure on the slope or at the base.

We assume that the proposed embankment will be constructed predominately of clayey soils. A slope stability analysis was carried out, assuming a shear strength of 75 kPa and zero friction angle for soils compacted to a minimum of 95% Standard Proctor Dry Density and a shear strength of 10 kPa and zero friction angle for clayey silt/peat deposits. The minimum factor of safety against failure is $F=2.0$.

All slopes should be protected against erosion by grassing.

6. EXCAVATION AND DEWATERING

Excavation of up to 10.6m will be necessary to place footings on engineered fill. Most of the excavation will be within the existing fill. Temporary slopes in the fill should be cut back at 45 degrees to comply with provision of the Ontario Construction Law.

The factor of safety against base failure of this temporary slope, using the average shear strength of 150 kPa and a zero friction angle, is $F>4$.

Excavation for the foundations on engineered fill will be to an elevation of approximately 146.0m which is 4.7m above the stabilized water table elevation of 141.3m. No special dewatering measures are necessary. There could, however, be some perched water conditions within the fill. The amount of perched water will be small and can easily be handled by pumping from local sumps.

7. CONSTRUCTION CONSIDERATIONS

The proposed temporary realignment embankment will abut the existing embankment. Shoring and/or any other special provisions to support the slopes during and after construction will not be needed.

The existing embankment will be cut after the proposed temporary alignment has been constructed and the tracks have been laid. The excavation will be carried out from north.

We recommend the following construction sequence:

1. Excavate to proposed road subgrade with side slopes of existing embankment of 45 degrees or less.
2. At location of west abutment footings, excavate to elevation of 148.0m or lower to provide for a minimum 1.2m frost cover. At the location of central pier and east abutment footing, subexcavate to elevation 146.0m. The width of the bottom of the excavation should be as shown on Figure 13.
3. Place granular 'A' to base of footing level, compacted according to current MTO standards.

4. Construct footings.
5. Place remainder of fill.

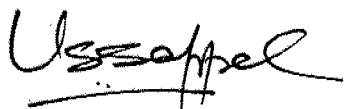
8. CLOSURE

The conclusions and recommendations given in this report are based on information determined at the borehole locations. The soil stratigraphy and groundwater conditions between and beyond the boreholes may differ from those encountered at the borehole locations and subsurface conditions may become apparent during construction which could not be detected or anticipated from the site investigation. Also, depending on seasonal factors, the groundwater table could be at a different level than at the time of the field work.

The recommendations given in this report are applicable only to the project described in the text and then only if constructed in accordance with the general principles stated in the report.

Yours very truly,

B.P. WALKER ASSOCIATES LTD.

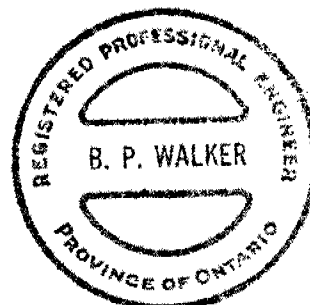


U.S. Sappal, P.Eng.



B.P. Walker, Ph.D., P.Eng.

/lb



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/0.3m)	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 (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	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

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	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_f	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

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



RECORD OF BOREHOLE No 1

METRIC

W P 88-78-26

LOCATION CO-ORDS N 4846791.6; E 297390.8

ORIGINATED BY T.O.

DIST 6 HWY KIPLING AVE

BOREHOLE TYPE TRIPOD - 75mm DRIVEN CASING

COMPILED BY U.S.S.

DATUM GEODETIC

DATE JANUARY 10, 1990

CHECKED BY J.S.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100						
151.6	GROUND SURFACE												GR 5A SI CL
0.0	FILL-silty clay with sand, trace of gravel, trace organic stained soil, stiff to very stiff grey/brown		1	SS	13	*							5 18 40 37
			2	SS	17								
			3	SS	17								
			4	SS	17								
			5	SS	21								
			6	SS	14								
			7	SS	29								2 24 37 37
			8	SS	78								
			9	SS	74								
			10	SS	46								
			11	SS	21								
			12	SS	24								
			13	SS	24								
			14	SS	23								
			15	SS	22								
142.0	Het. Mixture of sand and silt,		16	SS	46								
9.6	traces of gravel and clay, very		17	SS	97								
140.8	dense, brown		18	SS	57								
10.8	END OF BOREHOLE												
	*Dry on completion												

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 2

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846781.4; E 297393.6 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGERS AND CONE COMPILED BY U.S.S.
 DATUM GEODETIC DATE DECEMBER 27, 1989 CHECKED BY U.S.S.

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPa						
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)						
147.2	GROUND SURFACE													GR SA SI CL	
0	FILL-silty clay with sand, trace of gravel, trace organic stained soil, very stiff to stiff grey/brown		1	SS	16		146								
			2	SS	15		144								
			3	SS	20										
			4	SS	14										
			5	SS	17										
			6	SS	18										
139.0			7	SS	26		140								
8.2	Het. Mixture of sand and silt, some clay, trace gravel, (Glacial Till) compact		8	SS	24		138								
137.2															
10			SILTY SAND TO GRAVELLY SAND-traces of silt and clay, very dense	9	SS		56	136							
				10	SS		16	134							
	11	SS		90	132										
	12	SS		95											
131.0															
16.2	SANDY SILT-trace of gravel and clay, very dense		13	SS	70/10cm		130								
128.5															
18.7	END OF BOREHOLE		14	SS	100										
	Water level reading on January 17, 1990														

RECORD OF BOREHOLE No 3

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4 846770.0; E 297379.7 ORIGINATED BY T.O.
DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGER, 75mm CASING AND CONE COMPILED BY U.S.S.
DATUM GEODETIC DATE JANUARY 5, 10 and 11, 1990 CHECKED BY LSS

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
147.2	GROUND SURFACE															GR SA SI CL
141.8	15cm Topsoil FILL-silty clay with sand, trace of gravel, trace organic stained soil stiff to very stiff		1	SS	12	*	146									
			2	SS	37											
			3	SS	44											
			4	SS	23											
			5	SS	34											
5.4	Het. Mixture of sand and silt, traces of gravel and clay (Glacial Till) very dense		6	SS	80/	13cm										
138.7			7	SS	100/	15cm										
8.5	SILTY CLAY/CLAYEY SILT WITH SAND- hard		8	SS	60/	10cm										0 12 48 40
135.9			9	SS	106/	25cm										0 10 81 9
11.3	SILTY SAND TO GRAVELLY SAND-trace of silt and clay very dense		10	SS	76											
			11	SS	60											0 53 45 2
			12	SS	66											
130.2			13	SS	80/	13cm										59 30 (11)
17	Het. Mixture of sand, silt, clay, trace of gravel (Glacial Till) very dense		14	SS	80/	13cm										4 21 62 13
			15	SS	100/	10cm										
125.8			16	SS	100/	10cm										
21.4	END OF BOREHOLE *Water level not established															

RECORD OF BOREHOLE No 4

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846774.4; E 297365.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE TRIPOD - 75mm DRIVEN CASING COMPILED BY D.S.S.
 DATUM GEODETIC DATE January 11, 1990 CHECKED BY LS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
151.7	GROUND SURFACE																
0	FILL-silty clay with sand, trace of gravel, trace of organic stained soil	X	1	SS	5	*											
		X	2	SS	13												
149.6	soft to very stiff	X	3	SS	27												
149.1	Het. Mix. of sand and silt, traces of clay	X	4	SS	111												
148.1		X	5	SS	100/												
2.6	and gravel, very dense (Glacial Till) END OF BOREHOLE *Dry on completion					15cm											

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 5

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846762.2; E 297369.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGER COMPILED BY U.S.S.
 DATUM GEODETIC DATE DECEMBER 21, 1989 CHECKED BY USS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
147.3	GROUND SURFACE																GR SA SI CL
0	FILL-silty clay with sand, trace of gravel, soft		1	SS	8												
145.8			2	SS	90/	28cm	146										
1.5	Organic silt with sand and gravel, trace of clay		3	SS	60/	13cm											
	SILTY SAND-traces of gravel and clay very dense		4	SS	60/	15cm	144										
143.3																	
4	Het. Mixture of sand and silt, some clay, trace of gravel (Glacial Till) very dense		5	SS	60/	13cm	142										3 38 42 17
			6	SS	60/	10cm											
			7	SS	80/	15cm	140										
			8	SS	80/	15cm	138										
137.3																	
10	SILTY CLAY/CLAYEY SILT traces of sand and gravel, hard		9	SS	85/	15cm	136										
135.7																	
11.6	SILTY SAND TO GRAVELLY SAND-traces of clay very dense		10	SS	31		134										0 67 33 0
			11	SS	108/	25cm											
			12	SS	107/	25cm	132										
130.3																	
17	SANDY SILT WITH CLAY trace of gravel very dense		13	SS	80/	13cm	130										11 86 (3)
128.9			14	SS	80/	17cm											
18.4	END OF BOREHOLE																
	Water level on completion of BH at 6.7m																

OFFICE REPORT ON SOIL EXPLORATION



Ministry
of
Transportation
Ontario

RECORD OF BOREHOLE No 6

METRIC

W P 88-78-26

LOCATION CO-ORDS N 4846841.6; E 297375.0

ORIGINATED BY T.O.

DIST 6 HWY KIPLING AVE.

BOREHOLE TYPE SOLID AND HOLLOW STEM AUGER AND CONE

COMPILED BY U.S.S.

DATUM GEODETTIC

DATE December 27 and 28, 1989

CHECKED BY U.S.S.

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
140.7	GROUND SURFACE													GR SA SI CL
0	FILL-silty clay with sand, trace of gravel, boulders, soft		1	SS	16		140							
139.5			2	SS	7		138							
1.2	PEAT/ORGANIC SILT WITH SAND-some clay, trace of gravel, soft		3	SS	11		136							
138.4			4	SS	11									
2.3	SILTY CLAY WITH SAND-traces of gravel and organics (ALLUVIAL)		5	SS	15									
137.4			6	SS	90									
3.3			7	SS	82/	28cm								
	SILTY SAND TO SAND-trace to some gravel, trace of clay loose to very dense		8	SS	117									
132.2			9	SS	75/	15cm								
8.5	Het. Mixture of sand and silt, traces of gravel and clay (Glacial Till) very dense		10	SS	49									
129.4			11	SS	85/	15cm								
11.3	SAND TO GRAVELLY SAND-traces of silt and clay very dense		12	SS	112/	23cm								
			13	SS	87									
122.1			14	SS	100/	13cm								
18.6	END OF BOREHOLE													
	On completion water level at surface.													
	Bentonite plug installed between 1.2m to 2.0m													

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846833.0; E 297359.4 ORIGINATED BY T.O.
DIST 6 HWY KIPLING AVE. BOREHOLE TYPE HOLLOW STEM AUGER AND CONE COMPILED BY U.S.S.
DATUM GEODETIC DATE January 9 and 10, 1990 CHECKED BY USS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
140.7	GROUND SURFACE													GR SA SI CL
139.2	FILL-silty clay with sand, trace of gravel, boulders, soft		1	SS	8		140							
1.5	SAND TO GRAVELLY SAND-trace to some silt, trace of clay, loose to very dense		2	SS	7									
			3	SS	35		138							
			4	SS	120	28cm								
			5	SS	96		136							10 76 5 9
			6	SS	92		134							22 54 21 3
			7	SS	53		132							
			8	SS	79		130							
130.7	SILT TO SANDY SILT-traces of clay and gravel, very dense		9	SS	87	15cm	128							1 27 69 3
127.7	SILTY SAND-traces of gravel and clay, very dense		10	SS	91		126							
13			11	SS	83	15cm	124							
			12	SS	89	15cm								
121.6			13	SS	100	15cm								1 59 40 0
17.1	END OF BOREHOLE													
	*Water Level on January 23, 1990													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 8

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846826.2; E 297348.2 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE HOLLOW STEM AUGER: 75mm CASING AND CONE COMPILED BY U.S.S.
 DATUM GEODETIC DATE January 2, 4, 5 and 9, 1990 CHECKED BY L.S.E.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT (%)
140.2	GROUND SURFACE														GR SA SI CL		
0	FILL-boulders, sand and silt with clay, some gravel, loose		1	SS	10										7 61 24 8		
138.8	Het. Mixture of sand and silt, traces of gravel and clay, occasional sand seam		2	SS	87												
137.2	(Glacial Till) very dense		3	SS	53												
3	SILTY SAND TO GRAVELLY SAND-trace of clay very dense		4	SS	98												
			5	SS	77												
			6	SS	105												
			7	SS	80/13cm												
			8	SS	120										40 50 7 3		
			9	SS	103/25cm										0 51 46 3		
			10	SS	91												
			11	SS	89												
			12	SS	74/15cm												
			13	SS	148/25cm												
121.0			14	SS	86/15cm												
19.2	Het. Mix. of sand, gravel and silt, trace of clay changing to Het. Mix. of sand and silt, traces of gravel and clay (Glacial Till) very dense		15	SS	166/15cm										34 52 11 3		
			16	SS	110/15cm												
			17	SS	80/15cm										8 47 41 4		
			18	SS	114/15cm												
112.8			19	SS	100/1cm												
27.4	END OF BOREHOLE Water level reading on January 23, 1990 (Water frozen at ground surface)																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 9

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846735.0: E 297348.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE Solid stem auger COMPILED BY H.S.S.
 DATUM GEODETIC DATE DECEMBER 21, 1989 CHECKED BY G.S.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
145.3	GROUND SURFACE															GR SA SI CL
143.5	15cm Topsoil SILTY SAND, some clay very dense		1	SS	81	15cm										0 67 23 10
1.8	Het. Mix. of sand and silt, some clay, trace of gravel (GLACIAL TILL) very dense		2	SS	60/	23cm										
			3	SS	100/	23cm										
			4	SS	99/	23cm										
			5	SS	51/10cm	140										3 49 36 12
			6	SS	90/	15cm										
			7	SS	60/	8cm										
136.1			8	SS	60/	8cm										
9.2	END OF BOREHOLE															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 10

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846714.0; E 297303.0 ORIGINATED BY T.O.
 DIST 6 HWY RIPLING AVE. BOREHOLE TYPE Solid Stem augers and cone COMPILED BY H.S.S.
 DATUM GEODETIC DATE December 22, 1989 and January 12, 1990 CHECKED BY J.S.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
145.5	GROUND SURFACE													
0	20cm Topsoil		1	SS	13		144							
143.4	SILTY SAND WITH GRAVEL traces of clay and organics, (ALLUVIAL DEPOSIT)		2	SS	45									
141.5	SILTY CLAY with sand, trace gravel, hard		3	SS	38									
			4	SS	50									
141.5							142							0 15 65 20
4.0	Het. Mix. of sand and silt, traces of gravel and clay, (Glacial Till) very dense		5	SS	100/28cm									6 36 42 6
			6	SS	60/13cm									
			7	SS	80/10cm		138							
136.1			8	SS	60/8cm									
9.4	END OF BOREHOLE													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 11

METRIC

W P 88-78-26 LOCATION CO-ORDS N4846687.0; E 297239.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE Solid Stem Auger and cone COMPILED BY U.S.S.
 DATUM GRODZETIC DATE December 27, 1989 and January 12, 1990 CHECKED BY U.S.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		NATURAL MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W _p	W	W _L		
149.4	GROUND SURFACE													GR SA SI CL
148.4	FILL-silty clay, trace of sand & gravel, stiff		1	SS	20		148							0 18 49 33
147.1	CLAYEY SILT/PEAT WITH SAND- stiff		2	SS	20		146							0 12 68 20
142.7	SILTY CLAY WITH SAND- trace of gravel, thin silt partings, very stiff to hard		3	SS	21		144							
140.1			4	SS	21		142							
139.3			5	SS	36									
138.7			6	SS	39									
136.7	Het. Mix. of sand and silt with clay, trace of gravel, occ. wet sand layer (Glacial Till) very dense		7	SS	70/	13cm								
130.1			8	SS	79/	15cm								
129.3	END OF BOREHOLE													

RECORD OF BOREHOLE No 12

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846790.0; E 297440.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGER AND CONE COMPILED BY U.S.S.
 DATUM GEODETTIC DATE DECEMBER 27, 1989 CHECKED BY ES

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100						
142.0	GROUND SURFACE													GR SA SI CL
0	FILL-silty clay with sand, trace of gravel, very stiff		1	SS	19									
141.0			2	SS	12									
1.0	PEAT/ORGANIC SILT with sand, trace of gravel and clay		3	SS	11									
138.7			4	SS	13									
3.3	SILTY CLAY-traces of sand and gravel, very stiff		5	SS	5									
138.0			6	SS	11									
4.0	SILTY SAND with gravel, trace clay, loose to compact		7	SS	21									
135.0			8	SS	49									
7.0	Het. Mix of sand and silt, some clay, trace of gravel, (Glacial Till) compact to dense													
132.4														
9.6	END OF BOREHOLE													

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 13

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846819.0; E 297480.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGER AND CONE COMPILED BY U.S.S.
 DATUM GEODETIC DATE DECEMBER 29, 1990 CHECKED BY U.S.S.

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 x LAB VANE	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%)	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE							
140.0	GROUND SURFACE										
0	FILL-silty clay with sand, trace of gravel, very soft		1	SS	7						
138.2			2	SS	9						
1.8	SILTY SAND WITH GRAVEL trace of clay, occasional thin peat layer, (ALLUVIAL DEPOSIT) loose		3	SS	6						
136.3			4	SS	10						
3.7	SILTY SAND TO GRAVELLY SAND, trace of clay compact to very dense		5	SS	56						
			6	SS	17						
			7	SS	15						
130.4			8	SS	29						
9.6	END OF BOREHOLE										

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 14

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4846854.0; E 297540.0 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE SOLID STEM AUGER AND CONE COMPILED BY U.S.S.
 DATUM GEODETIC DATE December 29, 1989 and January 12, 1990 CHECKED BY U.S.S.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
139.6	GROUND SURFACE															
0	FILL-silty clay with sand, trace of gravel, soft		1	SS	7											
138.1			2	SS	6											
137.6	TOPSOIL		3	SS	29											
2.0	SANDY SILT TO SILT- Het. Mix. of sand and silt with clay, trace of gravel (Glacial Till) very dense		4	SS	84/	15cm										
			5	SS	86/	15cm										
			6	SS	87/	15cm										
			7	SS	90/	15cm										
131.1			8	SS	112											
8.5	SILTY CLAY, trace of sand, hard															
130.0																
9.6	END OF BOREHOLE															

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 101

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4 846 803.4; E 297 353.6

ORIGINATED BY T.O.

DIST 6 HWY KIPLING AVE. BOREHOLE TYPE TRIPOD CONTINUOUS SAMPLES

COMPILED BY U.S.S.

DATUM **GEODETIC** DATE **MAY 14, 1990**

CHECKED BY _____

[illegible]

OFFICE REPORT ON SOIL EXPLORATION

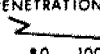

+3, x⁵ : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 102

METRIC

W P 88-78-26 LOCATION CO-ORDS N 4 846 811.4; E 297366.5 ORIGINATED BY T.O.
 DIST 6 HWY KIPLING AVE. BOREHOLE TYPE TRIPOD CONTINUOUS SAMPLES COMPILED BY U.S.S.
 DATUM GEODETTIC DATE MAY 22, 1990 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p W W _L					
151.5	GROUND SURFACE							20	40	60	80	100						
0.0	FILL-SILTY CLAY/CLAYEY SILT with sand, trace of gravel, trace organic stained soil, occasional gravelly sand layers, soft to hard		1	SS	4	150												
			2	SS	9													
			3	SS	13													
			4	SS	20													
			5	SS	10													
			6	SS	90	148												
			7	SS	77													
			8	SS	30													
			9	SS	32	146												
			10	SS	46													
145.3	Piece of Wood		11	SS	100/ 3m												19.4	7 17 44 32
6.2	END OF BOREHOLE																	

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 103

METRIC

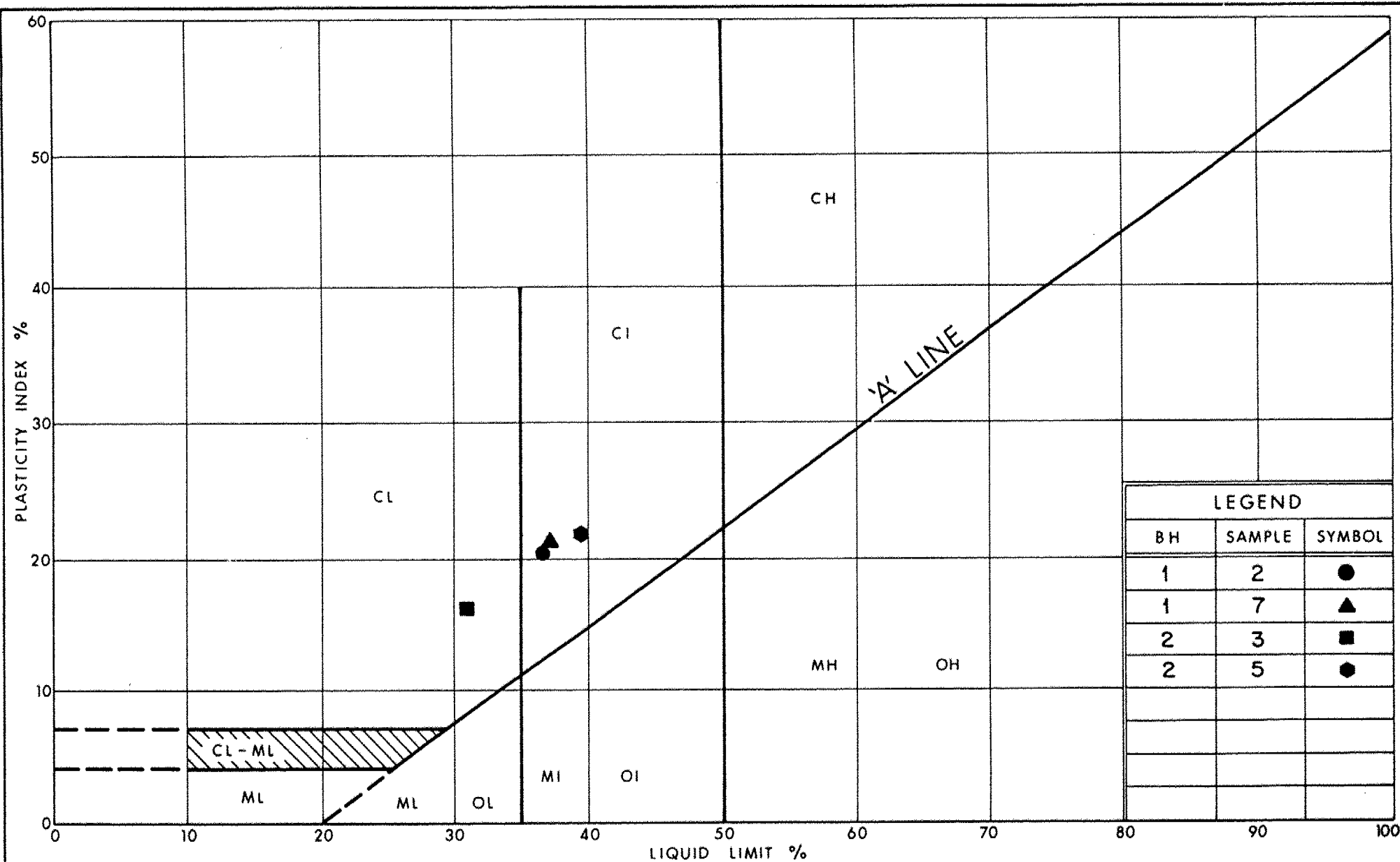
W P 88-78-26 LOCATION CO-ORDS N 4 846 822.5; E 297383.0 ORIGINATED BY T.O.
DIST 6 HWY KIPLING AVE. BOREHOLE TYPE TRIPOD, CONTINUOUS SAMPLES COMPILED BY U.S.B.
DATUM GEODETIC DATE May 15, 1990 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)
								O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
								20 40 60 80 100							
151.6	GROUND SURFACE													GR SA SI CL	
0.0	FILL-SILTY CLAY/CLAYEY SILT with sand, trace gravel, trace organic stained soil, stiff to hard		1	SS	8										
			2	SS	6										
			3	SS	10										
			4	SS	13										
			5	SS	11										
			6	SS	28										
			7	SS	31										
			8	SS	26										
			9	SS	57										
			10	TW	*										
			11	SS	25										
			12	SS	28										
			13	SS	34										
143.1			14	SS	22										
8.5	HET Mixture of sand & silt, trace of gravel & clay, very dense, brown (Glacial Till)		15	SS	82										
			16	SS	136										
141.4			17	SS	64										
10.2	END OF BOREHOLE														
	<u>Note:</u> SS9-High N-value is probably due to cave. SS sampler full of cave material. * Thin wall Shelby tube driven into soil using 623N drop hammer.														

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION



Ontario

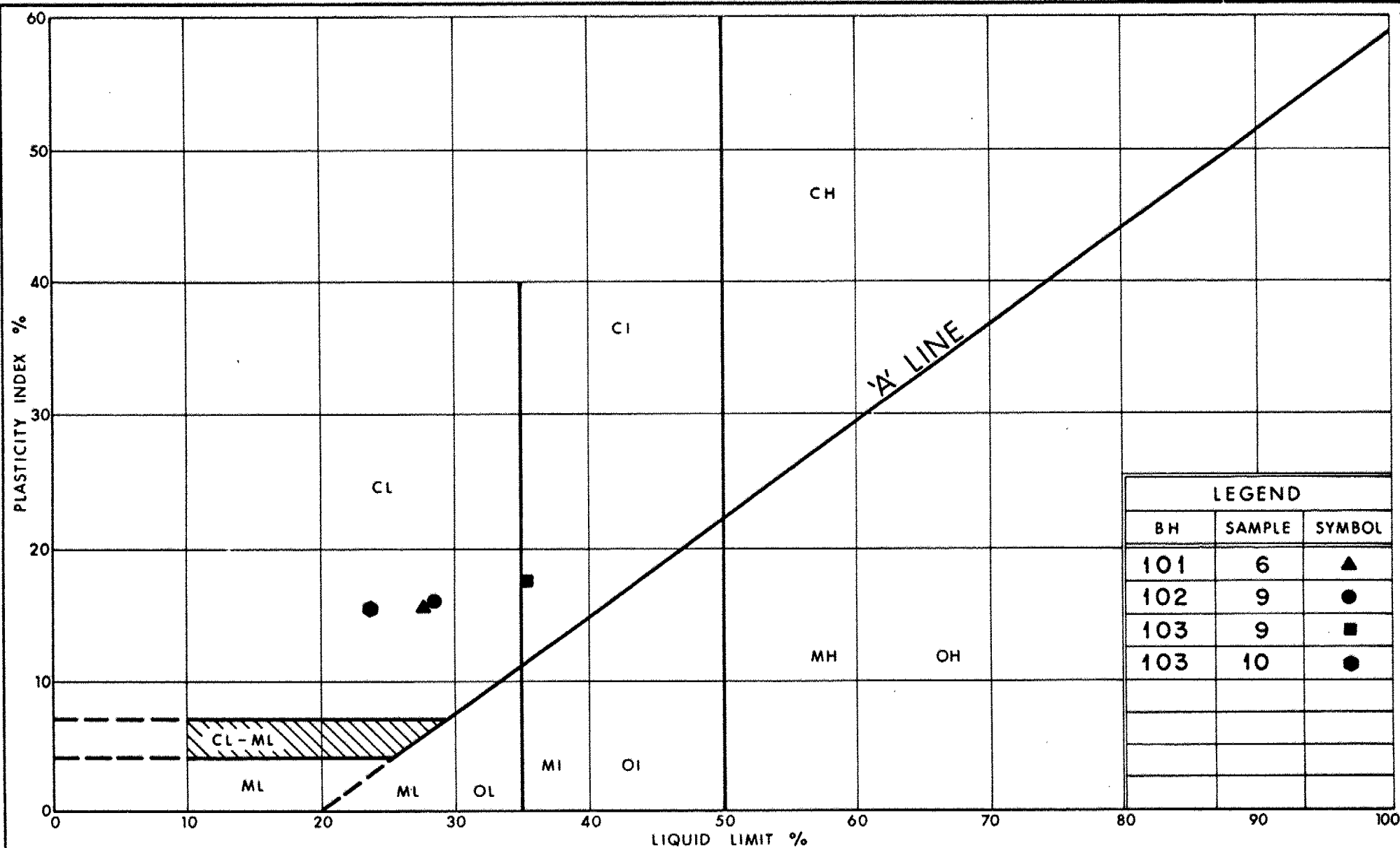
Ministry of
Transportation

PLASTICITY CHART

SILTY CLAY (FILL)
WITH SAND TRACE GRAVEL

FIG No 1

W P 88-78-26



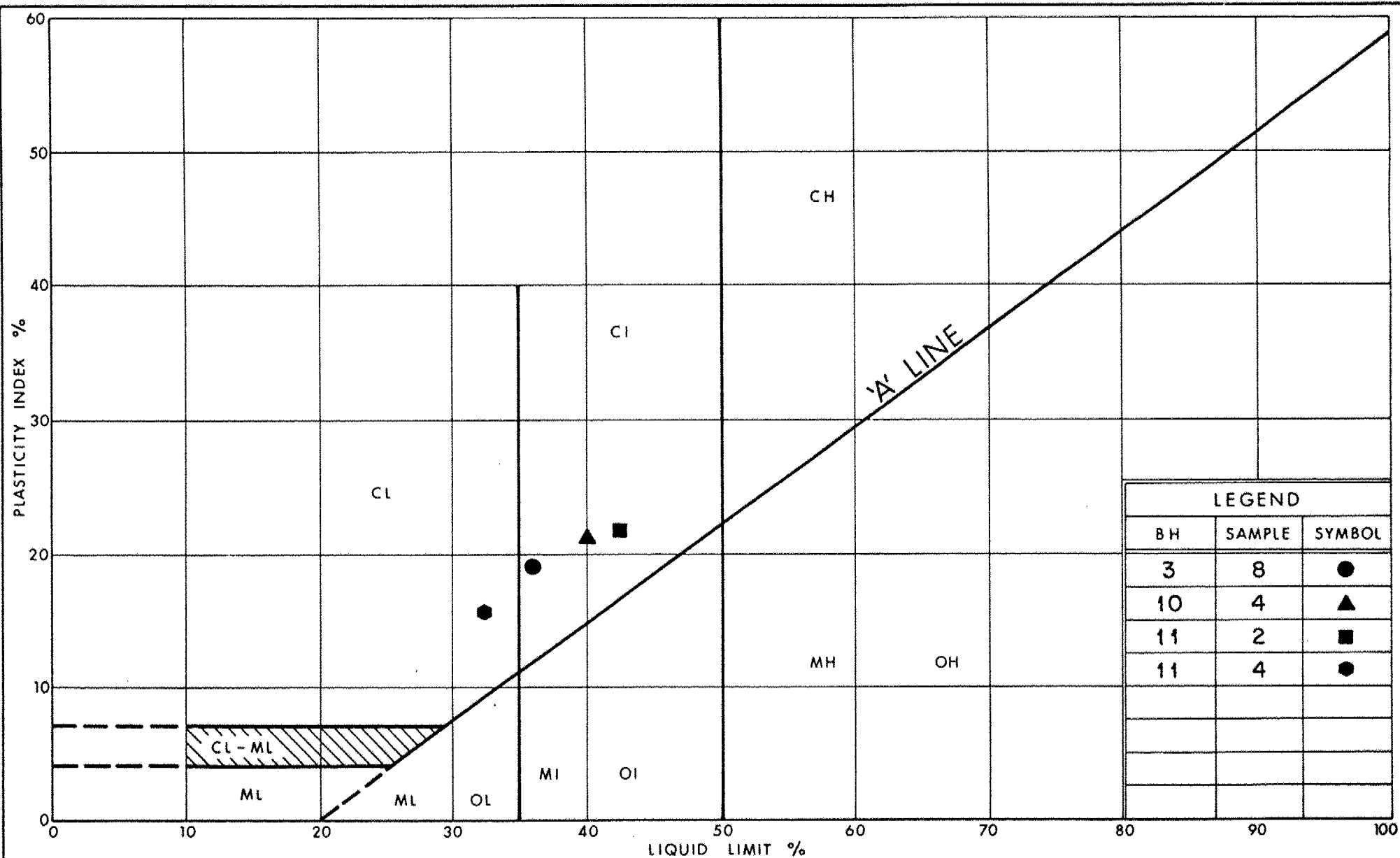
Ministry of
Transportation

Ontario

PLASTICITY CHART SILTY CLAY WITH SAND, TRACE GRAVEL (FILL)

FIG No 1A

W P 88-78-26



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Transportation

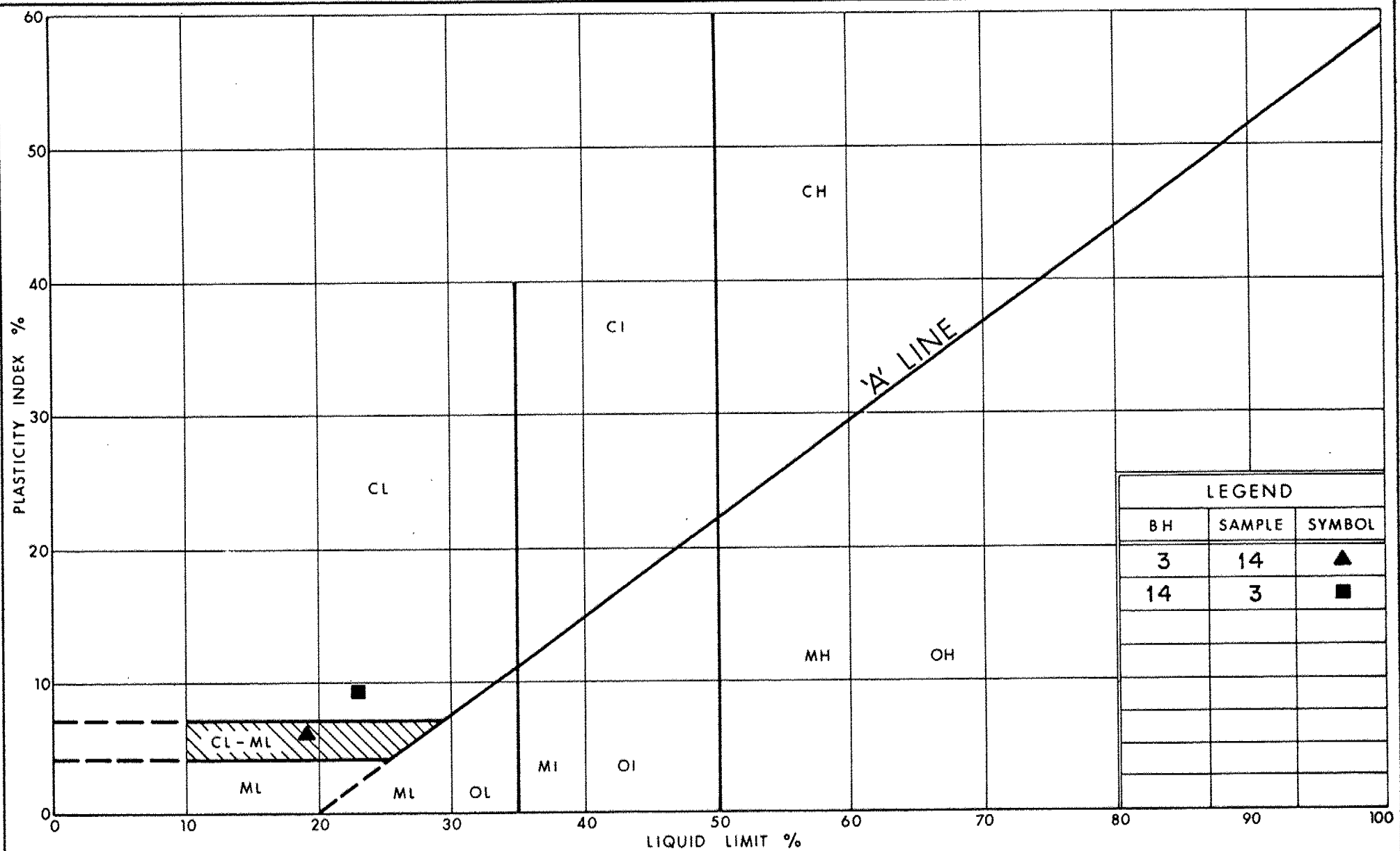
Ontario

PLASTICITY CHART

SILTY CLAY, TRACE SAND

FIG No 2

W P 88-78-26



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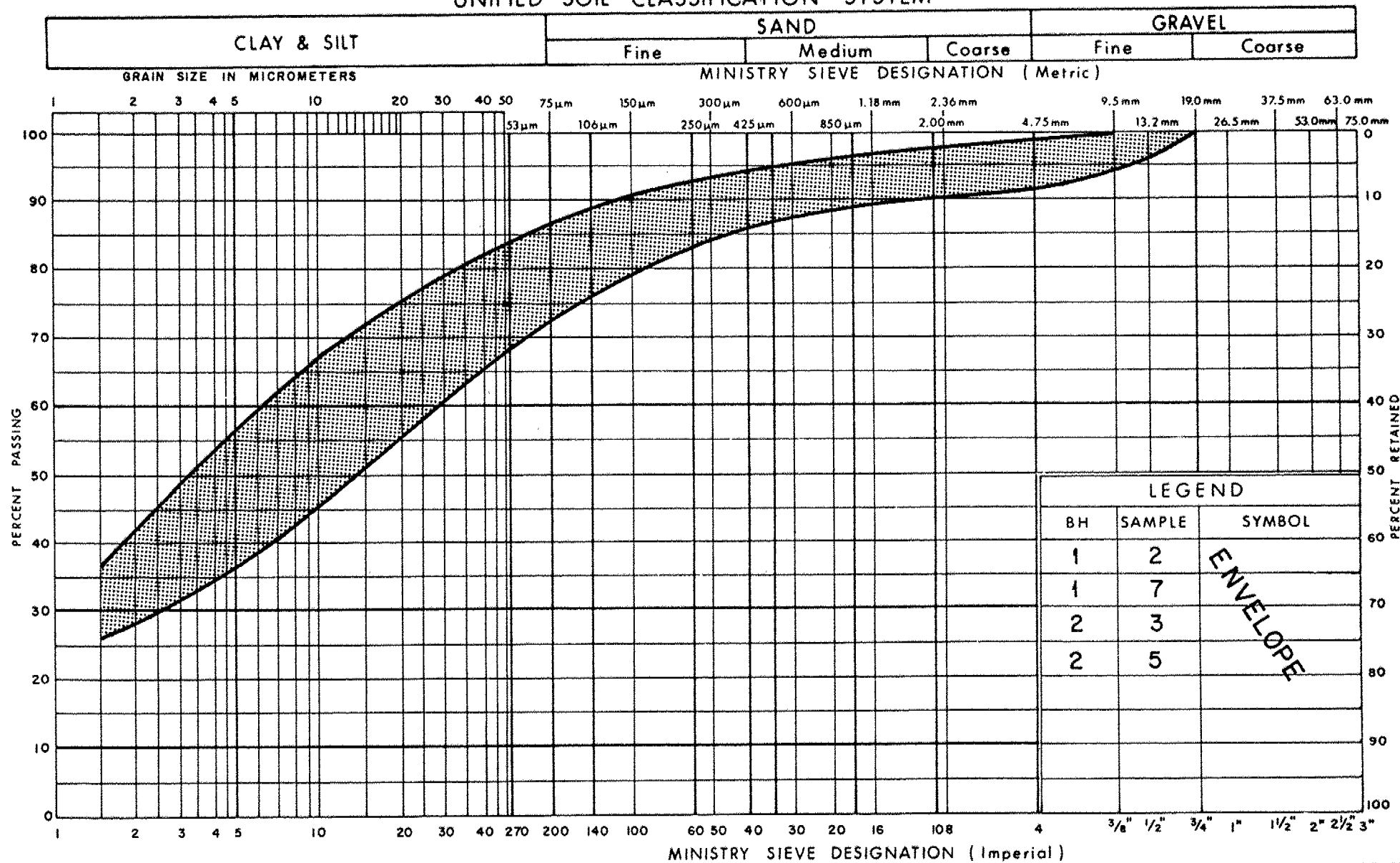
Ontario

PLASTICITY CHART
HET MIXTURE OF
SAND, SILT, CLAY TRACE GRAVEL (Glacial Till)

FIG No 3

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

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Transportation

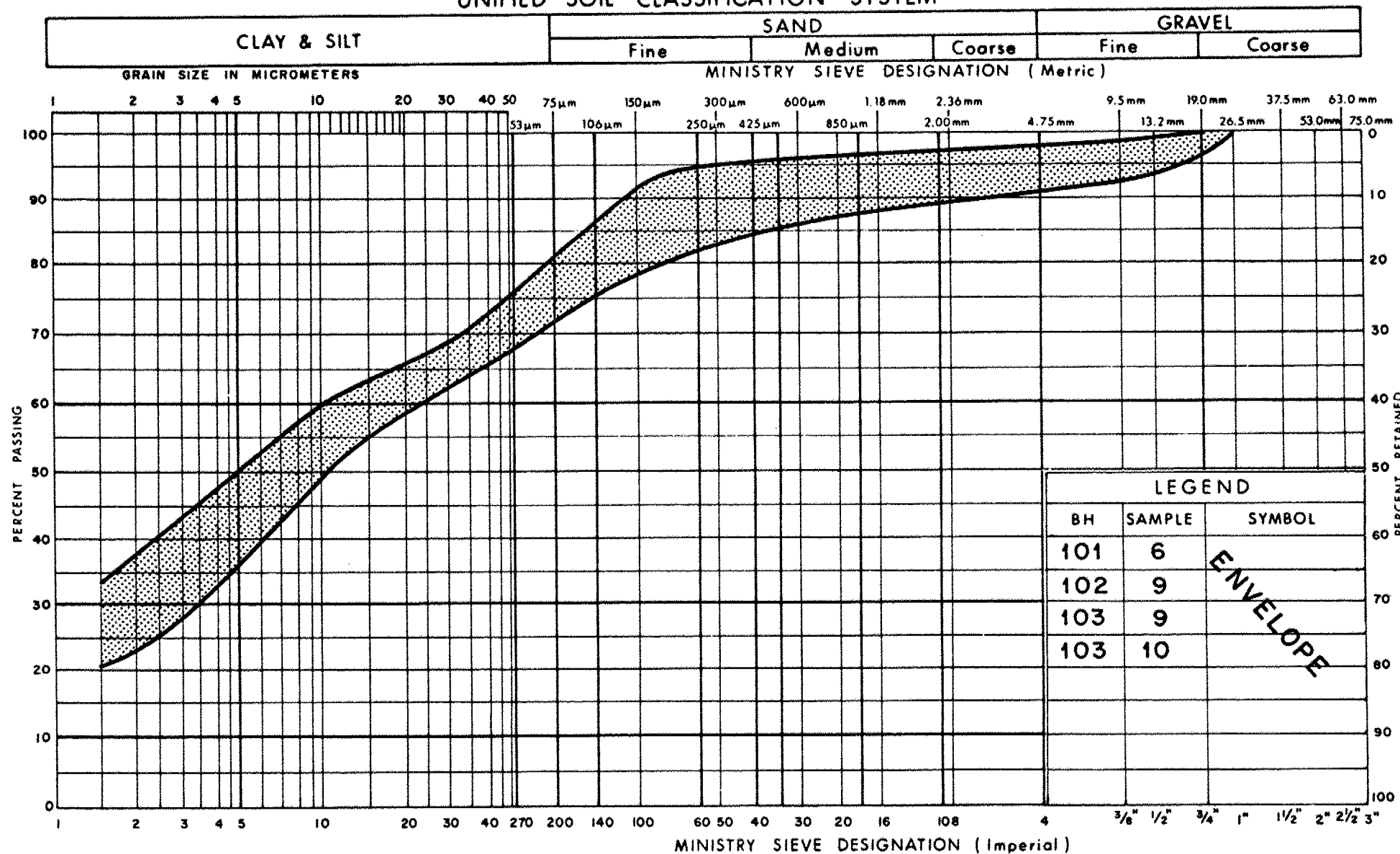
GRAIN SIZE DISTRIBUTION

SILTY CLAY WITH SAND, TRACE GRAVEL
(FILL)

FIG No 4

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



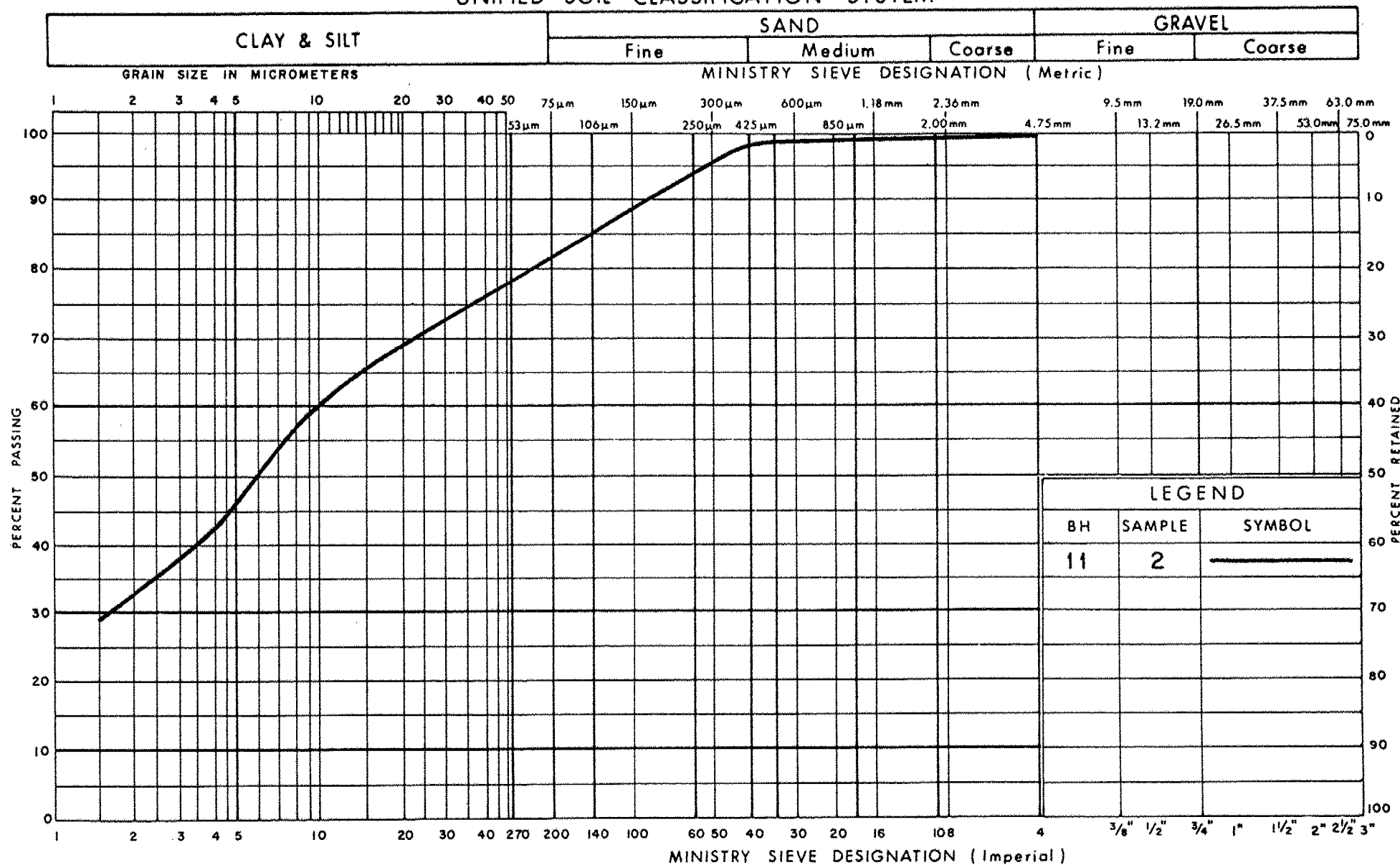
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY CLAY WITH SAND, TRACE GRAVEL
(FILL)

FIG No 4A

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



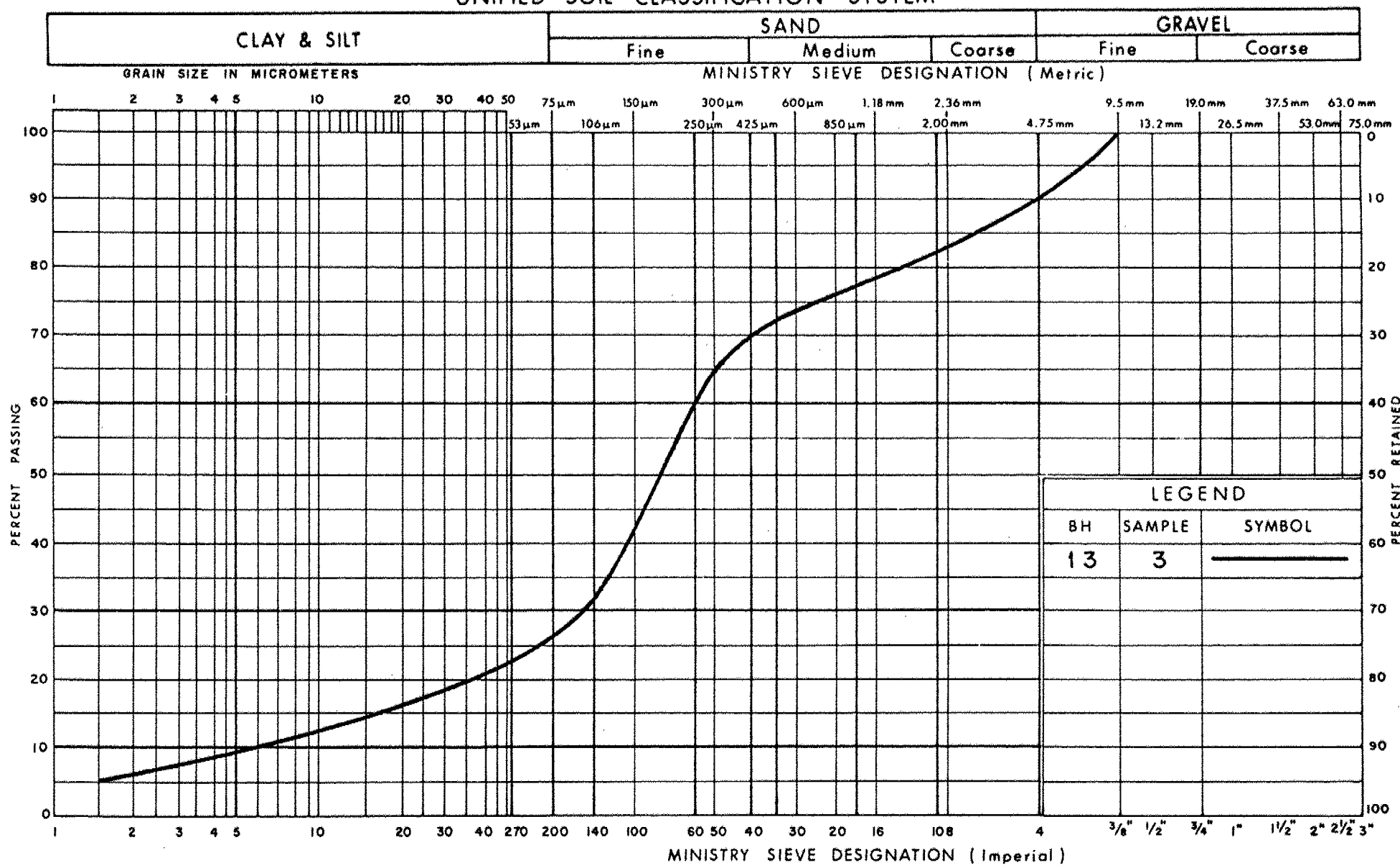
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
CLAYEY SILT / PEAT

FIG No 5

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



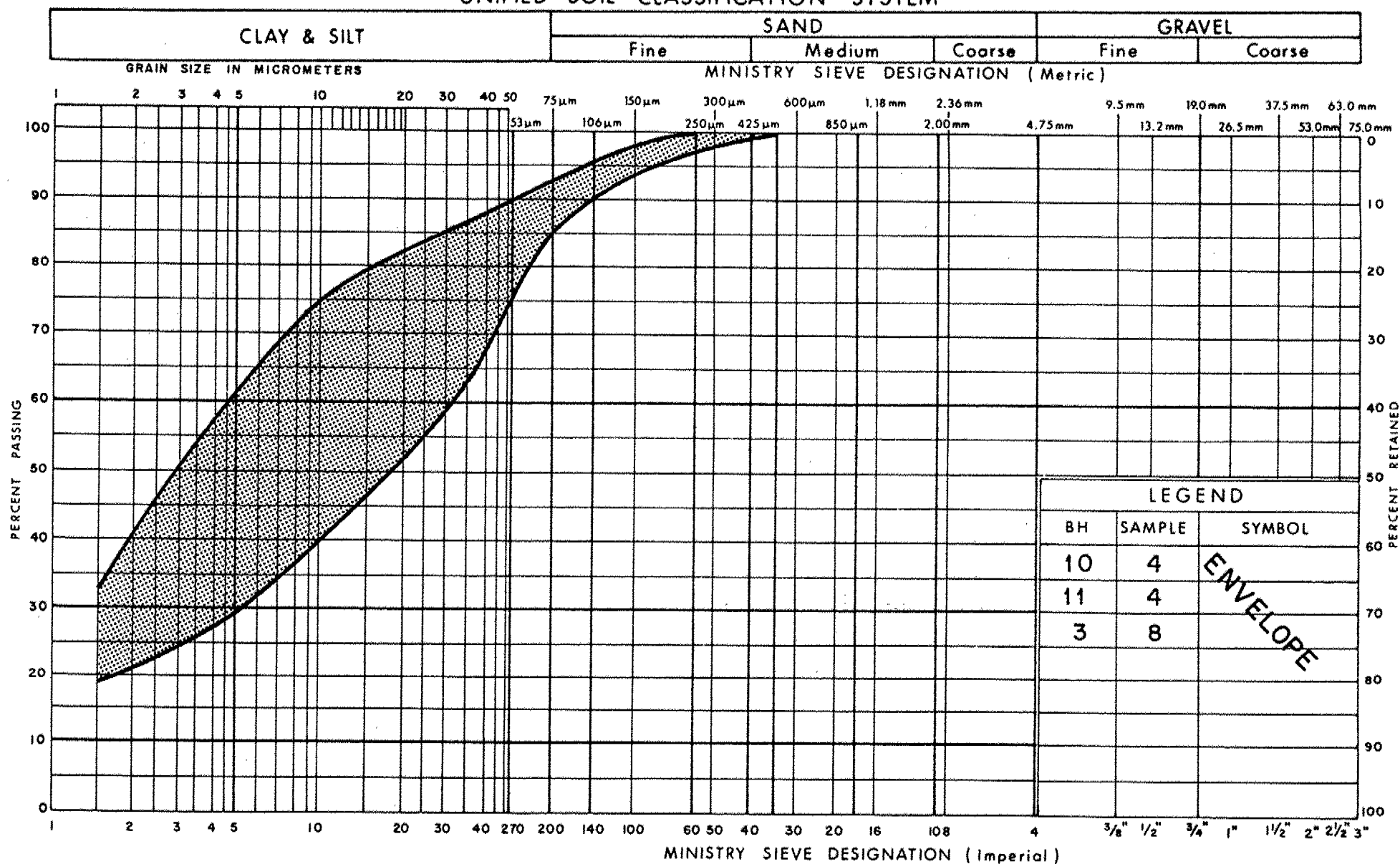
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY SAND WITH GRAVEL, TRACE CLAY
(ALUVIAL DEPOSIT)

FIG No 6

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



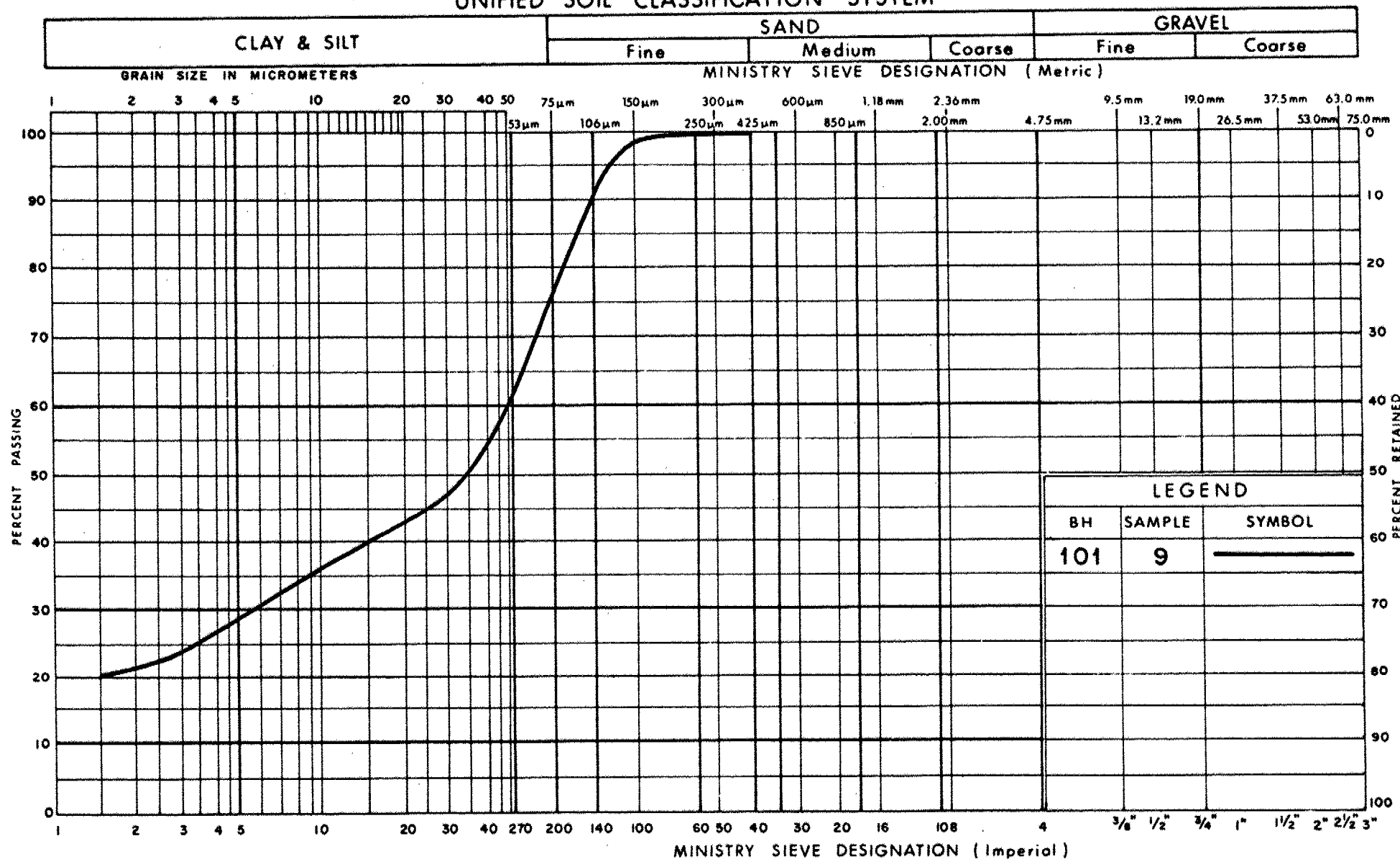
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SILTY CLAY TRACE SAND

FIG No 7

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

Ministry of
Transportation

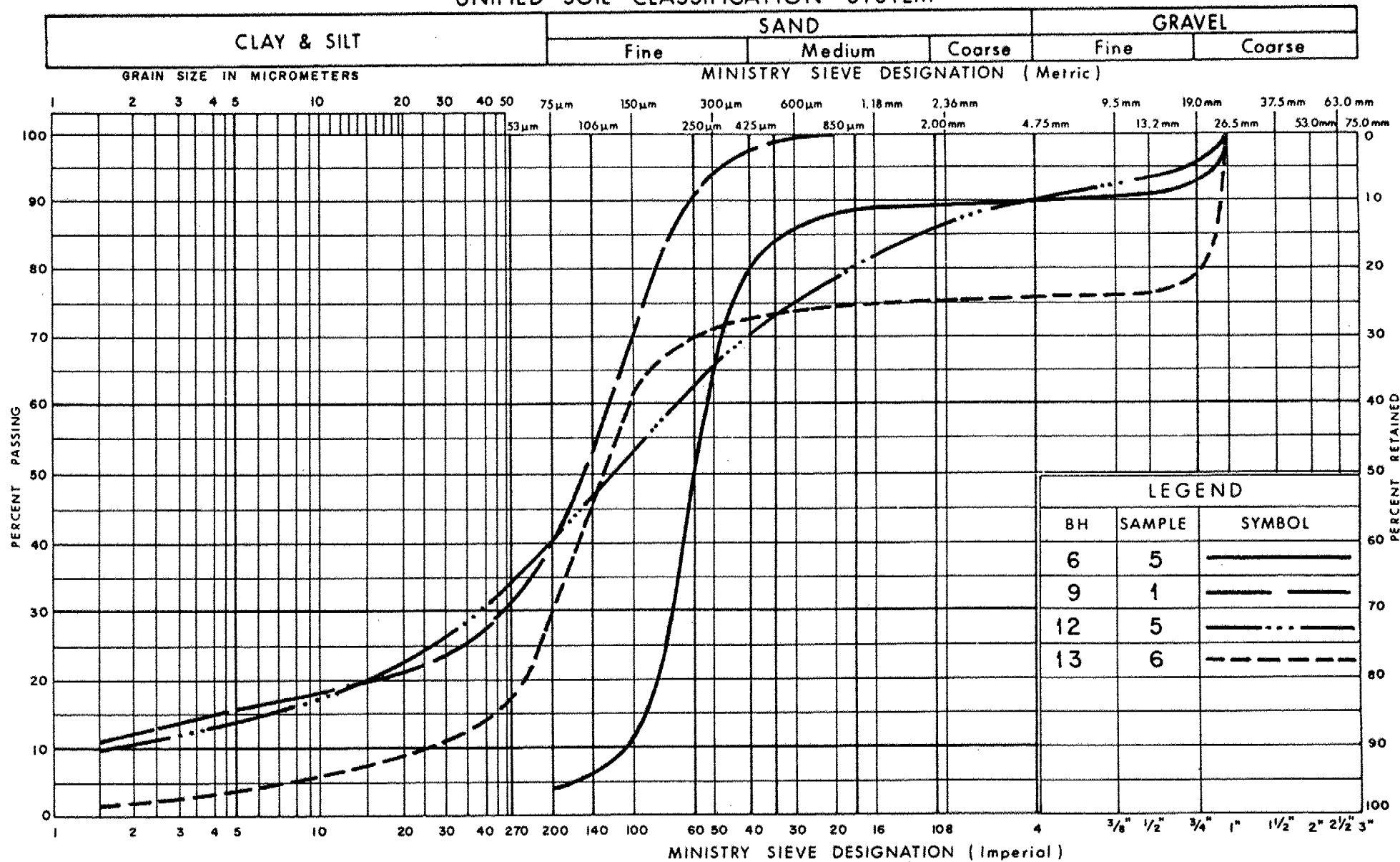
GRAIN SIZE DISTRIBUTION

SILTY CLAY, TRACE SAND

FIG No 7A

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



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Transportation

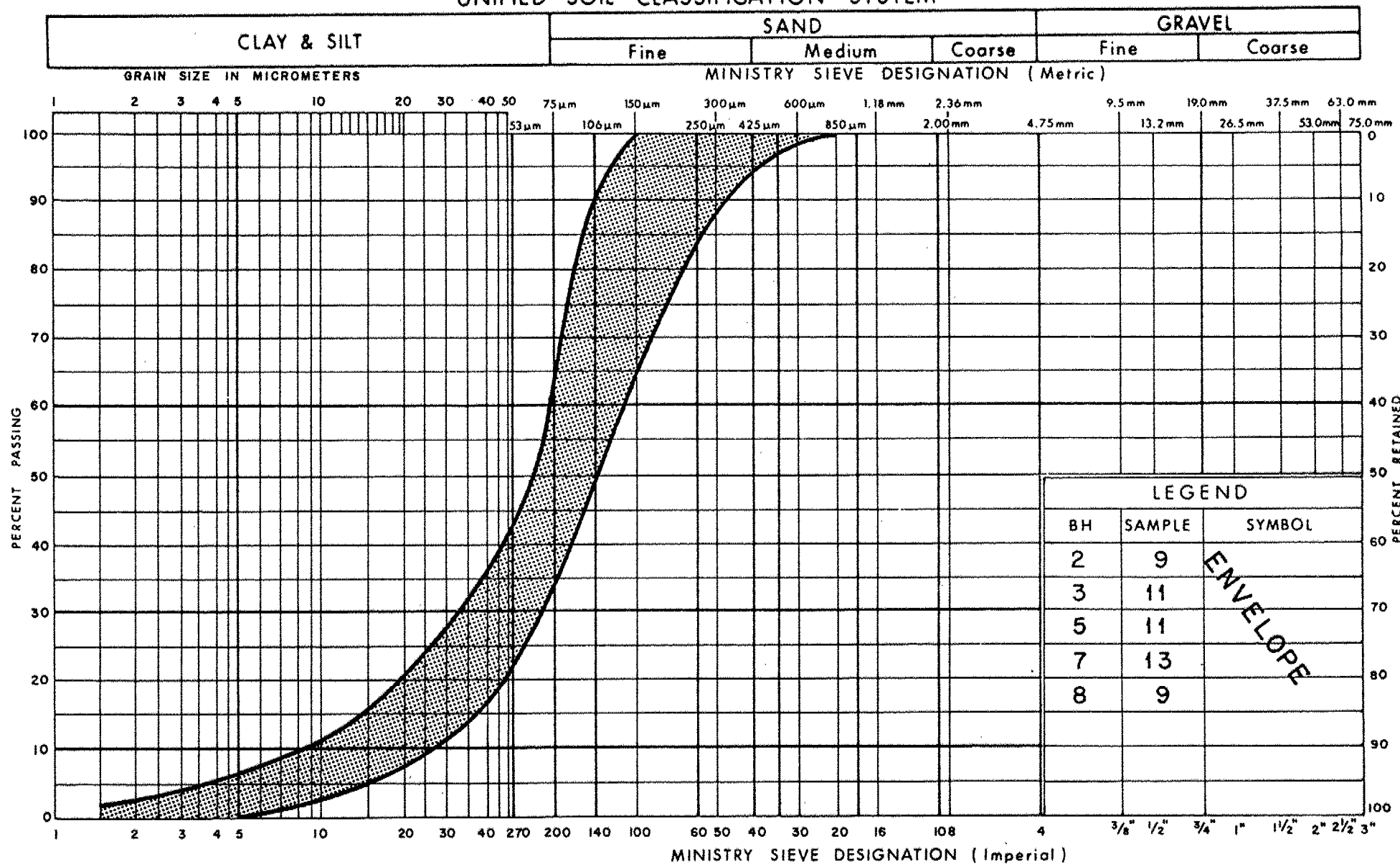
GRAIN SIZE DISTRIBUTION

SILTY SAND TO GRAVELLY SAND, TRACE CLAY

FIG No 8

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SILTY SAND, TRACE CLAY

FIG No 9

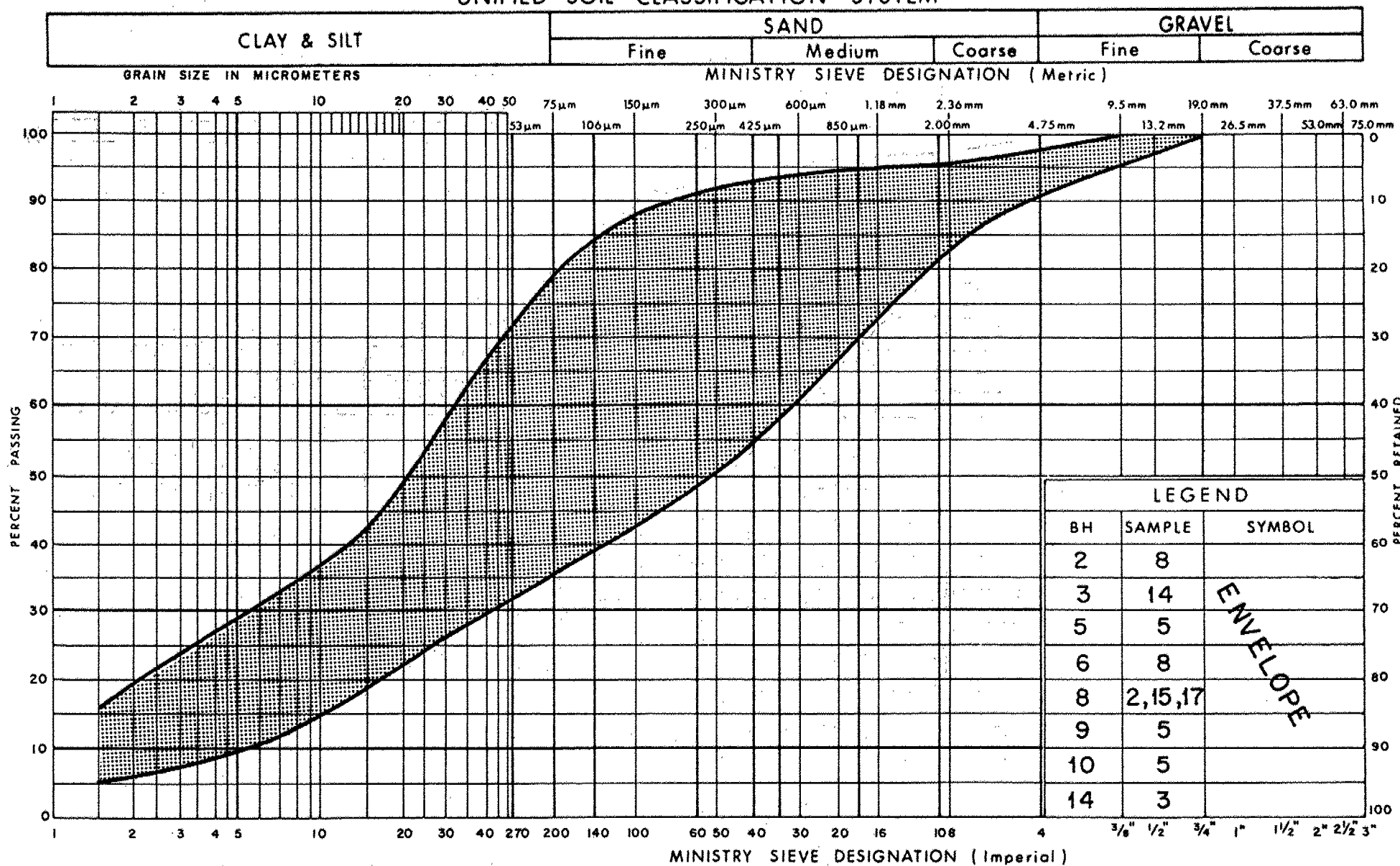
W P 88-78-26



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Transportation

UNIFIED SOIL CLASSIFICATION SYSTEM



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Transportation

GRAIN SIZE DISTRIBUTION

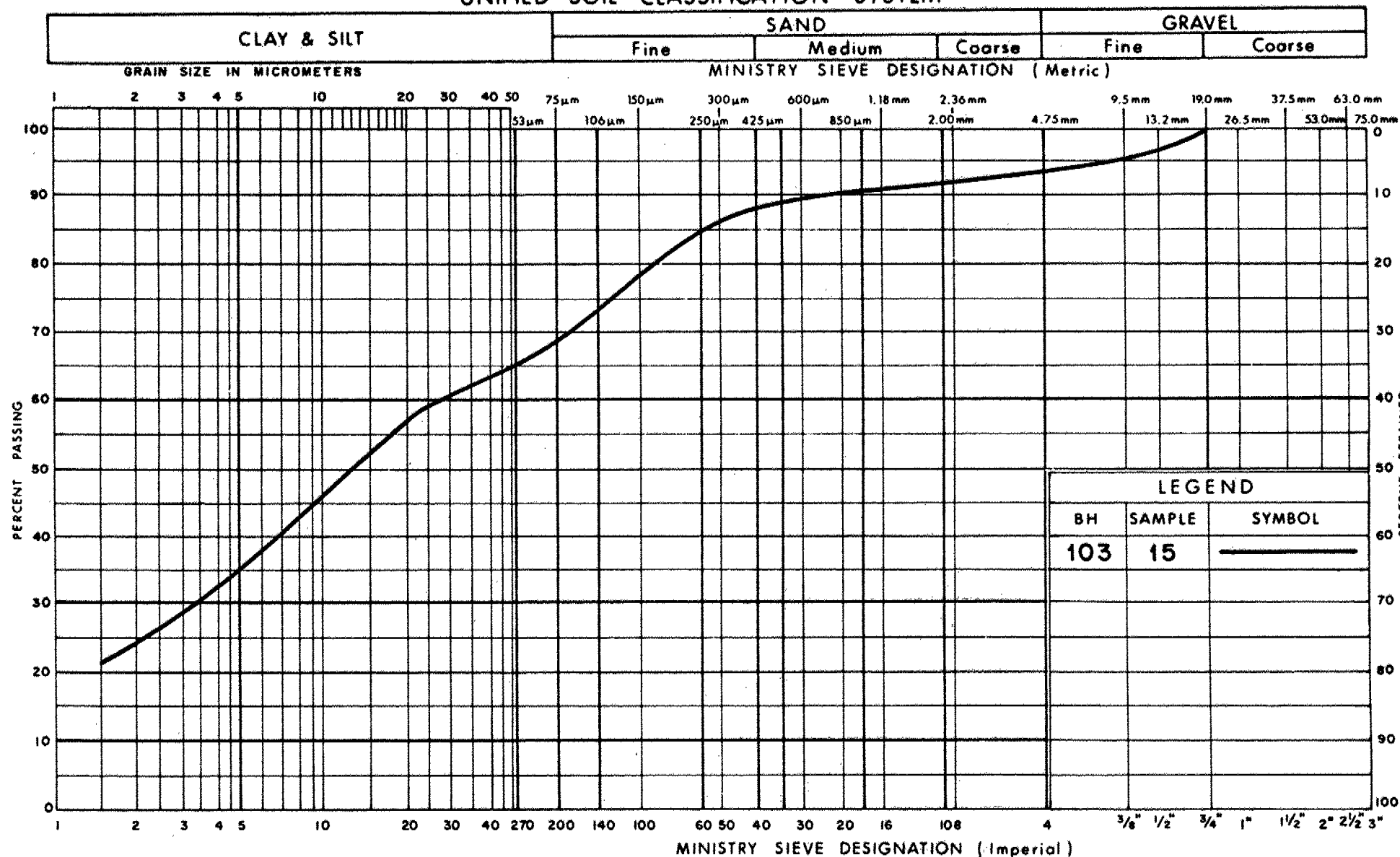
HET MIXTURE OF

SAND & SILT, TRACE/SOME CLAY TRACE GRAVEL (Glacial Till)

FIG No 10

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

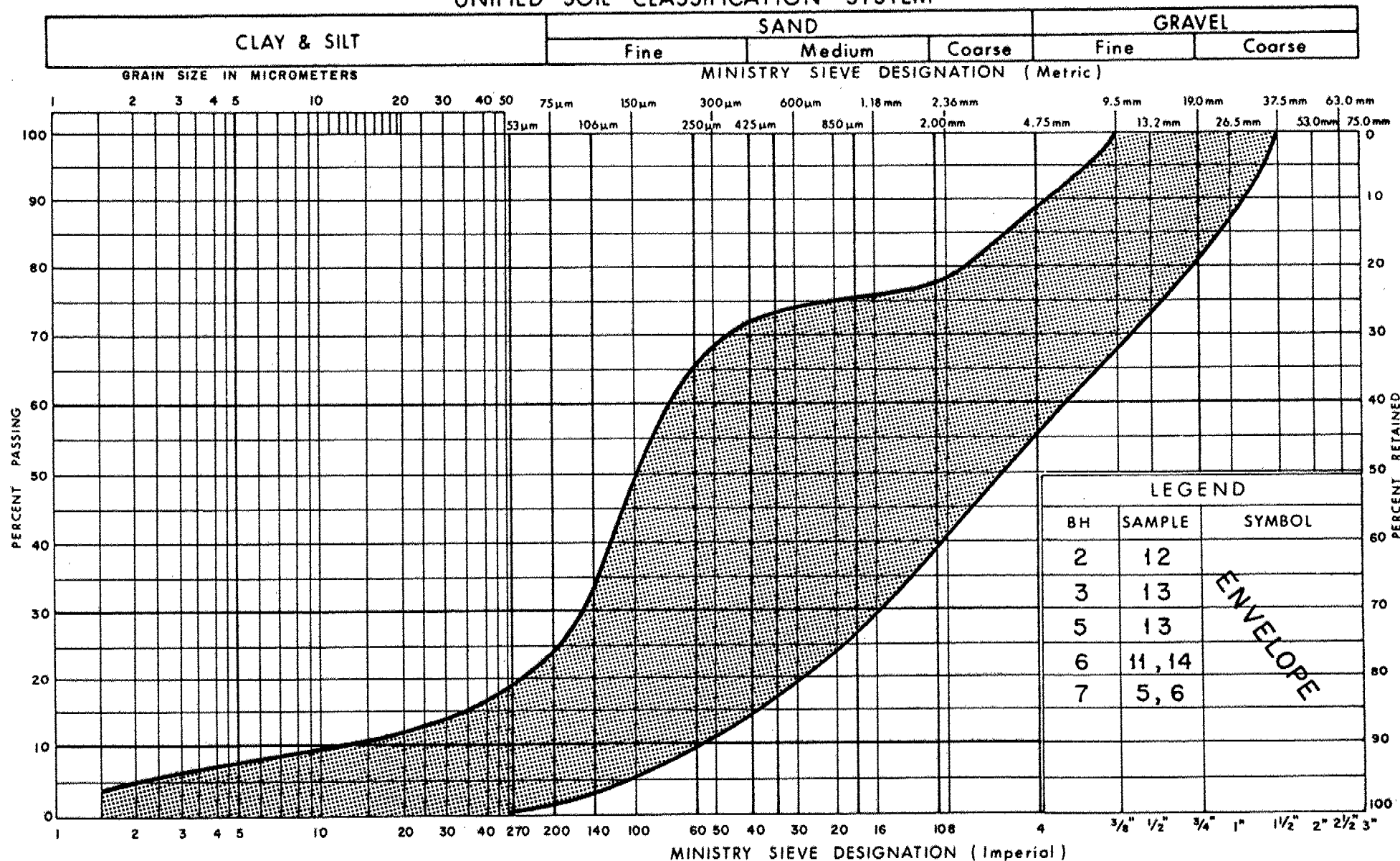
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
HET MIXTURE OF
SAND & SILT, SOME CLAY TRACE GRAVEL (Glacial Till)

FIG No 10A

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



Ontario

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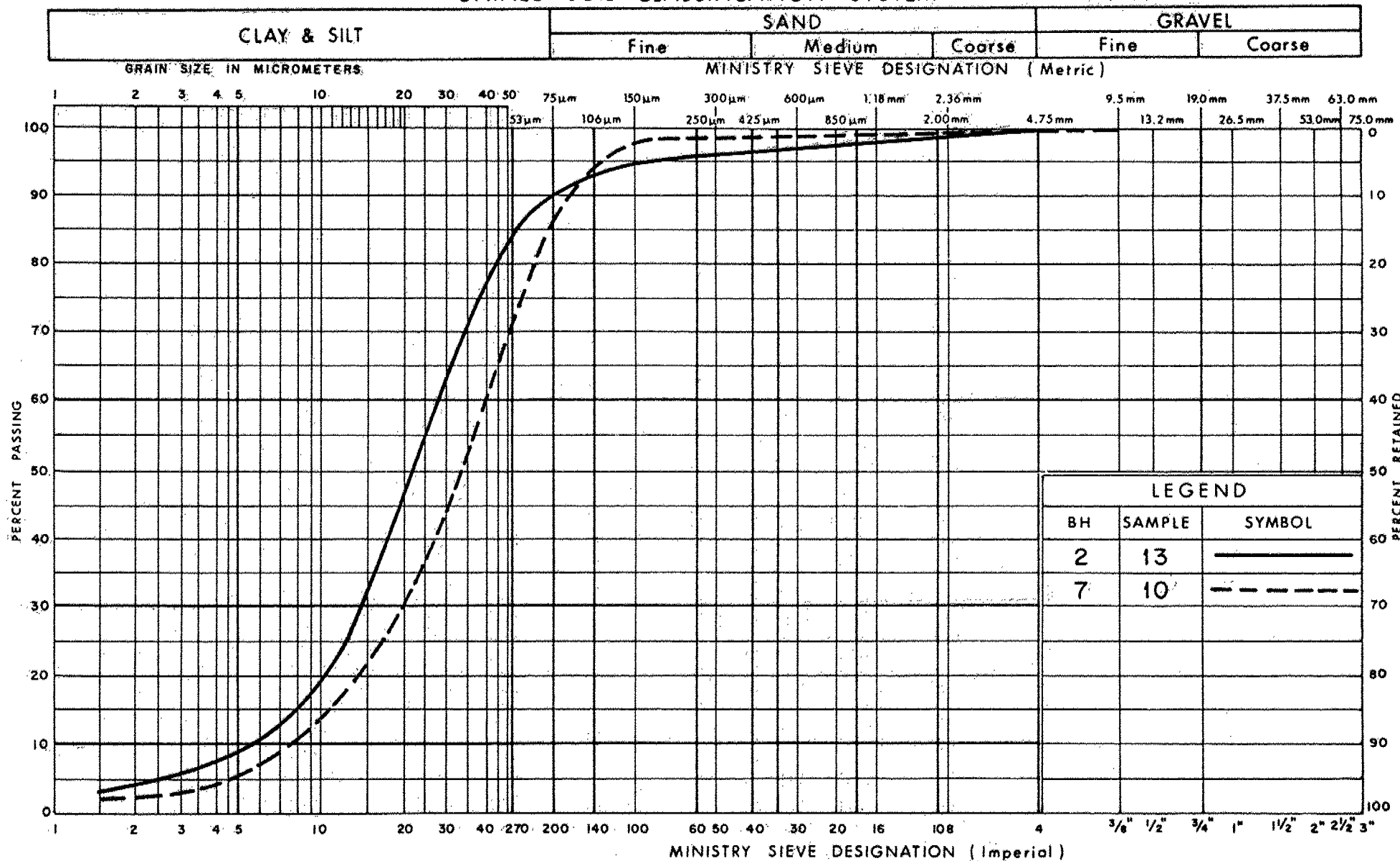
GRAIN SIZE DISTRIBUTION

GRAVELLY SAND
TRACE SILT, TRACE CLAY

FIG No 11

W P 88-78-26

UNIFIED SOIL CLASSIFICATION SYSTEM



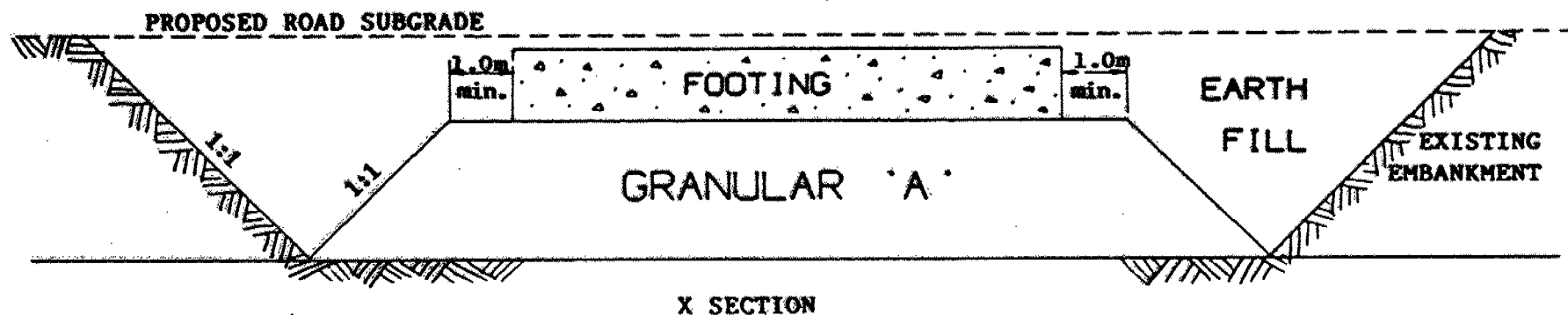
GRAIN SIZE DISTRIBUTION

SILT TO SANDY SILT TRACE CLAY

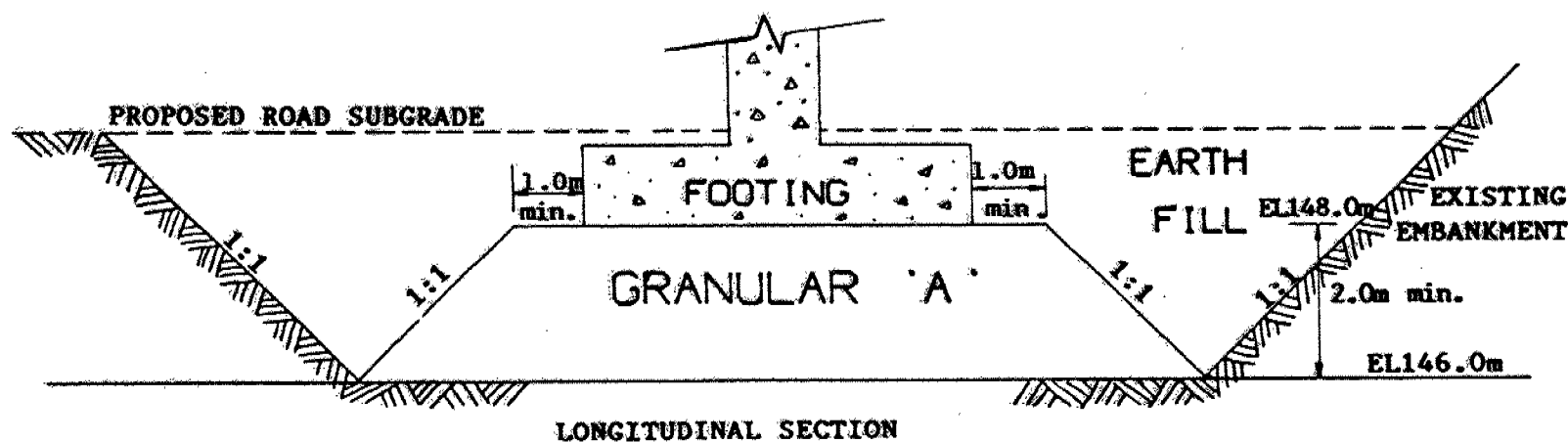
FIG No 12

W P 88-78-26

Ministry of
Transportation



NOT TO SCALE



NOTES:

- 1- Excavate to proposed road subgrade with side slope of existing embankment at 45° or less
- 2- Excavate to elevation of 146.0m and remove soft subsoil under area of compacted granular 'A' & earth fill.
- 3- Place granular 'A' & earth fill to base of footing level, compact according to current M.T.O. standards.
- 4- Construct footings.
- 5- Place remainder of fill.

**FOOTINGS ON COMPACTED FILL
SHOWING GRANULAR 'A' CORE**

**FIG No. 13
WP 88-78-26**

OVERSIZE DRAWING

memorandum

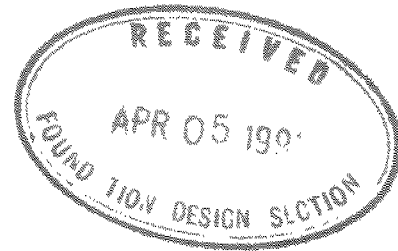


Tel: (416) 235-5652

To: Dave Dundas
Sr. Foundation Engineer
Foundation Design Section
Room 315, Central Building


Date: 92 03 26

Re: CNR Subway at Kipling Ave.
W.P. 88-78-26, Site 37-1339
Hwy 407, District 6, Toronto



With reference to your memorandum dated 1991 03 19: 90?

1. The Preliminary General Arrangement drawing was distributed for review in February 1991. I have no record of any comments received from your office. A revised foundation investigation report was received from you dated 90 07 23. I also have a note that revised abutment and wing wall details were discussed with Foundation Section. No formal memorandum was issued.
2. Rest of the comments deal with the work handled by Planning and Design. I have passed your comments to them through Ms. Markovic.


B. Farago
Design Engineer

BF/sl

c.c. L. Markovic

memorandum



To: B. Farago
Design Engineer
Design Section
Structural Office
4th Floor, Atrium Tower

From: Foundation Design Section
Room 315, Central Bldg.

Re: Final Design Review
CNR Subway at Kipling Avenue
W.P. 88-78-26, Site 37-1339
Hwy. 407, District 6, Toronto

Date: 1991 03 19

Further to your memo of Dec. 10/90, we have reviewed the final design documents for this project. Our comments are as follows:

- 1) We have no record of any preliminary design review. Please advise us on the status of the preliminary review.
- 2) Regarding dewatering, since excavations are expected to be above the prevailing groundwater elevation, routine sump pumping will be capable of removing any surface run-off that may enter excavations. It is noted that no dewatering SP has been included in the contract.
- 3) Regarding structure foundations, the Foundation Report recommends that any soft areas under the bearing surfaces of footings should be replaced with compacted granular "A". The bearing surfaces could be evaluated by proof rolling.
- 4) No details of the detour have been provided. Reference is made to pages 15 to 17 in the Foundation Report for recommendations pertaining to the detour.

To Summarize:

- The embankment should be 2H:IV or flatter.
- Slopes should be protected against erosion.
- The alignment of the detour should be selected to eliminate the need for any shoring. That is, it should be sufficiently offset to the south so as not to encroach upon the construction area.
- The ground surface under the plan limits of the detour embankment should be replaced with suitable compacted fill. Localized zones of peat may be encountered and will have to be removed.
- The embankment should be pre-loaded a minimum of 8 weeks prior to being put in use.

- 5) No details of temporary excavations are provided. The Foundation Report requires that excavations up to 4.5 m may be 1H:IV or flatter, excavations up to 8 m may be 1.5H:IV or flatter and excavations deeper than 8 m should incorporate a 1 m bench so that no uninterrupted slope is deeper than 8 m.

If there are any questions, please call.

for *BBennett*
D. Dundas, P. Eng.
Sr. Foundation Engineer

for

M. Devata, P. Eng.
Chief Foundation Engineer

MD/DD/jb

Memo

To: File

Oct 5/50

Re: WP 88-78-26
CWR Kipling

Bruce Phelps of Fema calls:

① He asked if pore water pressure should be used for design of earth pressure. I told him to use pore meters.

② He asked if K_0 should be used for retaining walls rigidly attached to K_0 abutments. I told him yes.

D. Dundas

Sr. Fdr Eng.

HWY 407/KIPLING AVE - CNR UNDERPASS
MEMO TO FILE Re: DEWATERING @ BRIDGE FOOTINGS

CENTRAL REG.
90/08/15
(P1/1)

OK D. SOLOMON
D. IVANAUSKAS
D. DUNDAS

AUG 16 1990

PROBLEM

DURING CONSTRUCTION OF THE CNR BRIDGE FOOTINGS IS THERE A POSSIBILITY OF ENCOUNTERING LEACHATE CONTAMINATED GROUND WATER (FROM THE NEARBY THACKERY LANDFILL SITE) IN THE EXCAVATION?

BACKGROUND INFORMATION

± CNR TRACKS @ PROPOSED BRIDGE LOCATION IS 9m NORTH OF ESTIMATED LIMIT OF THE WASTE (LIMIT OF WASTE MAT'L ESTABLISHED BY BOREHOLES - MMM).

GROUND WATER ELEVATION - Stabilized pressure head (Foundation Report p 11) EL = 141.3m

FOOTINGS ELEVATION - Bottom of excavation for the engineered fill to support the footings; MINIMUM EL = 146.0m

BOTTOM OF EXCAVATION IS $\approx 5m$ ABOVE WATER TABLE (A EL $\approx 4.7m$)

CROSS CHECK: (from Foundation Report borehole X-section drawing 87826-B)

▽ EL @ N side of existing embankment EL = 141.3
(Matches Rainbow Creek Tributary water level)

▽ EL @ S side of embankment - say equals EL $\leq 141m$
the water level in the CNR drainage ditch
(from contour map)

Since the watertable elevations on both sides of the embankment are at least 4m lower than the bottom of the proposed excavation (146.0m), there is no reason to believe that there would be any water in the excavation. (This was discussed and confirmed with D. Dundas, Foundation Design Section 8/08/90).

CONCLUSION : IT IS HIGHLY UNLIKELY THAT ANY GROUNDWATER WOULD BE ENCOUNTERED DURING EXCAVATION FOR THE CNR BRIDGE FOOTINGS

JRM

RE: W.P. 88-78-26CNR SUBWAY AT KIPLING AVENUE
WINGWALL DESIGN

MEETING held at Foundation Design Section
requested by B. Farago, Structural Section
attended by B. Farago, M. Devata, B. Bennett

- B. Farago presented the scheme proposed by the Consultant for the CNR subway structure i.e. parallel wingwalls extending back from closed abutments for a considerable length
- CNR did not reject design but proposed a scheme that they would prefer - a shorter wingwall followed by a retaining wall



vs.



- B. Farago requested opinion of the Foundation Design Section.
- it was noted that the retaining wall would be founded on material that had not been identified during the soils investigation; boreholes were not advanced that high up on the embankment.
- it would be likely that the retaining wall would be founded on a granular pad.
- it was agreed, that from a structural and geotechnical point of view, the wingwall scheme was preferable.
- may require additional borings if the CN design is approved.

B. Bennett
90 07 30

memorandum



To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 07 20

Atten: S. Markovic

From: Foundation Design Section
Room 315, Central Building

Re: Foundation Investigation Report For
C.N.R. Subway at Kipling Avenue and
W.P. 88-78-26, Site 37-1339
Hwy. 407/Kipling Ave. Interchange
District 6, Toronto

The Foundation Design Section retained B.P. Walker Associates Ltd., consulting geotechnical engineers, to carry out an addendum to the foundation investigation for the above-noted project. The revised Foundation Investigation and Design Report is forwarded under cover of this memo. It supersedes the previous report for this project.

After preparing the consultant agreement, this office provided technical supervision including the establishment of terms of reference and careful review of the consultant's proposals and progress at all stages of the project. Several meetings were held with the consultant during which our comments were incorporated into his report. The Foundation Investigation (factual) portion of the report was reviewed only for format, and its accuracy and completeness are the responsibility of the consultant. The Foundation Design (recommendation) portion of the report has been carefully reviewed by this office based on the subsurface information provided by the consultant.

The following comments supersede the Foundation Investigation and Design Report:

- 1) For calculation of earth pressures, refer to O.H.B.D.C. Section 6-6.1.2.1 and utilize the material properties as detailed on Page 14 of the report.
- 2) Temporary excavations less than 4.5 m deep may be sloped at 1H:1V or flatter. Temporary excavations from 4.5 m to 8 m deep should be sloped at 1.5H:1V or flatter. Temporary excavations deeper than 8 m should be sloped at 1.5:1V or flatter and incorporate a 1 m wide bench so that no uninterrupted slope is deeper than 8 m.

If there are any questions regarding the report or during the design please contact this office.


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

for

M. Devata, P. Eng.
Chief Foundation Engineer

DD/mmj

Distribution

c.c. - V. Boehnke (3)
G. Cautillo
J. Cullen (2)
A. Wittenberg
K.G. Bassi
S.J. Dunham
G. Szekreny
File

90 06 08

Meching

B.P. Walker
Upker Suppl
M. Dent
D. Dunder

Re: WP 88-78-28(B)
Addendum to CRR Kepling
to determine quality of fill as per for granular pad.

1) W abut can be founded @ 148 in on below
at SLS = 350 kPa
ULS = 525 kPa

2) E abut, OK to suber to 146
2 m of gran A to 148
SLS = 300 kPa
ULS = 775 kPa

3) Pier same as E. Abut.

Subsistence localized soft pockets
replaced with Gran. A.

B.P. Walker to incorporate addendum in report.
MTO will reproduce copies & return to B.P.W. for binding.

D. Dunder
Sr. Fdn. Eng.

B.P.Walker Associates Ltd.

Consulting Geotechnical, Inspection and Testing Engineers

101 Amber Street, Suite 2, Markham, Ontario, L3R 3B2 (416) 491-4075 Fax. # 475-5376

May 10, 1990
Project No. 2313-1189

Ministry of Transportation of Ontario
1201 Wilson Avenue
Room 315, Central Building
Downsview, Ontario
M3M 1J8

Attention: Mr. Dave Dundas, P. Eng.

Re: Additional Investigation for
CNR Subway At Kipling Avenue
Vaughan, Ontario

Dear Sir:

This letter is to confirm our telephone conversation of today.

We will be starting the drilling at the above site on May 14, 1990. Our field representative for the duration of the drilling programme will be Tim Olson, P. Eng.

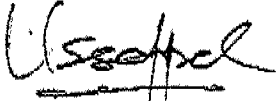
The additional boreholes on the north slope will be carried out using a Tripod supplied by Eastern Soils Investigation Ltd. due to non availability of a tripod or a Diamond Drill from other contractors until the end of May 1990. The hourly rate for the Tripod from the Eastern Soils Investigation Ltd. will be \$110.00. The total cost of drilling, including mobilization, will not exceed \$3,570.00 and we would like your permission to use Eastern Soils Investigation Ltd. for the drilling operation.

Attached herewith are copies of our letters to drilling contractors who have the tripod or a diamond drill but could not supply them until the end of May 1990.

If you have any questions concerning the contents of this letter, please contact this office.

Yours very truly,

B. P. WALKER ASSOCIATES LTD.

A handwritten signature in dark ink, appearing to read "U. Sappal". The signature is written in a cursive style with a horizontal line underneath the name.

U. S. Sappal, P. Eng.

USS:lb

B.P.Walker Associates Ltd.

Consulting Geotechnical, Inspection and Testing Engineers

101 Amber Street, Suite 2, Markham, Ontario, L3R 3B2 (416) 491-4075 Fax. # 475-5376

May 4, 1990

Atcost Soil Drilling
2160 Highway 7
Concord, Ontario
L4K 1B6

Dear Sirs:

This letter confirms our request by telephone of April 30, 1990 for the supply of a Tripod as per your Tender for Drill Items 1.1, Contract S 89-0147 for our Project Foundation Investigation for CNR Subway at Kipling Avenue, Ontario, at which time we were advised by Stan Sukunda that you were not able to comply with our request until the end of May, 1990. We have therefore obtained the services of another company.

Yours very truly,

B. P. WALKER ASSOCIATES LTD.



U. S. Sappal, P. Eng.

USS:lb

cc: M.Devata, P. Eng.

Ministry of Transportation

B.P.Walker Associates Ltd.

Consulting Geotechnical, Inspection and Testing Engineers

101 Amber Street, Suite 2, Markham, Ontario, L3R 3B2 (416) 491-4075 Fax. # 475-5376

May 10, 1990

Master Soil Investigations Limited
192 Toryork Dr.
Weston, Ontario
M9L 1X6

Dear Sirs:

This letter confirms our request by telephone of May 10, 1990 for the supply of a Diamond Drill as per your Tender for Drill Items 1.1, Contract S 89-0147 for our Project Foundation Investigation for CNR Subway at Kipling Avenue, Ontario, at which time we were advised by Harold Dageneis that you were not able to comply with our request for a minimum of two weeks. We have therefore obtained the services of another company.

Yours very truly,
B. P. WALKER ASSOCIATES LTD.

Ussapal

U. S. Sappal, P. Eng.

USS:lb

cc: M.Devata, P. Eng.

Ministry of Transportation

B.P.Walker Associates Ltd.

Consulting Geotechnical, Inspection and Testing Engineers

101 Amber Street, Suite 2, Markham, Ontario, L3R 3B2 (416) 491-4075 Fax. # 475-5376

May 4, 1990

Dominion Soils
104 Crockford Blvd.
Scarborough, Ontario
M1R 3C6

Dear Sirs:

This letter confirms our request by telephone of April 30, 1990 for the supply of a Tripod as per your Tender for Drill Items 1.1, Contract S 89-0147 for our Project Foundation Investigation for CNR Subway at Kipling Avenue, Ontario, at which time we were advised that the Tripod will not be available for drill holes greater than 6.0m (20ft.). We have therefore obtained the services of another company.

Yours very truly,

B. P. WALKER ASSOCIATES LTD.



U. S. Sappal, P. Eng.

USS:lb

cc: M.Devata, P. Eng.

Ministry of Transportation

memorandum



To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 03 23

Attn: S. Markovic
Sr. Structural Engineer

From: Foundation Design Section
Room 315, Central Bldg.

Re: Foundation Recommendations
CNR Structure at Kipling Avenue
W.P. 88-78-26 - District 6 (Toronto)

Regarding your request dated March 19, 1990, the O.H.B.D.C. bearing capacity values at S.L.S. Type II may be assumed to be the allowable bearing capacities for the CNR structure footings.

If additional information is required, please advise.

A handwritten signature in cursive script that reads "B. Bennett".

B. Bennett, P. Eng.
Foundation Engineer

for

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

DD/BB/jb

MINISTRY OF TRANSPORTATION

M E M O R A N D U M

To: Mr. M. Devata
Chief Foundation Engineer
Foundation Design Section
3rd floor
Central Building

Date: March 19, 1990

From: Structural Section
Central Region



Re: W.P. 88-78-02 Highway 407/Kipling Avenue Project
W.P. 88-78-26 CNR Structure at Kipling Avenue

In our meeting of 90/02/12, the question of access to construct the CNR bridge was raised. Once the temporary CNR detour embankment is in place, it would prevent access to the bridge site from the south. As you suggested, a temporary structure would then be required in order to provide this access.

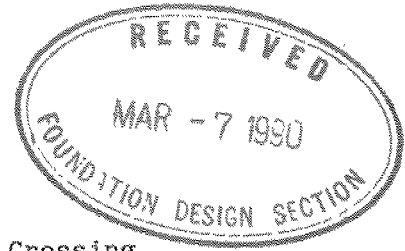
As confirmed with Planning and Design Section on 90/03/07, access to construct the CNR bridge would be from the north, thereby eliminating the need for the temporary structure.

S. Markovic
S. Markovic
Senior Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

SM/vn

cc: D. Solomon
D. Dundas

MINUTES OF MEETING



Date: 90-02-12

Project: Preliminary Foundation Design
Recommendations for
W.P. 88-78-26 Kipling Avenue - C.N.R. Crossing

Attendance: M. Devata
S. Markovic
D. Dundas

A meeting was held at the Foundation Design Section to discuss the Foundation requirements for the C.N.R. Crossing at Kipling Avenue.

Based on the Foundation Investigation Consultant's subsurface information for the proposed structure: Foundations for both the abutments and the pier can be supported on shallow foundations constructed on engineered fill.

These footings may be designed with the following OHBDC requirements:

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

The report will be finalized after the meeting with the Foundation Design Section Consultant, and will be available for distribution by 90-02-23.

S. Markovic
S. Markovic
Senior Structural Engineer

SM/vn

cc: M. Devata
D. Dundas
V. Boehnke

memorandum



To: V. Boehnke
Head, Structural Section
Central Region

Date: 1990 03 01

Atten: S. Markovic

From: Foundation Design Section
Room 315, Central Building

Re: Foundation Investigation Report For
C.N.R. Subway at Kipling Avenue and
Related C.N.R. Detour
W.P. 88-78-26, Site 37-1339
Hwy. 407/Kipling Ave. Interchange
District 6, Toronto

The Foundation Design Section retained B.P. Walker Associates Ltd., consulting geotechnical engineers, to carry out a foundation investigation for the above-noted project. The Foundation Investigation and Design Report is forwarded under cover of this memo.

This office provided technical supervision including the establishment of terms of reference and careful review of the consultant's proposals and progress at all stages of the project. Several meetings were held with the consultant during which our comments were incorporated into his report. The Foundation Investigation (factual) portion of the report was reviewed only for format, and its accuracy and completeness are the responsibility of the consultant. The Foundation Design (recommendation) portion of the report has been carefully reviewed by this office based on the subsurface information provided by the consultant.

The following comments supersede the Foundation Investigation and Design Report:

- 1) The following O.H.B.D.C. bearing capacities are recommended for design of footing on compacted Granular 'A' pads constructed as indicated in the report.

Factored Bearing Capacity at U.L.S. = 775 kPa
Bearing Capacity at S.L.S. Type II = 300 kPa

- 2) For calculation of earth pressure, refer to O.H.B.D.C. Section 6-6.1.2.1 and utilize the material properties as detailed on Page 14 of the report.

- 3) Temporary excavations less than 4.5 m deep may be sloped at 1H:1V or flatter. Temporary excavations from 4.5 m to 8 m deep should be sloped at 1.5H:1V or flatter. Temporary excavations deeper than 8 m should be sloped at 1.5H:1V or flatter and incorporate a 1 m wide bench so that no uninterrupted slope is deeper than 8 m.

If there are any questions regarding the report or during the design please contact this office.

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

for

M. Devata, P. Eng.
Chief Foundation Engineer

DD/mmj

c.c. - V.F. Boehnke (3)
G. Cautillo
J. Smrcka (2)
A. Wittenberg
K.G. Basi
S. Dunham
G. Szekreny
File

memo

To: FLE

Date 90 02 15

Re: WP 88-78-26

CNR / Kipling

Meeting to review B.P. Walker report

B. Walker

Usher Suppl. (post-hum.)

M. Dent

D. Dondos

1) B. Walker presented initial conditions for structure

2) Discussion ensued regarding Gen. post. Int^t
which for 300 & 350 SLS.
Gen. post. to be on existing R/I

3) Agreed that B.P. Walker can put down
2 more shallow berths though R/I
MRD to arrange additional,
B.P. to supply proposal & cost estimates.

4) Discussion on details
~~under~~ Agreed to indicate that
agencies not that much concerned,
& that settlement would be nominal
& preliminary would be OK.

5) D. Dundas requested report to
cover slope stability
& temporary excavations for structure

6) Agree that geometry of abutment
embankment / existing embankment
unseen be considered in report.

D. Dundas

memo

To: File

Dec: 90 02 12

Re: WP 88-78-26

Hapling / CNR

Review of B.P. Walker report

During review of this report
with Mr. Denato it was agreed

1) preloading should be used for
setback (not interconnection)

2) soil descriptions should be
improved

3) bridge should be founded on
gravel & pebbles subbase to bedrock
@ 350 SLS, 500 ULS
each footing should be detailed no benching etc.

4) consideration should be given on
a cost basis to constructing heath
to permit access from south
to bridge site

5) the report needs more for
stability and slope geometry
for both temporary & final cases.

6) the report needs storm & design
recess

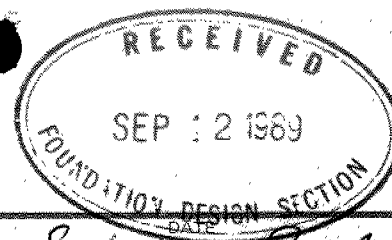
7) cavers may be alternative

8) 11 reports required

D. Denato
Sr. Foundation Eng.

SEND
TO

M. Devata / Dunder
Head Foundation Section
Attention Dave Dandas



FROM

Karan GANESH Geotechnical Section Sept 8/89.

SUBJECT

- WP 88-78-26 Hwy 407 / Kipling Ave
CN Structure Detour at Kipling Ave.

In making your recommendation for the above detour, please take into account paragraph 4 of the attached letter from CN.

Thank you

Karan

REPLY

CC:
Peter Jefford

REPLY FROM

REPLY DATE



RECEIVED

SEP 06 1989

CENTRAL REGION
PLANNING & DESIGN

Operations
Northern Ontario District
Suite 504
277 Front Street West
Toronto, Ontario
M5V 2X7

1 September 1989

Our File: 1600-HAL-4.9

The Ontario Ministry of Transportation
Planning & Design Sections
Central Region
1201 Wilson Avenue
4th Floor, Atrium Tower
Downsview, Ontario
M3M 1J8

Attention: Peter Jefford
Sr. Project Manager

Dear Sir

Re: Proposed Kipling Avenue Subway - Mile 4.90, Halton Subdivision

CN Rail has reviewed your letter of 27 July 1989, received on 15 August 1989, and comment as follows.

The alignment of the detour is to be designed by CN as per your 23 January 1989 letter. Funding of \$10,000.00 must be provided in order that all track and signal designs and estimates can be performed. Hence, you will be billed on an actual cost basis.

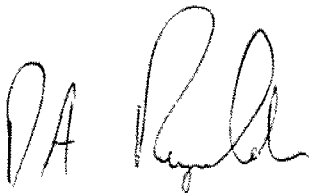
With respect to your request for comments on the grading specifications, CN can only tolerate negligible settlement in our diversion embankments. If more restrictive grading specs are required than normal to achieve this, then the specifications or project staging should be appropriately revised. The depth of ballast is to be 12 inches and the cross fall of the earth embankment is as per the attached Standard Dwg. No. S.362B. The actual platform width is dependant on the track design.

* The proposed 1.7:1 slope is acceptable provided it is approved by a qualified geotechnical engineer and appropriate measures are taken to ensure the embankment is protected from erosion.

- 2 -

Upon receipt of a work order, CN will proceed with the required designs.

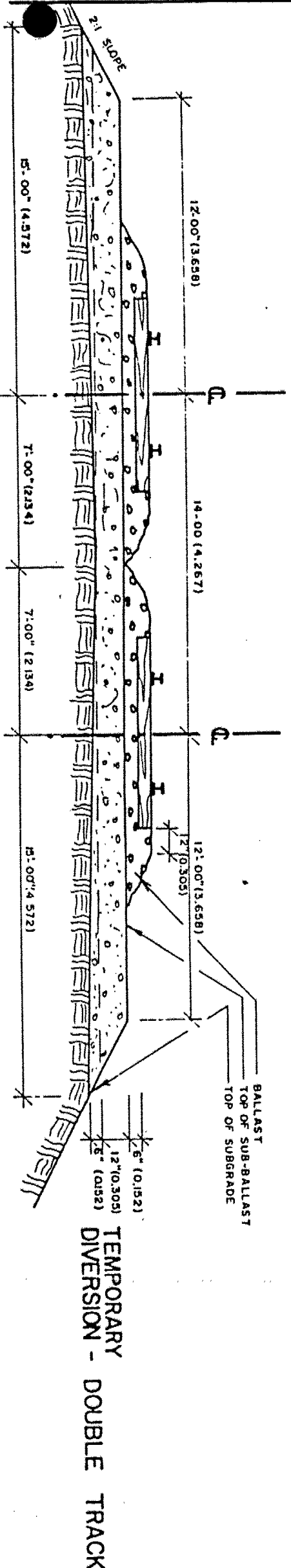
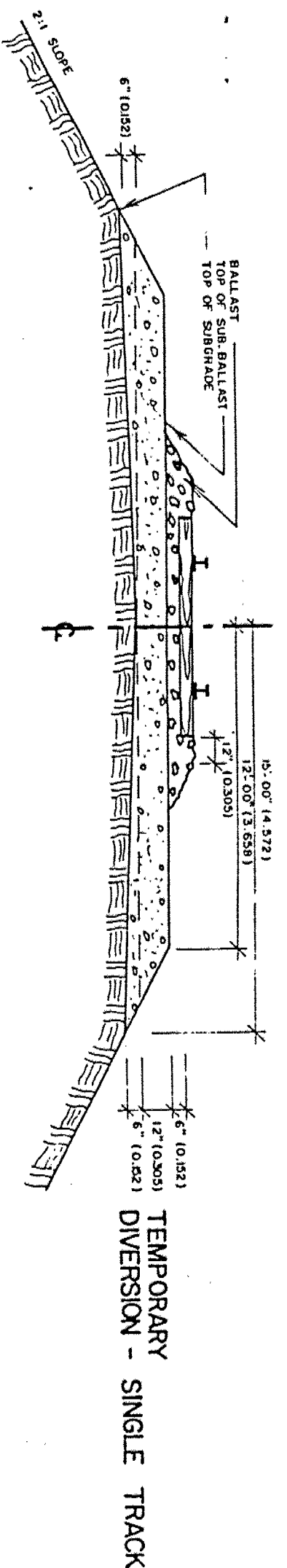
Yours truly

A handwritten signature in dark ink, appearing to read 'D.A. Reynolds'. The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

D.A. Reynolds, P.Eng.
Technical Support Engineer

DAR/T3933ln

cc K. Ganesh 89-09-08.




NOTES:

- 1 SUBGRADE MUST BE COMPACTED TO 95% STANDARD PROCTOR DENSITY TEST (S.P.D.T.)
- 2 SUB-BALLAST MUST BE MATERIAL ACCEPTABLE TO CN RAIL ENGINEERING
- 3 FOR MULTIPLE TRACKS, SUBGRADE AND SUB-BALLAST WIDTH MUST BE INCREASED BY TRACK CENTRES
- 4 ON CURVED TRACK ADDED TRACKS CENTRES, SUBGRADE AND SUB-BALLAST WIDTH MUST BE INCREASED AS REQUIRED BY STANDARD PLAN NO: R1U-1.2 (INCH PER DEGREE OF CURVE)
- 5 FILL OR CUT SLOPES MUST BE 2:1. IF GREATER, THEY MUST BE AUTHORIZED BY CN RAIL ENGINEERING
- 6 FOR DIVERSIONS WITH DESIGN SPEED OF 50 MPH AND OVER THE BALLAST DEPTH MUST BE INCREASED TO A MINIMUM OF 9 TO 12 INCHES. RECOMMENDED THAT FIRST 6" OF BALLAST BE COMPACTED WITH VIBRATOR.

METRIC - (0.000m)

REV'D. MAY 1985 JDS.

 <p>RAIL GREAT LAKES REGION</p>	
<p>ROAD BEDS FOR TEMPORARY DIVERSION TRKS</p>	
<p>LEGEND/TECHNICAL SERVICES</p>	<p>DRAWN BY J.A. BEYSOVEC</p>
<p>DATE - 22 JULY 1980</p>	<p>SCALE - 1" = 5'</p>
<p>DIVISION - II (III) Y 1001</p>	
<p>OWG NO. - S-362 B</p>	



Planning and Design Section
Central Region
1201 Wilson Avenue
4th Floor, Atrium Tower
Downsview, Ontario
M3M 1J8

July 27, 1989

Canadian National Railway
277 Front Street West
Suite 504
Toronto, Ontario
M5V 2X7

Attention: Dave Reynolds, P.Eng.
Technical Support Engineer

Dear Mr. Reynolds:

RE: CN Rail Structure Over Kipling Avenue at Highway 407 Interchange
MTO W.P. 88-78-02

Attached please find a draft plan indicating a preliminary alignment of the CN Rail Detour and Kipling Avenue.

The alignment has been prepared based upon MTO predesign plans which were based upon 1984 air photographs. When our field survey, which is now in progress, is complete the alignment may have to be refined.

However, based upon this preliminary base plan, and Railway Crossing Plan G-73-407-1 (attached), could CN please provide comments regarding:

- 1) The suitability of the design standards used for the horizontal alignment of the CN Rail Detour. Could you also please advise of CN's requirements for superelevation.
- 2) The amount of settlement of the CN Detour that could be tolerated by CN.
- 3) MTO construction specifications require that "all earth materials shall be compacted to a density of 95% of the maximum dry density", as determined by the Proctor Test Method.

Please advise if this is acceptable to CN or if any special requirements or construction standards may apply.

- 4) Please confirm the depth of ballast, platform width, and cross-fall requirements of the earth embankment for the detour. It is assumed that CN will construct the ballast and track after construction of the earth embankment for the detour by the MTO.

The profile grade of the detour will not be calculated until our field survey is complete, however the detour profile will be designed to match the existing track profile. This will result in a fill height of approximately 10 meters. Side slopes to the detour embankment have been designed at 1.7:1 in order to locate the detour in the R.O.W. available between the Rainbow Creek Tributary and the CN Rail structure site.

I have also requested the MTO Foundations Section to provide some soils information including an estimate of the anticipated fill settlement based upon this preliminary alignment. I will forward this information to you when it is available in two to three months time.

Please do not hesitate to call if I can provide any further information.

Thank you.

Yours truly,



Peter Jefford
Senior Project Manager

PJ/ri

attach.

cc: J. Klowak
K. Ganesh
R. Yu
R. Kivi, Marshall, Macklin, Monaghan

memorandum



To: G.C.E. Burkhardt
Head
Structural Section
Central Region

Date: 1989 05 12

Atten: Randy Yu

From: Foundation Design Section
Room 315, Central Building

RE: CNR Subway Track Diversion
W.P. 88-78-26, Site N/A
South of Hwy. 407,
District 6, Toronto

Further to your memos dated 89 03 30 and 89 04 04, this memo provides our preliminary assessment of possible settlements that may be induced by the proposed track diversion. As you have indicated in your memos, our assessment has been based on available site information.

It is our understanding that it is proposed to divert the CNR to the south of its existing alignment and that a 10 m high embankment will be constructed for this purpose.

Following a site inspection and a review of historical air photos, we can only report that there are no obvious site conditions that would contribute to excessive settlement of either the proposed or existing embankment.

As you are aware, it is not possible to quantify settlement predictions without a thorough knowledge of the subsurface conditions under the loaded area and this information is normally obtained during the foundation investigation. However, for a newly constructed 10 m high embankment it would not be unusual for total settlements to exceed 150 mm even if the foundation soil is not excessively compressible due to settlements within the foundation material and within the fill itself.

If there are any question, please advise.

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

DD/sp

MINISTRY OF TRANSPORTATION

M E M O R A N D U M

TO: Mr. M. S. Devata
Chief Foundation Engineer
Foundation Design Section
3rd Floor, Central Building
1201 Wilson Avenue
Downsview, Ontario

DATE: 1989-03-30

FROM: Structural Section
Central Region

RE: Preliminary Foundation Recommendation Request
CNR Structure over Kipling Avenue
South of proposed Hwy. 407
W.P. 88-78-26

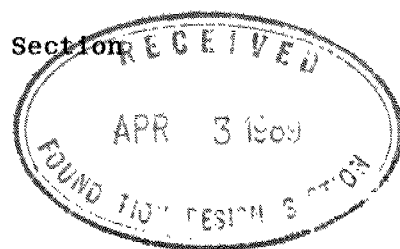
This has reference to Mr. V. F. Boehnke's speedy memo dated 1989-02-01. Our section is studying the options to build a single track/two tracks diversion for the construction of above mentioned CN structure over Kipling Avenue, south of proposed Hwy. 407.

Could you please provide us a preliminary foundation recommendation regarding to possible soil settlement on the proposed track diversion, and settlement of existing track due to combined train load with earth surcharge from the proposed track diversion. Enclosed please find the 1:1000 plan with the proposed track diversion location for your preliminary foundation investigation. Thank you.

Randy Yu

Randy Yu
Structural Project Engineer
for:
G.C.E. Burkhardt
Head, Structural Section

RY/dd
c.c. P. Jefford, MTO P & D
J. Klowak, MTO P & D
R. D. Kivi, Marshall Macklin Monaghan



memorandum



To: Attendance

Date: 1989 11 06

From: Foundation Design Section
Room 315, Central Building

Re: ^{CNR}~~CPR~~ Subway at Kipling Avenue and Related Detour
W.P. 88-78-26
Hwy. 407/Kipling Ave., IC, District, Toronto

Following is a summary of our meeting to discuss the scope of the foundation investigation and the impact of related construction considerations.

- The current schedule requires foundation recommendations by early Jan./90 and the Foundation Report by early Feb./90.
- Construction of this bridge will be complex due to the high fills and the requirement to maintain traffic on 2 CNR tracks.
- The probable method of construction should be established prior to the design phase in order to ensure that the foundation report has sufficient scope to provide the necessary details.
- The bridge will probably be 2 spans with closed abutments while a detour will probably be required to maintain traffic on 2 tracks.
- There is some uncertainty regarding the roles of MTO and CNR in the design of the bridge and detour. This will be clarified by the Central Region Structural and Planning and Design Sections. It will be assumed until further notice that MTO will carry out all design except for the horizontal and vertical alignment of the detour which will be determined by CNR. Since the detour will be an integral component of the design, any delay in establishing its alignment may affect the MTO Schedule.

.... /2

- It would be advantageous from a construction viewpoint to construct the detour far enough to the south to minimize shoring requirements. Alternatively, an extensive shoring system or a temporary trestle structure may be required for the detour. The various alternatives will be considered on a cost basis.


D. H. Dundas,
Sr. Foundation Eng.

DHD/jb

Attendance:

K. Bassi	-	Structural Office
G. Al-Bazi	-	"
V. Boehnke	-	C.R. Structural Section
S. Markovic	-	"
J. Klowak	-	Central Reg. P & D (Part-time)
M. Devata	-	Foundation Design Section
D. Dundas	-	"

memorandum



To: Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region

Date: 1989 08 15

Attn: S. Markovic
Structural Engineer

From: Foundation Design Section
Room 315, Central Building

RE: W.P. 88-78-26, Highway 407
Foundation Investigation Proposal at CNR/Kipling Structure Site

In order to obtain sufficient subsurface data for the design of the proposed structure and CN detour, the foundation investigation at this site will require approximately eight boreholes. Ideally, we would like to advance three boreholes along the base of the embankment on the North side; three boreholes on the South side, and two boreholes on the South embankment itself. (Refer to attached sketch).

The boreholes advanced on the embankment would require construction of a crib and platform at each borehole location onto which a diamond drill rig would be lifted. These boreholes are essential in obtaining information about the fill material used to construct the embankment.

Please forward this foundation investigation proposal to the appropriate CN authorities. In addition, please advise our office of any restrictions that apply to this type of work conducted on CN property, e.g. hours of work, minimum distance from tracks, type of drilling allowed, etc.

A reply at your earliest convenience would be appreciated.

A handwritten signature in cursive script, reading "B. Bennett".

B. Bennett, P. Eng.
Foundation Engineer

BB/sp

Attach.

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN FLOODWAYS - METRES

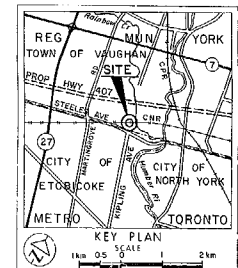
CONT No
WP No 88-78-26



CANADIAN NATIONAL RAILWAYS
AND
PROPOSED KIPLING AVE
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

B. P. Walker Associates Ltd.



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 1/blow)
- CONE Blows/0.3m (60° Cone, 475 1/blow)
- ⚡ Wt at time of investigation

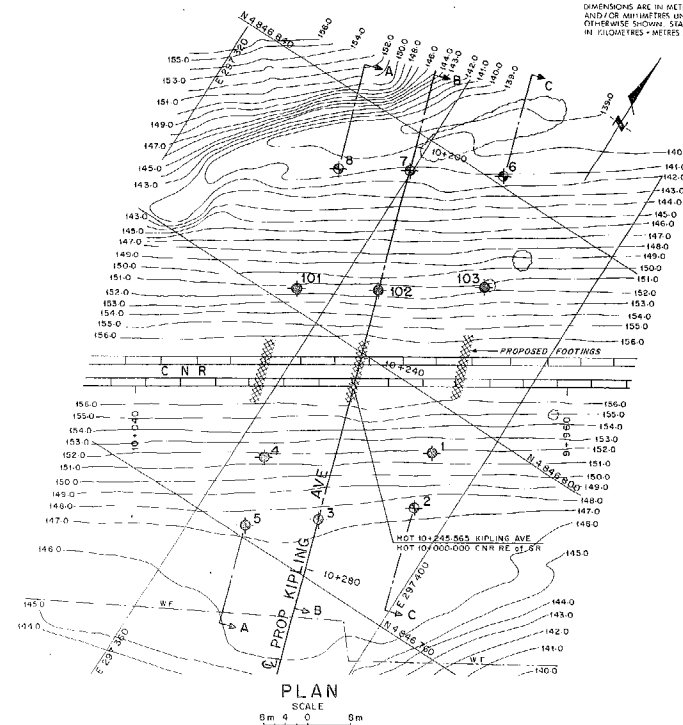
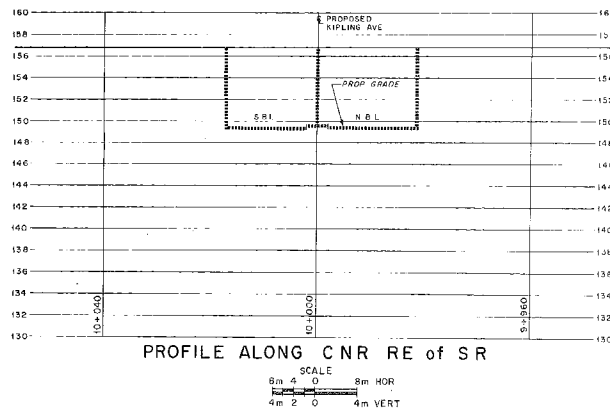
No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	151.6	4846 791.6	297 390.8
2	147.2	4846 781.4	297 393.6
3	147.2	4846 770.0	297 379.7
4	151.7	4846 774.4	297 365.0
5	147.3	4846 782.2	297 369.0
6	140.7	4846 841.6	297 375.0
7	140.7	4846 833.0	297 359.4
8	140.2	4846 826.2	297 348.2
101	151.6	4846 803.4	297 353.6
102	151.5	4846 811.4	297 366.5
103	151.6	4846 822.5	297 363.0

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 107-2 of Form 100.

DATE	BY	DESCRIPTION
1990	30M13-94	Geocres No 30M13-94
1990	407 KIPLING AVE / CNR	DIST 6
1990	DATE Pub 5, 1990	MTF 37-1339
1990	DRAWN P.S. CHECKED	DWG 887826-A



NOTE:
For Sections refer to Dwg No 887826-B

METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES UNLESS
OTHERWISE SHOWN. STATIONS
IN PARALLELS - METRES.

CONT No
WP No 88-78-26

CANADIAN NATIONAL RAILWAYS
AND
PROPOSED KIPLING AVE
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

B. P. Walker Associates Ltd.

SEE DWG 887826-A

KEY PLAN
SCALE

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blow/0.3m (Std Pen Test, 475 J/blow)
- CONE Blow/0.3m (60° Cone, 475 J/blow)
- W1 at time of investigation
Dec 1969 and Jan 1990
- W.L. in Piezometer
- Head Artesian Cond.
- Encountered

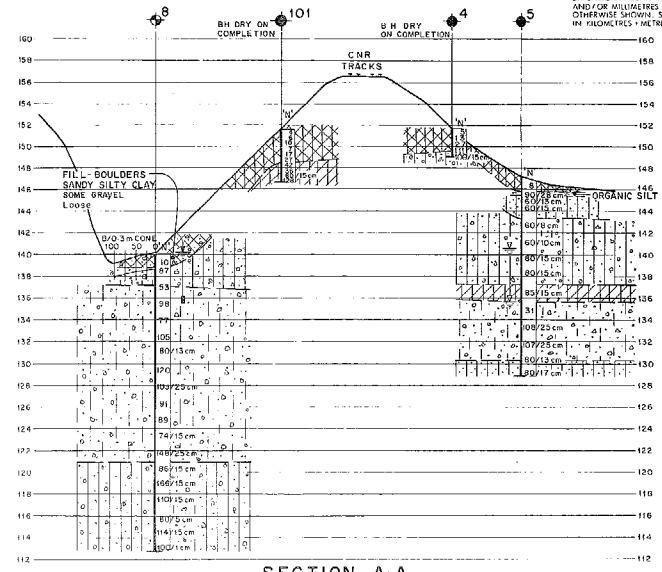
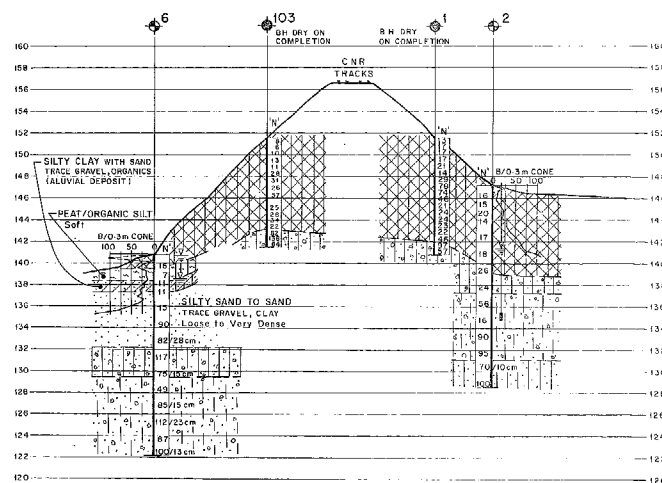
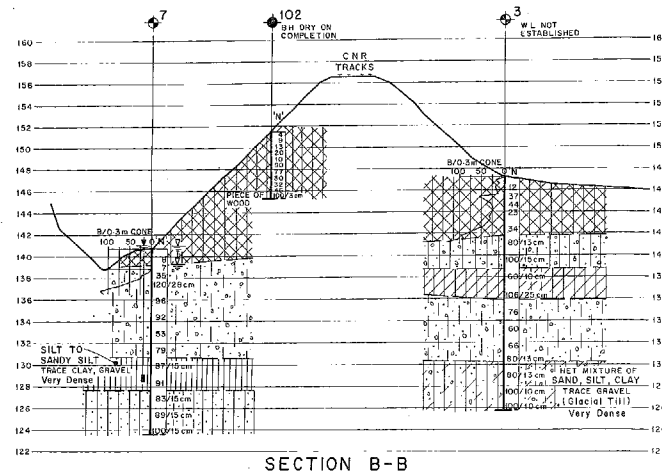
No	ELEVATION	CO-ORDINATES NORTH	EAST
1	151.6	4846 791.6	297 390.8
2	147.2	4846 781.4	297 393.6
3	147.2	4846 770.0	297 379.7
4	151.7	4846 774.4	297 365.0
5	147.3	4846 762.2	297 369.0
6	140.7	4846 841.6	297 375.0
7	140.7	4846 833.0	297 359.4
8	140.2	4846 826.2	297 348.2
101	151.5	4846 803.4	297 353.6
102	151.5	4846 811.4	297 366.5
103	151.6	4846 822.5	297 383.0

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 included in accordance with the conditions of Section 102-2 of Form 100.

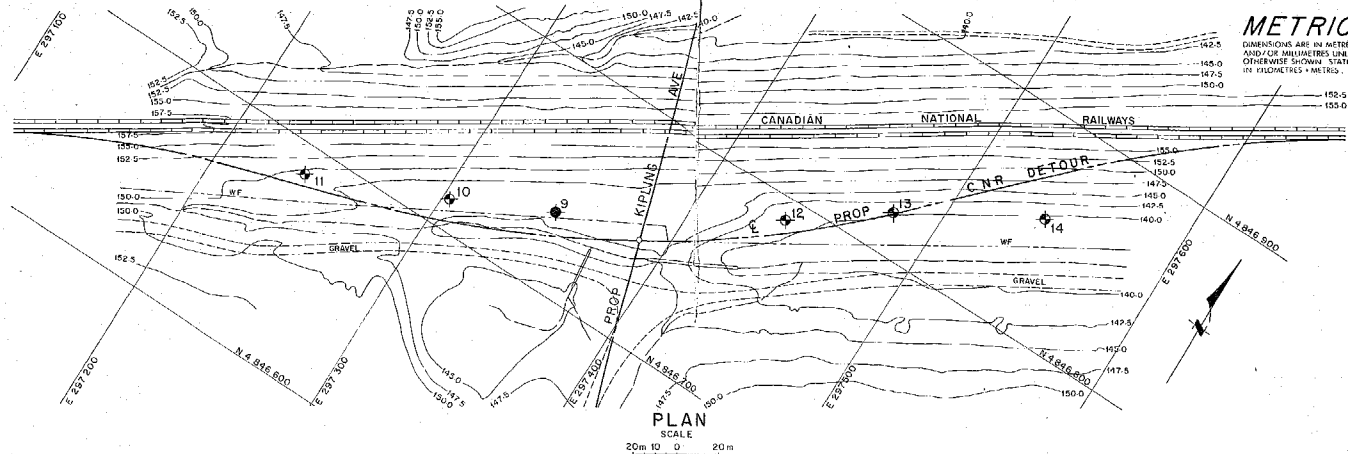
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SOIL STRATIGRAPHY LEGEND

- FILL - SILTY CLAY WITH SAND, TRACE GRAVEL, TRACE ORGANICS, Soft to Very Shiff
- SILTY CLAY/CLAYEY SILT, TRACE SAND, TRACE GRAVEL, Hc/d
- SILTY SAND/SANDY SILT, TRACE GRAVEL, TRACE CLAY, Very Dense
- WET MIXTURE OF SAND AND SILT, TRACE/SOME CLAY, TRACE GRAVEL, Compact to Very Dense (Glacial Till)
- SILTY SAND TO GRAVELLY SAND, TRACE CLAY, Loose to Very Dense

Geocres No 30M13-94	DATE	BY	DESCRIPTION
HWY No 407/KIPLING AVE / CNR			
SUMMARY'S CHECKED	DATE	BY	DESCRIPTION
DRAWN P.S. CHECKED			



CONT No
WP No 88-78-26



CANADIAN NATIONAL RAILWAYS
PROPOSED KIPLING AVE
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

B. P. Walker Associates Ltd.

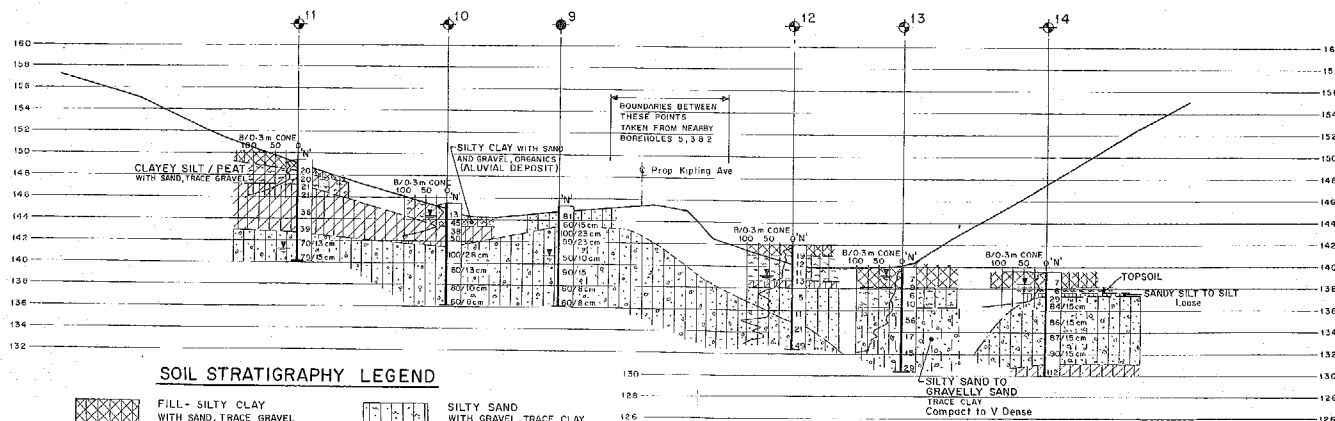
SEE DWG 887826-A

KEY PLAN
SCALE

LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 1/blow)
- CONE Blows/0.3m (60° Cone, 475 1/blow)
- W/L at time of investigation
Dec 1989

No	ELEVATION	CO-ORDINATES NORTH	EAST
9	145.3	4846 735.0	297 348.0
10	145.5	4846 714.0	297 303.0
11	149.4	4846 687.0	297 239.0
12	142.0	4846 790.0	297 440.0
13	140.0	4846 819.0	297 480.0
14	139.6	4846 854.0	297 540.0



SOIL STRATIGRAPHY LEGEND

- | | | | |
|--|--|--|---|
| | FILL - SILTY CLAY
WITH SAND, TRACE GRAVEL
TRACE/SOME ORGANICS
Soft to Stiff | | SILTY SAND
WITH GRAVEL, TRACE CLAY
OCC ORGANICS
Loose (ALUVIAL DEPOSIT) |
| | ORGANIC SILT / PEAT
WITH SAND, TRACE GRAVEL, CLAY | | SILTY CLAY
TRACE SAND, TRACE GRAVEL
Stiff to Hard |
| | SILTY SAND
SOME GRAVEL, TRACE CLAY
Very Loose to Very Dense | | WET MIXTURE OF
SAND AND SILT
TRACE/SOME CLAY, TRACE GRAVEL
Dense to Very Dense
(Glacial Till) |

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. Downstream information contained in the report and related documents is specifically excluded in accordance with the conditions of Section 102.2 of Form 100.

DATE	BY	DESCRIPTION
30M13-94		Geocres No 30M13-94
HWY No 407/KIPLING AVE / CNR	DBT 6	
SUBMIT D.S. CHECKED	DATE Jan 31, 1990	SITE 37-1939
DRAWN P.S. CHECKED	DATE	DWG 887826-C