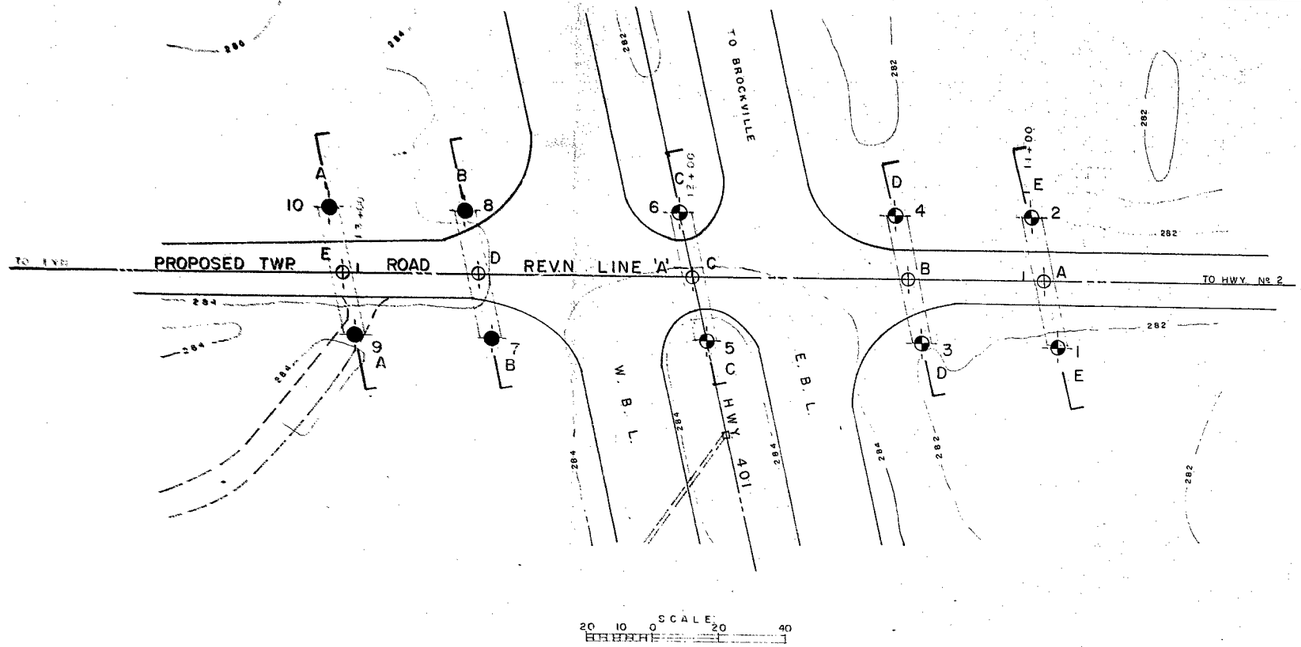
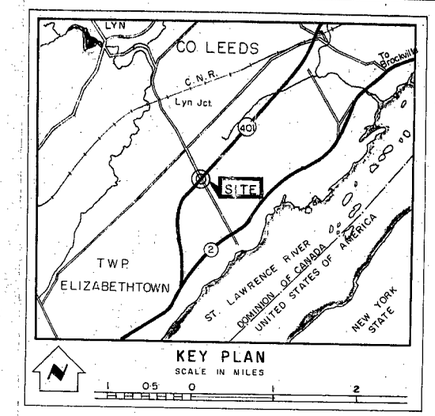
#66-F-235C

W.P.#133-59

HWY. #401 *

LYN ROAD

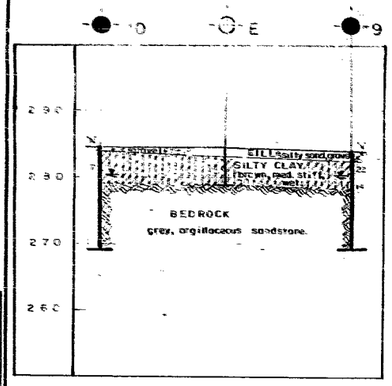




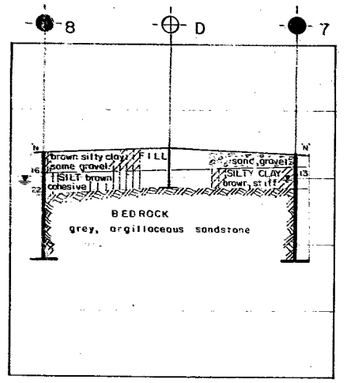
LEGEND

- Bore Hole
- Washed Bore Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.

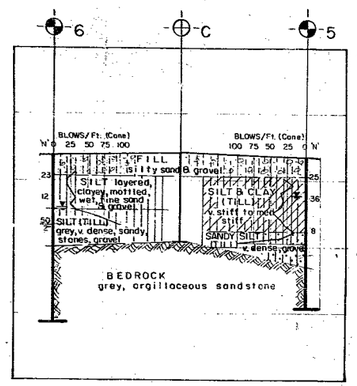
NO.	ELEVATION	STATION	OFFSET
1	281.3	10+88.5	20' LT.
2	282.8	10+97.5	19' RT.
3	282.5	11+30	19' LT.
4	283.3	11+34.5	19' RT.
5	283.5	11+95.5	19' LT.
6	283.7	12+04.7	19' RT.
7	283.5	12+61	19' LT.
8	283.7	12+70	19' RT.
9	284.2	13+01.5	19' LT.
10	284.5	13+06	19' RT.



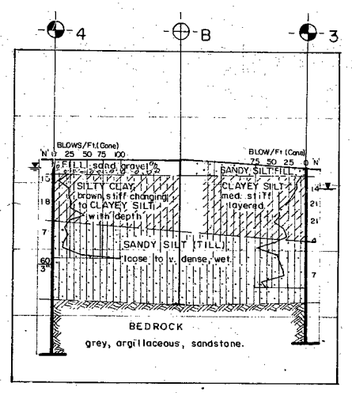
A — A



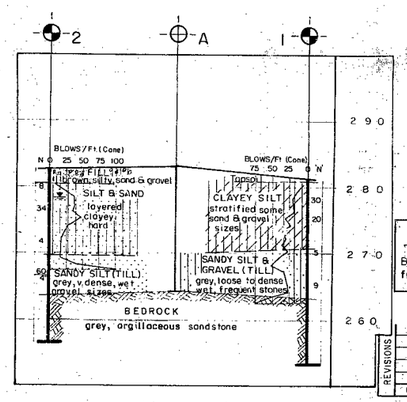
B — B



C — C



D — D



E — E

SECTIONS
SCALE
10 5 0 10 20

— NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

WILLIAM TROW ASSOCIATES LTD

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

PROPOSED CROSSING AT PROP. TWP. ROAD REV'N LINE 'A'

KING'S HIGHWAY NO. 401 & LYN. RD. DIST. NO. 8
CO. LEEDS
TWP. ELIZABETHTOWN LOT 28 CON. 1

SUBM'D.	CHECKED K.P.	W.P. NO. 133-59	2750
DRAWN E.F.K.	CHECKED K.P.	JOB NO.	
DATE JAN. 1966		SITE NO.	BRIDGE DRAWING NO.
APPROVED PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

DEPARTMENT OF HIGHWAYS OF ONTARIO
MACDONALD CARTIER FREEWAY AND KEELE STREET
DOWNSVIEW, ONTARIO

FOUNDATION INVESTIGATION
PROPOSED GRADE SEPARATION
HWY. 401 AND KEELE ROAD
DISTRICT NO. 6
W.P. 133-59

Project: J2750

February, 1966

William Trow Associates Limited

86 Milvan Drive
Weston, Ontario
749-1290

William Trow Associates Ltd.

Project: J2750

Soil Mechanics
Consultants
W. A. Trow
MSc. MEIC. P. Eng.
K. Peaker
PhD. MEIC. P. Eng.
D. H. Shields
PhD. MEIC. P. Eng.

February 8, 1966

Mr. A. Rutka, P.Eng.,
Materials and Testing Engineer,
MacDonald Cartier Freeway and Keele Street,
Downsview, Ontario.

Attention: Mr. A.G. Stermac, P.Eng.

Foundation Investigation
Township Road to Lyn Underpass, MacDonald Cartier Freeway
(Highway 401; District 8)
Lot 28, Township of Elizabethtown, County Leeds, Ontario
Site No: 16-116

Dear Sirs:

A foundation investigation has been completed at the above site in conformance with your authorization of Local Purchase Order No. J.34802, dated December 30th, 1965. Our report of findings, discussion and recommendations follow.

SUMMARY

1) The site is underlain by 5 to 21 feet of periglacial silts and glacial tills followed by sandstone bedrock. The periglacial silts are frequently varved and clayey, and are wet. Both the silts and the underlying sandy silt till exhibit a variable density. At the north-west end the silts directly overlie bedrock.

2) Foundations for the three southerly piers can consist of simple spread footings placed approximately 4 feet below ground

surface and designed for a safe net bearing value of 3 tsf. The two northerly piers should be carried down the additional 1 to 2½ feet to sound sandstone bedrock, with a safe net bearing value of 15 tsf applied.

3) Settlement of the three southerly piers under the suggested loading should be less than 1 inch. If such settlement is not desirable, the piers can be founded on short cylindrical tube or end-bearing 'H' section piles driven to refusal in the glacial till or on the sandstone bedrock, respectively.

4) Excavation to footing level will not encounter unusual or severe difficulty, particularly if carried out during the drier summer period. Seepage of ground water entering the excavations should be small and can be controlled within the excavation.

5) No stability problem is envisaged for either embankment approach. However, some consolidation of the softer lower layers of lacustrine silt and loosened underlying till must be expected under the southern approach fill. A total movement of less than 1 inch is estimated for Holes 1 and 2, where the maximum thickness of apparently softer compressible subsoil occurs. A similar problem does not exist at the northwest abutment where the overburden soils are thin.

FIELD WORK

The on-site investigation for this township road overpass comprised 10 boreholes and 13 cone tests. Each borehole

was advanced using standard drilling procedures in both overburden and bedrock. In one or two cases it was necessary to core through the cobbles and boulders near the base of the glacial till before reaching bedrock. The cone tests were all driven to refusal in either the occasionally very dense till or on the bedrock contact.

Borehole and cone test locations are shown on the site plan drawing, Dwg. 1, together with an interpreted stratigraphical profile. Elevations are referenced to the bench mark located on this drawing. A detailed breakdown of the subsoil encountered in each boring is given in the individual borehole logs, Dwgs. 2 to 11. Additional cone test data is included as Dwgs. 12 and 13.

SUBSOIL

Natural overburden in the area of the proposed crossing consists of up to 13 feet of layered lacustrine silt overlying 0 to 11½ feet of variably dense glacial sand and silt till. The underlying bedrock consists of very sound unweathered hard argillaceous sandstone and quartzite of Lower Paleozoic age.*

The lacustrine or periglacial silts consist in general of finely layered or varved silt, clayey silt and subordinate silty sand. Layering and separation into definite silt, clayey silt or cohesive silty sand seams is not as marked in the shallower north-westerly portion, where the soil directly overlies bedrock. The soil is generally very stiff or moderately dense near the surface but tends to increase in wetness and decrease in competency near its basal contact with the underlying glacial till.

*Cambrian or Lower Ordovician

The glacial sandy silt till interposed between the lacustrine silts and bedrock in the area extending south and east from the west-bound lane of Highway 401 is generally wet, and exhibits considerable variation in denseness. The till also contains a very variable but usually large percentage of gravel, as well as stones of cobble and boulder size. A ridge of bedrock is exposed a short distance east of the site extending southward from a 50 to 60 foot high rock escarpment located about 800 feet north from Borehole 10.

GROUND WATER

Ground water was encountered at relatively shallow depth in all 10 boreholes, though in some cases water did not enter the borings until the upper desiccated crust of layered silty clay and silts had been penetrated. This was particularly noticed in holes 1, 2, 3 and 5.

Although most of the boreholes began to cave in immediately the casing was pulled, water levels appeared to be stabilizing within 1 to 5 feet of ground surface. Variations in the final recorded levels do occur, but are to be expected to some extent because of -

a) the short duration of the period of ground water observation in any one hole,

b) the variable rate of dissipation of drill water left in the hole on completion of drilling. A small part of the variability may also be due to local interference with the ground water regime caused by the relatively recently constructed Highway 401.

Natural drainage of the site area is generally towards a shallow pond and northward flowing stream, located some three to four hundred feet west of Lyn (or Halleck) Road. The stream passes beneath Highway 401 in a long concrete box culvert. Deep lateral and median ditches paralleling the divided lanes of Highway 401 also drain towards the northward flowing stream.

FOUNDATIONS

The three southerly piers of the township road crossing at Sta. 10+90, Sta. 11+35, and Sta. 12+00 approximately, can be founded either on spread footings located on the upper very stiff or dense layers of silt and clayey silt, or on short cylindrical piles driven to refusal in the glacial till or underlying bedrock. 'H' section steel piles can be considered as an alternative to the tube piles, driven to refusal on bedrock.

If spread footings are to be used, they should be located approximately four feet below surface for frost protection, and designed to a safe net bearing pressure of 3 tons per square foot. This allowable bearing pressure will limit settlement to a small order, of 1 inch or less. The recommendation is based on empirical relationship with the penetration resistance of the soil, taking into consideration the presence of the softer layer some 4 to 6 feet below founding level.

If a piled foundation is used, the load capacity of both cylindrical and 'H' section piles should be calculated

on the basis of their ultimate structural capacity when considered as a short column. The safe load for 12¾ inch diameter concrete filled case steel tube piles driven to a 'set' of 10 blows per inch using a standard Delmag D12 pile driver, or its equivalent will in this case be in the order of 75 tons.

Careful record should be kept where driving 'H' piles, to observe for possible deflection or refusal on boulders within the lower section of the till.

In view of the shallow depth to bedrock, it is recommended that the two northerly piers at Sta. 12+65 and Sta. 13+00 approximately be founded directly on sound sandstone bedrock. A safe net bearing pressure of 15 tons per square foot may be applied.

EARTH PRESSURES

If abutments and wing walls are used on this project, i.e. the approach fill does not spill through the abutments, they must be designed to withstand the lateral earth pressure exerted by the retained soils. The earth pressure that will act on the walls can be estimated using a value of earth pressure coefficient equal to 0.35. The earth pressure, p, on the walls at any depth, h, can be found from the expression:

$$P = K \left\{ \gamma (h - h_w) + \gamma_s h_w + q \right\}$$

where:

- K = 0.35, the recommended earth pressure coefficient assuming the walls to be rigid
- γ = 125 pcf, the estimated unit weight of the retained soil
- γ_s = 60 pcf, the estimated submerged weight of the retained soil
- h_w = height of water table above the point being considered
- q = surcharge, if any, acting at the top of the wall.

The stability of the abutment and wing walls should be checked for horizontal sliding along the footing base. The resistance against the sliding is the frictional force acting along the footing base. The frictional force developed along the footing base can be calculated using a friction coefficient of 0.5 (concrete sliding on granular soils).

If the resisting force is less than 1½ times the estimated sliding force, the footing base can be extended under the fill to increase the weight of backfill carried by it. In this manner, the resistance to sliding can be increased.

EMBANKMENTS

Both approach embankments for the proposed crossing will be founded upon medium to very stiff silty clay or clayey

silt. At the north-west end, the stiff silty clay directly overlies hard bedrock at a shallow depth of about 5 feet, and no stability problem is anticipated.

A slightly less favourable condition is seen to exist at the south-east end of the crossing, where the stiff silty clay and clayey silt is underlain by a variable but rather less competent 1 to 7 foot thick layer of sandy clayey silt and silt till, see Holes 1 and 2. However, in view of the 8 foot thickness of the upper desiccated crust and the essential granularity of the greater part of the material within the softer layer, the foundation is considered to possess an adequate factor of safety against failure. The strength of the soil will also be increased by consolidation under the weight of superimposed fill.

The amount of settlement likely to occur under the south-east abutment fill due to consolidation of the rather less competent soil below 8 feet depth will be small, probably in the order of $\frac{1}{2}$ to $\frac{3}{4}$ inch. This estimate is based on the maximum thickness of the apparently less dense soils encountered in Boreholes 1 and 2. The movement will occur largely as the fill loads are being applied. A maximum 2 horizontal to 1 vertical side and end slope has been assumed for both embankment fills.

No further problems are anticipated.

We trust you will find the contents and recommendations of this report in order, and thank you for the opportunity to be of service.

Yours very truly,

John D Morton

JDM/bs
Encls.
DIST: -Dept. of Highways of Ont., (11)

J.D. Morton

K Peaker.

for. William A. Trow, P.Eng.

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No 2.
PROJECT No 2750.

BOREHOLE No. 1.
PROJECT Proposed Overpass, Lyn Rd. & Hwy.401
LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds
HOLE LOCATION Sta. 10+88.5, 20 ft. left
HOLE ELEVATION 281.3
DATUM Geodetic. BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX
ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		281.3	
	4 inches Topsoil	281.0	0
	CLAYEY SILT - stratified, some sand and gravel sizes; stiff near surface becoming softer with depth; brown to ~6 ft. then grey; Wet.	280.2	
	SANDY SILT and GRAVEL (TILL) Grey, loose to dense, frequent stones wet.	271.0	10
	BEDROCK grey argillaceous sandstone, sound unweathered. (Lower Paleozoic)	263.1	20
	Terminated	253.1	30

PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80)
SHEAR STRENGTH P S F

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F
1	
2	
3	
4	
AX	100%
AX	100%

Core Size Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level at 0.5 ft. after 24 hours
3) Cone test 5 feet north from borehole

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING NO ____

PROJECT NO ____

BOREHOLE NO 2.

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Nizabethtown, Co.Leeds

HOLE LOCATION Sta.10 + 97, 19 ft. Right

HOLE ELEVATION 282.8

DATUM Geodetic, BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX (LI)

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		282.8	
	FILL - brown silty sand and gravel	280.3	0
	SILT & SAND - layered, clayey in part, hard from 4 to 8 feet; sand tends to be dominant below 8 feet; wet.	278.3	
		269.8	10
	SANDY SILT (FILL) Grey, very dense ; some gravel sizes, wet.	263.7	
	BEDROCK - grey argillaceous sandstone and white quartzite; sound.		20
	Terminated	256.3	
			30
			40

PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80)

SHEAR STRENGTH PSF (2000, 4000)

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT (10, 20, 30)

SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F
1	
2	
3	
4	
AX	70%
AX	100%

Core Size Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level at 4.0 ft. on completion.
3) Cone test located 4 feet to northeast of borehole

Borehole 2

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No. 4

PROJECT No. 2750

BOREHOLE No. 3

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co. Leeds

HOLE LOCATION Sta.11 + 30, 19 ft. Left

HOLE ELEVATION 282.5

DATUM Geodetic, BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX — X^LI

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		282.5	
	Sandy Silt Fill to 12 inches	281.5	0
	CLAYEY SILT Medium stiff, layered, finely varved in part, frequent irregular sand seams towards base.	279.5	
	SANDY SILT (TILL) Grey, loose to very dense, wet, much gravel	271.8	10
	BEDROCK - grey argillaceous sandstone, sound, unweathered. (Lower Paleozoic) Terminated	261.9 256.1	20

PENETRATION RESISTANCE 350 FT. LB BLOWS/FT
20 40 60 80
SHEAR STRENGTH PSF
1000 2000 4000

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS
% DRY WEIGHT
10 20 30

SAMPLE TYPE AND No.	NATURAL UNIT WEIGHT P.C.F.
1	
2	
3	
4	
5	
AX	457
AX	100%
AX	100%

Core Size Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level at 3.0 ft. after casing withdrawn
3) Cone test 5 feet south from borehole

Borehole 3

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No 5.

PROJECT No 2750

BOREHOLE No 4.

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds

HOLE LOCATION Sta.11 + 34.5, 19 ft. Right

HOLE ELEVATION 283.3

DATUM Geodetic, BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		283.3	
	FILL - sandy gravel	282.3	0
	SILTY CLAY - brown and stiff, turning to CLAYEY SILT with depth; fine sand layers.		
	SANDY SILT (TILL) grey, loose to dense, wet, gravel sizes. Boulders below 13 feet.	274.3	10
	BEDROCK grey argillaceous sandstone, sound unweathered. (Lower Paleozoic)	262.3	20
	Terminated	254.1	30
			40

PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80)

SHEAR STRENGTH PSF

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT (10, 20, 30)

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F.
1	
2	131
3	
AX	39%
AX	100%
AX	100%

Core Size / Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level at 1.0 ft. after casing withdrawn.
3) Cone test 5ft. to southeast of borehole

Borehole 4

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING NO 6.
PROJECT NO 2750

BOREHOLE NO 5.
PROJECT Proposed Overpass, Lyn Rd. & Hwy.401
LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds
HOLE LOCATION Sta.11 + 95.5, 20 ft. Left
HOLE ELEVATION 283.5
DATUM Geodetic, IM

LEGEND

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)
NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^LI
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT
SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		283.5	0
	FILL - silty sand and gravel	280.5	
	SILT & CLAYEY SILT, layered, brown, turning grey with depth, very stiff.	277.6	
	Medium stiff below ~ 9 ft.	272.3	10
	SANDY SILT (TILL) - grey, wet. Very dense below 12 feet, frequent gravel, stones & boulders.	267.0	
	BEDROCK - grey argillaceous sandstone and white quartzite; sound. Terminated	260.8	20
			30
			40

PENETRATION RESISTANCE 350 FT LB BLOWS/FT
20 40 60 80
SHEAR STRENGTH PSF
2000 4000

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS
% DRY WEIGHT
10 20 30

SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F
1	
2	
3	
AX	93.3 %
AX	85.7 %
AX	96.3 %

Core Size
Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level at 5.9 ft. after casing withdrawn.
3) Cone test 4ft. north from borehole

Borehole 5

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No 17.

PROJECT No 2750

BOREHOLE No 6.

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds

HOLE LOCATION Sta.12 + 04.5, 19ft. Right

HOLE ELEVATION 283.7

DATUM Geodetic. BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X LI

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		283.7	0
	FILL - sand to 3 ft.	280.7	
	SILT - clayey, layered, mottled, wet: fine sand, gravel & org. pockets	275.8	
	SILT (TILL) Grey, very dense, sandy, scattered stones and gravel.	275.7	10
	BEDROCK - grey argillaceous sandstone and white quartzite; sound. (Lower Paleozoic)	270.2	
	Terminated	258.8	20
			30
			40

PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80)

SHEAR STRENGTH PSF

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F.
1	
2	
3	
AX	100%
AX	100%
AX	100%

Core Size Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level 4.9 ft. after casing withdrawn.
3) Cone test 4 feet north from borehole

Borehole 6

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No. 8.

PROJECT No. 2750

BOREHOLE No. 7.

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds

HOLE LOCATION Sta. 12 + 61, 20ft. Left

HOLE ELEVATION 283.5

DATUM Geodetic. BM

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		283.5	0
	FILL - Sand and gravel	281.8	
	SILTY CLAY - brown, stiff; layered	279.8	
		278.4	
	BEDROCK - grey argillaceous sandstone and white quartzite; sound (Lower Paleozoic)		10
	Terminated	267.6	20
			30
			40

PENETRATION RESISTANCE 350-FT LB. BLOWS/FT
20 40 60 80
SHEAR STRENGTH PSF

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS
% DRY WEIGHT

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F.
1	
AX	93.8%
AX	100%
AX	100%
Core Size	Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level 3.7 ft. after casing withdrawn.
3) No cone test

Borehole 7

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No 9.
PROJECT No 2750.

BOREHOLE No. 8.
PROJECT Proposed Overpass, Lyn Rd. & Hwy.401
LOCATION Lot 2?, Twp. Elizabethtown, Co.Leeds
HOLE LOCATION Sta. 12 + 70, 20?'. Right
HOLE ELEVATION 283.7
DATUM Geodetic, MW

LEGEND

PENETRATION RESISTANCE
2" O.D SPLIT TUBE
2" I.D SHELBY TUBE
2" DIA. CONE
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^LI
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT
SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D SHELBY TUBE
3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		283.7	0
	FILL - Brown silty clay, some gravel	280.4	
	SILT - Brown, cohesive, saturated Thin clay and sand seams.	279.1	
	BEDROCK - grey arrillaceous sandstone and white quartzite; sound. (Lower Paleozoic)	277.3	10
	Terminated		20
			30
			40

PENETRATION RESISTANCE 350 FT LB BLOWS/FT
20 40 60 80
SHEAR STRENGTH PSF

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F
1	
2	
AX	94.5#
AX	96.7#
Core Size	Recovery

Notes

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level 4.6 after 12 hours, before casing withdrawn. Hole caved in on withdrawing casing, preventing further observation.
3) No cone test

Borehole 8

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

DRAWING No 10
PROJECT No 2750.

BOREHOLE No. 9.
PROJECT Proposed Overpass, Lyn Rd. & Hwy.401
LOCATION Lot 23, Twp. Elizabethtown, Co.Leeds
HOLE LOCATION Sta. 13 + 01.5, 20ft. Left
HOLE ELEVATION 284.2
DATUM Geodetic, BM

LEGEND

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)
NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^LI
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT
SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		284.2	0
	FILL - Silty, sand and gravel	282.1	
	SILTY CLAY - Brown, very stiff, layered, turns to clayey silt with depth.	280.2	
	BEDROCK	278.2	
	grey argillaceous sandstone and white quartzite; sound.		10
	Terminated	259.2	20
			30
			40

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

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F
1	
2	
AXT	100%
AXT	77%

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level 4.0 ft. on completion
3) No cone test
4) Eleven inches lost from final coring run, due to reduced water flow (freezing of waterline).

Borehole 9

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No 11.

PROJECT No 2750.

LEGEND

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

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

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X LI

ATTERBERG LIMITS
- LIQUID LIMIT
- PLASTIC LIMIT

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

BOREHOLE No. 10.

PROJECT Proposed Overpass, Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co. Leeds

HOLE LOCATION Sta.13 + 10.5, 20ft. Right

HOLE ELEVATION 284.5

DATUM Geodetic. FM

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET
		284.5	
	~ 18 ins. gravel FILL	283.0	0
	SILTY CLAY Brown, medium stiff, layered, wet ▽	280.3	
	BEDROCK - grey argillaceous sandstone and white quartzite; sound. (Lower Paleozoic)	279.0	10
	Terminated	269.0	
			20
			30
			40

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

SHEAR STRENGTH P S F

"Frank"

NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT

SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F.
1	
AX	100%
AX	100%
Core Size	Recovery

Notes:

1) Hole advanced by dry cutting, wash boring, and rotary diamond core drill techniques.
2) Water level 4.2 ft. on completion.
3) No cone test

Borehole 10

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No ____

PROJECT No 2780.

CONE TESTS A, A1, B & B1

PROJECT Proposed Overpass Lyn Rd. & Hwy.401

LOCATION Lot 28, Twp. Elizabethtown, Co.Leeds

HOLE LOCATION See below

HOLE ELEVATION See below

DATUM ____

LEGEND

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

3" DIA. CONE

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE ⊕

UNCONFINED COMPRESSION ⊗

VANE TEST AND SENSITIVITY (S) $+^{S}$

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX X^{LI}

ATTERBERG LIMITS

LIQUID LIMIT

PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80) SHEAR STRENGTH PSF	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND No	NATURAL UNIT WEIGHT P.C.F.
	A: Sta. 10 + 93, on ℄ Elev. 283.1		0				
	A_1: Sta. 10 + 93, 5ft. Left Elev. 283.1		10				
	B: Sta. 11 + 34.5, on ℄ Elev. 283.6		20				
	B_1: Sta. 11 + 34.5, 5ft. Left Elev. 283.6		30				
			40				

Cone Tests

WILLIAM TROW ASSOCIATES LTD.

SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

DRAWING No. 13.
PROJECT No. 2750.

CONE TESTS C, D & E.
PROJECT Proposed Overpass, Lyn Rd. & Hwy.401
LOCATION Lot 23, Twp. Elizabethtown, Co.Leeds
HOLE LOCATION See below
HOLE ELEVATION See below
DATUM

LEGEND

PENETRATION RESISTANCE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
2" DIA. CONE
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE
UNCONFINED COMPRESSION
VANE TEST AND SENSITIVITY (S)

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX
ATTERBERG LIMITS
LIQUID LIMIT
PLASTIC LIMIT
SAMPLE TYPE
2" O.D. SPLIT TUBE
2" I.D. SHELBY TUBE
3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT LB BLOWS/FT (20, 40, 60, 80) / SHEAR STRENGTH PSF	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F
	C: Sta. 12 + 00, on ℄ Elev. 284.0		0				
	D: Sta. 12 + 65.5, on ℄ Elev. 284.2		10				
	E: Sta. 13 + 00, on ℄ Elev. 284.6		20				
			30				
			40				

Ontario Test Hole

cc: Gen. Files

W. P. 133-57

Mr. B. R. Davis,
Bridge Engineer,
Bridge Division.

Attention: Mr. H. McCombie

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

February 14, 1966

FEB 14 1966

FOUNDATION INVESTIGATION REPORT BY:
William Trow Associates, Limited -
Proposed Grade Separation, Hwy. 401 &
Lyn Road, District No. 8 (Kingston).
-- W.P. 133-59 --

Attached, please find the above mentioned report prepared and submitted by the Consultant, William Trow Associates, Limited.

We have reviewed the report and have found the factual information adequate and well presented. We are also in agreement with the recommendations pertaining to the foundations. It appears to us that the alternative of having all the footings bearing on rock, either directly or on piles, merits special consideration. Although it might be a more expensive solution, it is one which is very straightforward, and certainly eliminates all the possible sources of trouble.

Should you have any additional questions concerning this report, please feel free to contact this Office.

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

AGS/Mlef
Attach.
cc: Messrs. B. R. Davis (2)
H. [illegible]. Tregunkes
D. W. Farren
R. S. Fillar
H. A. Cash
J. E. Crumpler
A. Watt
Foundations Office
Gen. Files