

W.P. 105-59

Mr. A. M. Toye,
Bridge Engineer.

August 3, 1960.

Materials & Research Section. by: William A. Trow & Assoc., Ltd.

Attention: Mr. S. McCombie.

Re: Charlottenburg Twp. Bridge No. 1 -
Highway 401 near Cornwall, District 9.
W.P. 105-59.

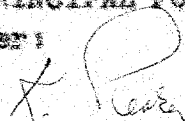
The foundation report for the above site, prepared by W. A. Trow & Associates, accompanies this memo.

The foundation recommendations have been summarized by the Consultant, and these recommendations adequately cover the conditions at the site.

If we can be of further assistance in connection with this report, please contact the Foundation Section.

L. G. Soderaan,
PRINCIPAL FOUNDATIONS ENGR.

Per:



(E. Peaker,
FOUNDATION FIELD SUPERVISING ENGR.)

EP/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
J. Ford
L. E. Walker
J. E. Gruspier
A. Watt
Foundations Office
Gen. Files. ✓

Project: J 531

July 26, 1960

Mr. A. Rutka,
Acting Materials & Research Engineer,
Department of Highways of Ontario,
Parliament Buildings,
Toronto, Ontario

Attention: Mr. L.G. Soderman, P.Eng.
Principal Soils and Foundations Engineer

Re: Foundation Conditions
County Road Crossing of Hwy. 401
Between Cornwall and Charlottetown (Que. HP 105-59)

Dear Sir:

Enclosed herewith are the borehole results of our investigation of the above-noted bridge site. Except for the difficulty of excavating the very dense soil at this location we do not foresee any foundation problems. Accordingly, we shall take the liberty to report in very brief form. Our observations and comments are as follows.

1) The ground is relatively flat at this location although minor variations in ground surface level do exist. A shallow cutting through a small knoll in the south lane of Hwy. 401 just east of this crossing has exposed dense silty sand with gravel and boulders. Some stones were too large to be removed by scraper equipment.

2) Five borings, made at the pier and abutment locations shown in Eng. 1, indicated that similar granular till with boulders exists at the bridge site. The soil in all borings was found to be dense to very dense below 5 feet and normal sampling in it was very difficult. Bedrock, consisting of dense limestone,

was found between Ml 162 and 164 or at a depth of about 22 feet below ground surface. The results of the borings are shown in Logs. 2 to 6.

3) Observations during the investigation program indicated that the water table lay close to the surface at approximate Ml 163 feet.

4) The pier and abutments of this bridge structure can be founded at a depth of 5 feet below present ground surface or at approximate Ml 160 feet.

5) Although the soil is quite dense below this level some disturbances to it should be anticipated when large boulders are removed from the footing beds. Attempts to remedy this situation by recompaction may be hindered because the soil at footing level will be saturated. In order to overcome this difficulty it is recommended that the footing trenches be covered with a blanket of fine crushed stone at least 6 inches thick. In this way the trenches can be made level and a dry surface will be provided for compaction equipment. At least 5 passes of a vibrating plate compactor over this granular surface should be specified.

6) Despite these precautions it is recommended that the safe net bearing pressure for footings be limited to a value of 4000 p.s.f. This conservative approach is warranted in view of the proximity of the water table and the aforementioned excavation disturbances. Even with the crushed stone blanket it will be difficult to return any pockets of disturbed silty sand to their original dense state.

7) Although the water table level is high no excavation difficulty due to unstable ground should be anticipated when digging to a depth of 5 feet except for those suggested in item (5).

8) No embankment stability problem exists at this location. Embankments can be placed at any convenient stage in the construction program.

9) If it is proposed to place end-abutments on piles driven through the fill, the use of cylindrical steel piles is recommended since refusal will be encountered at shallow depth below the present ground surface. H piles are less satisfactory because they may become deflected and bent by boulders in the natural till. It is conceivable also that the tips of H piles may encounter temporary refusal near the sloping edge of some large boulder. The danger

-3-

of this occurrence decreases when large displacement piles are used.

We hope that the factual information and associated comments of this brief report are of assistance to you in the preparation of the foundation design for this structure. We shall be pleased to discuss any detail that may occur to you after you have considered this information.

Yours very truly,

W. Trow

William A. Trow, P. Eng.

WAT/gc
Encls.



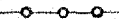
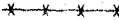
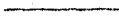
WILLIAM T. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION




LEGEND

DRAWING No. 2
PROJECT No. J531

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 

BOREHOLE No. 1
PROJECT Charlottesville Twp. Bridge # 1
LOCATION Hwy. 401 East of Cornwall
HOLE LOCATION See Pwr. 1
HOLE ELEVATION 185.0
DATUM Supplied by DHC Survey Crew

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		350 FT. LB BLOWS/FT 80	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS		SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40		% DRY WEIGHT			
				SHEAR STRENGTH		P S F				
DD	Light brown silty fine sand with gravel sizes. Boulder 3.8" to 5".	185.0	0							
	Very dense sandy silt containing gravel sizes, cobbles & boulders. Brown to 9' 0" then grey. Some clay from 15' 0"	183	10							
X	Bedrock -- laminated limestone	179	20						SS1	
		163	30						SS2	
End of Hole				147.7	40				SS3	
Notes: 1) BX casing drilled to 22' 0"									SS4	
2) AX " " " 23' 0"									SS5	
3) Refusal to sampler at 6' 10", 15' 7", 17' 4" & 20' 6"									SS6	
4) Rock cored from 23' 0" to 37' 4" - 96% recovery										
5) Water level recorded at end of boring and after 4 days										

PROJECT NO. J 531

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Charlottenburg Twp. Bridge #1

LOCATION Hwy. 401 East of Cornwall

HOLE LOCATION See Dwg. 1.

HOLE ELEVATION AND DATUM 184.8

BOREHOLE NO. 2

FIELD SUPERVISOR..

DRILL Diamond

PREP.

DRAWING NO. 3

LEGEND

2" DIA. SPLIT TUBE

2" SHELBY TUBE

2¹¹ SPLIT TUBE

2¹¹ DIA, CONE

CASING

2" SHELBY

1/2 UNCONFINED COMPRESSION [Qu]

VANE TEST [C] AND SENSITIVITY [S]

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P. S. F.	
	Ground Surface	184.8	0	BLOWS/FT.	
	Glacial till—brown, sandy to clayey silt containing gravel sizes, cobbles and boulders — dense to very dense below 5 feet				
	—gray below approx. 12 ft.				
	Bedrock-laminated limestone	163			
	End of hole	151			
Notes:	1) 3" pipe driven to 15 feet 2) BX casing drilled to 24 feet 3) 350 ft.lbs. hammer energy used to drive cone and sampler. 4) Refusal to sampler at 20 ft., & 23 ft. & 24 ft. 5) Rock cored from 24 ft. to 34 ft., 90% recovery.				

[illegible]

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SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

LEGEND

DRAWING No. 4
PROJECT No. J53


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 

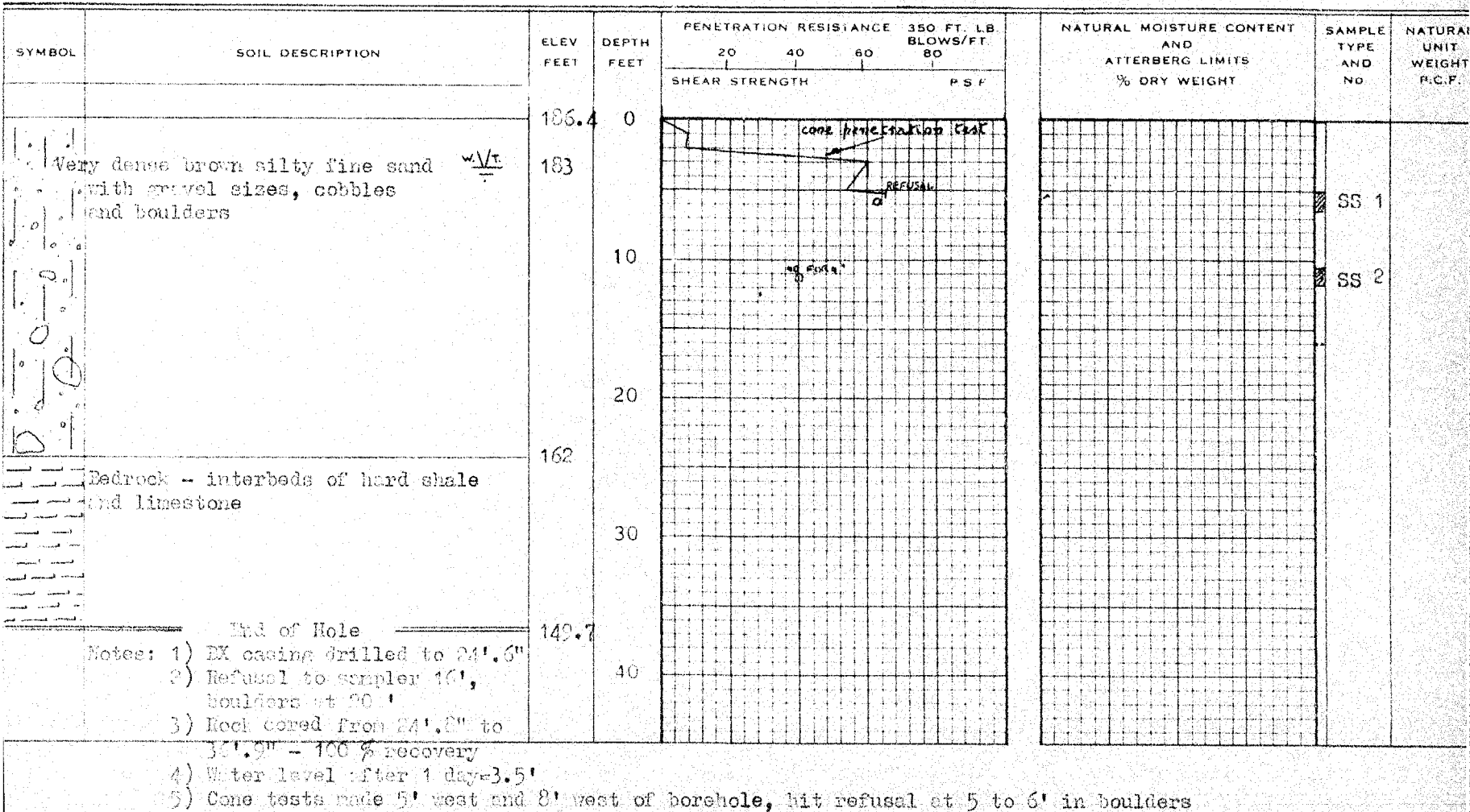
SAMPLE TYPE

2" O.D. SPLIT TUBE 

2" I.D. SHELBY TUBE 

3" O.D. SHELBY TUBE 

BOREHOLE No. 3
PROJECT: Charlottensburg Twp. Bridge # 1
LOCATION: Hwy. 401 East of Cornwall
HOLE LOCATION: See Dwg. 1
HOLE ELEVATION: 186.4
DATUM: Supplied by DHO Survey Crew



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SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

LEGEND

DRAWING No. 5
PROJECT No. J531

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

BOREHOLE No. 4

PROJECT Charlottenburg Twp. Bridge # 1

LOCATION Hwy. 401 East of Cornwall

HOLE LOCATION See Map. 1

HOLE ELEVATION 186.6

DATUM Levels provided by DHO Survey Crew

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE				NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
				20	40	60	350 FT. LB. BLOWS/FT. 80			
				SHEAR STRENGTH						
				P.S.F.						
	Very dense brown silty sand with fine to medium gravel sizes, cobbles and boulders - grey from 12' to 14' (Lost wash water 8 to 14')	186.6	0							
			10						SS1	
									SS2	
			20						SS3	
									SS4	
	Bedrock - laminated limestone	164								
			30							
	End of Hole	153.9								
	Notes: 1) BX casing drilled to 22'.6"		40							
	2) Rock cored from 22'.6" to 32'.9" - 100% recovery									
	3) Water level at end of bore = 3 1/2'									
	4) Ground appeared disturbed by construction equipment in this area.									

5) Cone 4(a) 10' north of hole; cone 4(b) 5' south of hole




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SITE INVESTIGATIONS - SOIL MECHANICS CONSULTATION




DRAWING No. 6
PROJECT No. J531

LEGEND

PENETRATION RESISTANCE






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

SHEAR STRENGTH

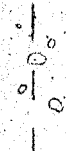
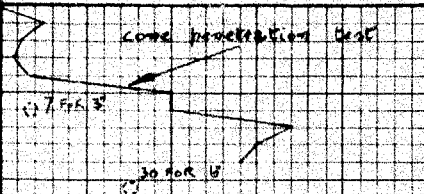

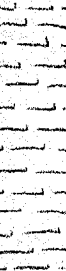
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

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 

BOREHOLE No. 5
PROJECT Charlottenburg Twp. Bridge # 1
LOCATION Hwy. 401 East of Cornwall
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 187.3
DATUM Levels supplied by DHO Survey Crew

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT. LB. BLOWS/FT.		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40 60 80			
	Very dense brown silty fine sand, gravel sizes, some cobbles and boulders.	187.3	0					
		177	10					
	Very dense fine grey sandy silt, gravel sizes, cobbles and boulders.		20					
	Bedrock - laminated limestone.	164.4	30					
	End of Hole	147.8	40					

- Notes: 1) EX casing drilled to 22'.9"
2) 350 ft. lbs. hammer energy used to drive cone of sampler
3) Refusal to sampler at 16'.0"
4) Rock cored from 22'.9" to 39'.6" - 100% recovery

#60-F-288-C

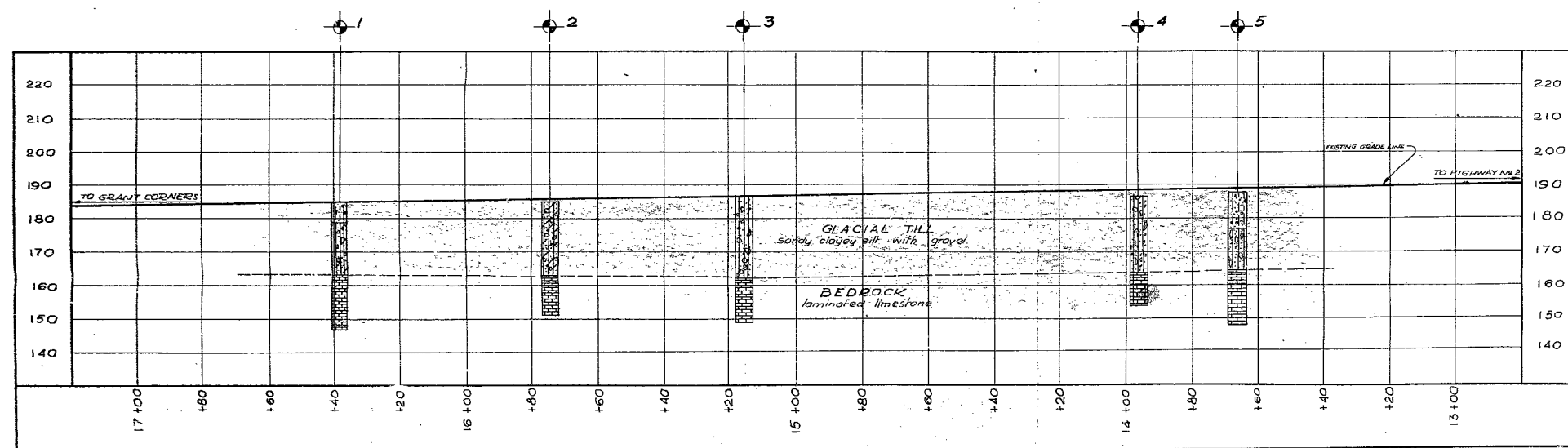
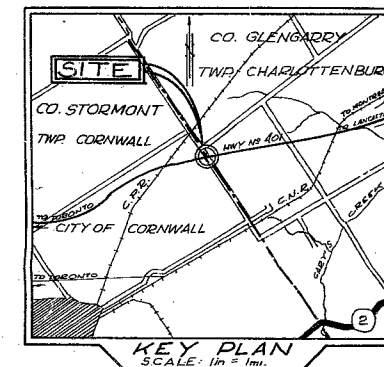
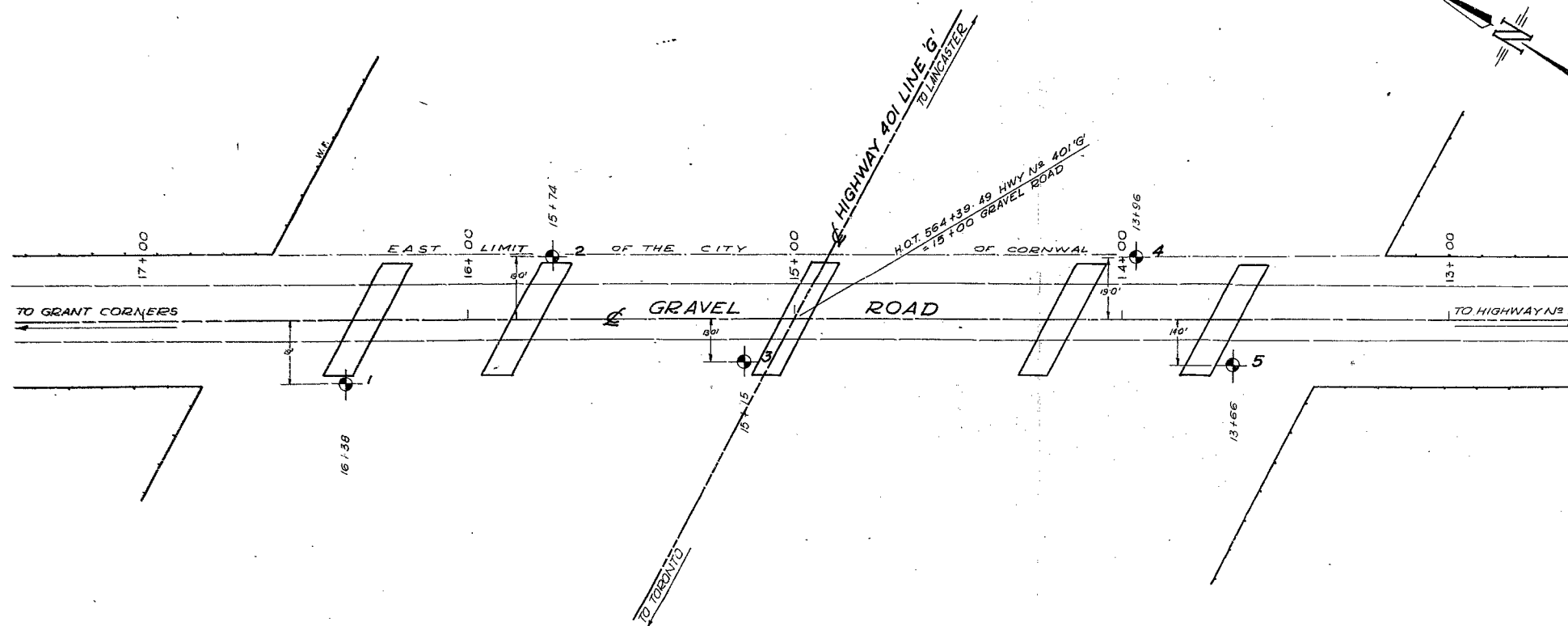
W.P.#105-59

HWY. #401,

CHARLOTTENBURG

TWP., BRIDGE NO. 1

NEAR CORNWALL



FOUNDATION INVESTIGATION
CHARLOTTENBURG TWP. BRIDGE
No 1.
William A. Inow & Associates Ltd.