

60-F-92

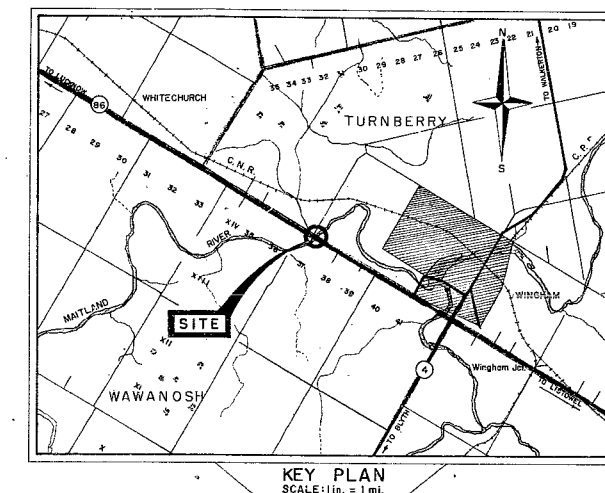
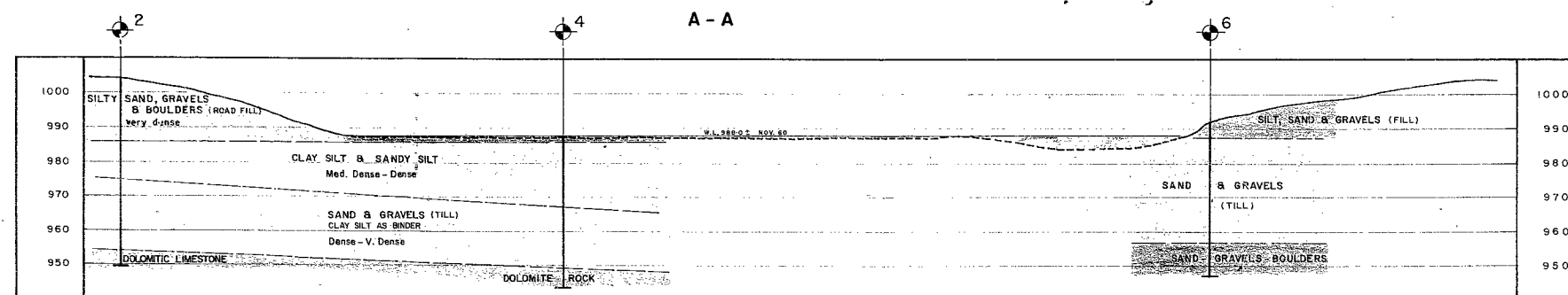
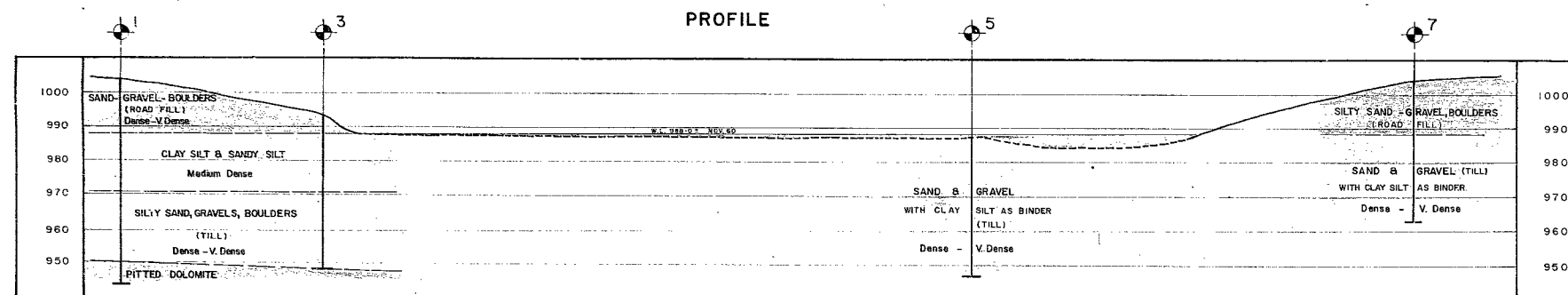
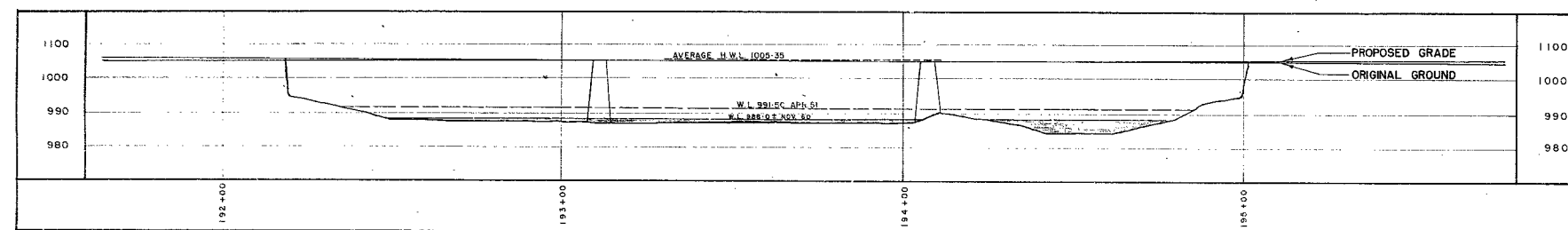
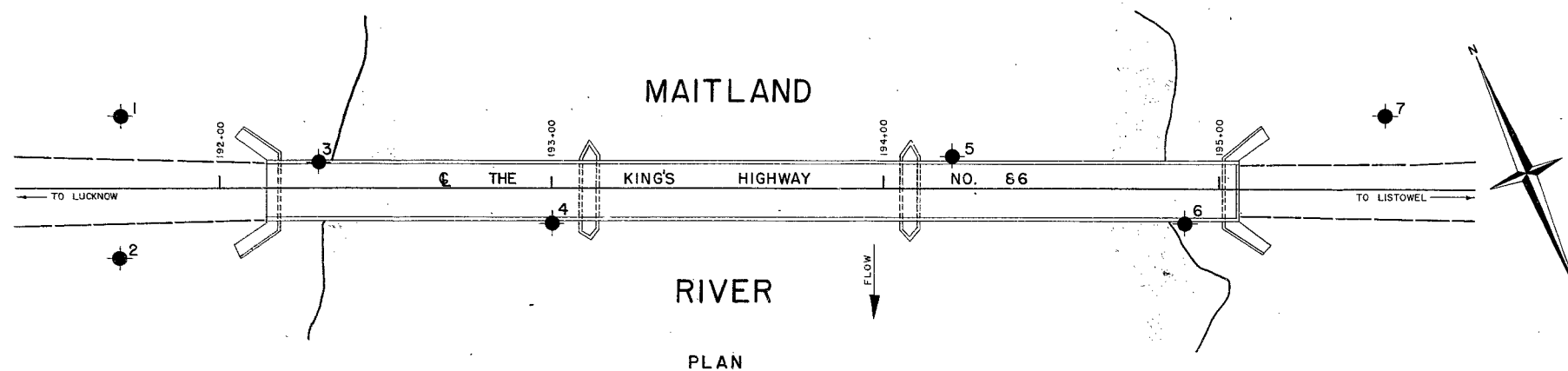
W.P. # 15-60

Hwy. # 86 &

ZETLAND BR.

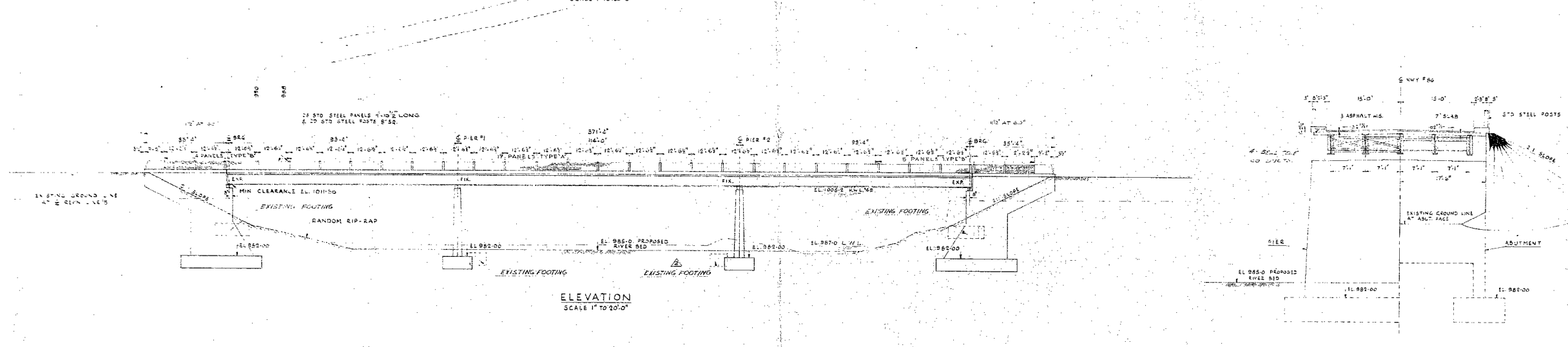
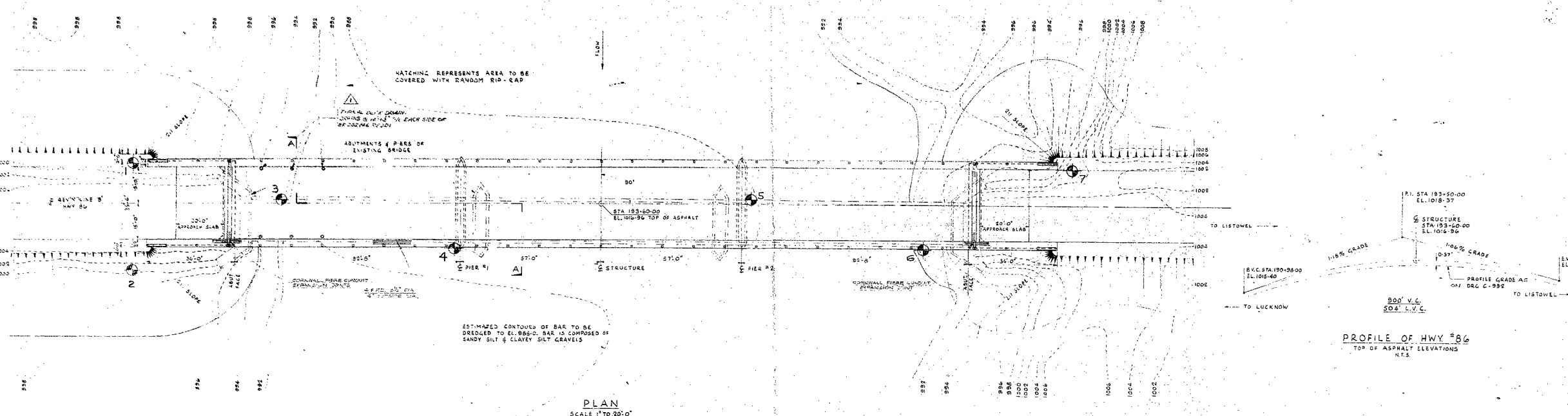
OVER MAITLAND

RIVER

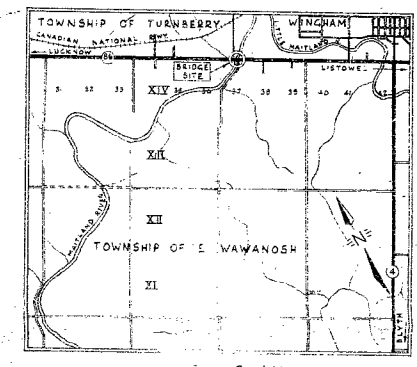


LEGEND			
● BORE HOLE			
HOLE	ELEVATION	STATION	DISTANCE FROM Q.
1	1004.0	191+70	22' LT.
2	1004.5	191+70	21' RT.
3	993.5	192+30	8' LT.
4	987.8	193+00	10' RT.
5	987.3	194+20	10' LT.
6	992.0	194+90	10' RT.
7	1004.5	195+50	22' LT.

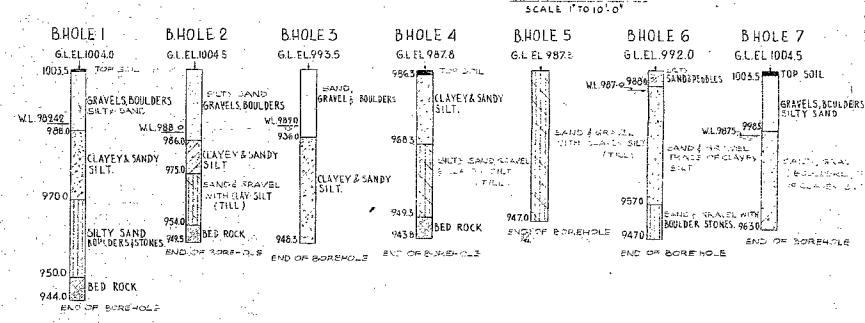
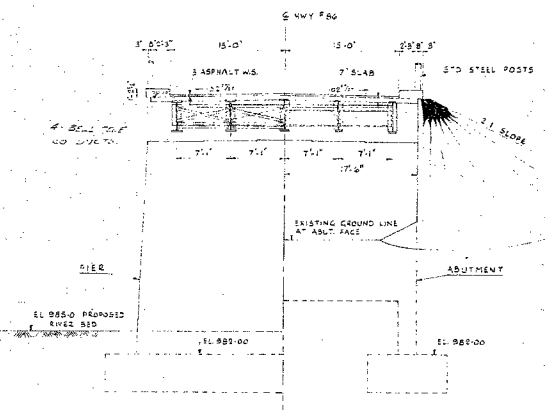
DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & RESEARCH SECTION			
PROPOSED NEW STRUCTURE AT MAITLAND RIVER AND HIGHWAY NO. 86			
ORIGINATED B. GHADIALI	DISTRICT NO. 3	DATE 7 DECEMBER 1960	
DRAWN D. NUMFORD	W.P. NO. 15-60	JOB NO. 60-F-92	
CHECKED <i>[Signature]</i>	SCALE	DRAWING NO.	
APPROVED <i>[Signature]</i>	1 INCH = 20 FEET	60-F-92A	



- LIST OF DRAWING**
- D-4846-1 GENERAL PLAN
 - D-4846-2 FOOTINGS
 - D-4846-3 DIM FOR ABUT'S WALLS & PIERS & ENDPOSTS
 - D-4846-4 REIN DET IN ABUT'S WALLS, PIERS & ENDPOSTS
 - D-4846-5 DETAIL OF BRG'S & EXPANSION JTS
 - D-4846-6 DETAILS OF DECK
 - D-4846-7 STRUCT STL DETAILS
 - D-4846-8 REIN STL SCHEDULE
 - D-4846-9 HANDRAIL DETAILS



PROFILE OF HWY #86
TOP OF ASPHALT ELEVATIONS
N.T.S.



BORE HOLE DATA
SCALE 1" TO 20' 0" VERT

NOTES

TO DISTRICT ENGINEER
CONCRETE WORK ON THIS STRUCTURE MUST NOT BE COMMENCED UNLESS THE BRIDGE OFFICE CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE DISTRICT ENGINEER.

TO CONTRACTOR
STRUCTURE TO BE BUILT IN ACCORDANCE WITH FORM NO. 9 AND THE BRIDGE OFFICE CONTROL POINTS WHICH MAY BE OBTAINED FROM THE DISTRICT ENGINEER.
MINOR REVISIONS SUPPLIED AND SEE THE STEEL CONTRACTOR FOR CONCRETE WORK.

ITEM	MINIMUM STRENGTH AT DAYS	MAXIMUM SIZE OF AGGREGATE
FOOTINGS	3000 PSI	1 1/2"
ALL OTHER CONCRETE	3000 PSI	1"

APPROVED SIGNATURES SUPPLIED BY THE CONTRACTOR WILL BE ADDED TO THIS CONCRETE AS SPECIFIED BY THE ENGINEER.

WORKING DATA
THE COMPLETE SOIL INVESTIGATION REPORT BA-1174 MAY BE EXAMINED AT THE BRIDGE OFFICE. DOWNSTREAM THE DEPARTMENT DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT OR THE ASSIGNED VERIFICATION SHOWN ON THESE PLANS.

LEAVE COVER ON REINFORCING STEEL.

FOOTINGS
ABUTMENT
DECK
PIERS
ENDPOSTS

CONSTRUCTION NOTES
A. EXPOSED EDGES TO BE CHAMFERED 1/4" EXCEPT AS NOTED.
B. ALL CONSTRUCTION JOINTS MUST BE APPROVED BY THE BRIDGE ENGINEER.
C. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BRIDGE SEAT DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF PLUS OR MINUS 1/8" INCH. IF THEY ARE CAST TOO HIGH THEY SHALL BE CUT DOWN BY THE GENERAL CONTRACTOR IF THEY ARE CAST TOO LOW THE GENERAL CONTRACTOR SHALL PROVIDE FULL BEARING SURF TO BRING THEM UP TO THE CORRECT ELEVATION. THE USE OF GROUT IS PROHIBITED.
D. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT THE FINAL DECK ELEVATIONS CONFORM WITH THE ELEVATIONS SHOWN.
E. NO CONCRETE SHALL BE PLACED ABOVE BRIDGE SEAT UNTIL CONCRETE IN DECK HAS BEEN PLACED.

5-20

DEPARTMENT OF HIGHWAYS-ONTARIO
BRIDGE OFFICE - TORONTO

ZETLAND BRIDGE
OVER MAITLAND RIVER
(1/2 MILES WEST OF VINHAM)

THE KING'S HIGHWAY NO. 86 & 25 / LINE 2 DIST. NO. 3
CD. HURON
TWP. TURNBERRY & E. WAWANOSH LOT 17.4.37 CORN. 2 & 4 XIV

GENERAL PLAN

APPROVED *Bill Long*
BRIDGE ENGINEER

DESIGN ENGINEER
DESIGN NO. 12-11
DATE 12-11-60

REVISIONS
DATE BY DESCRIPTION
12-11-60 D.R.H. LOCAL DECK DRAINAGE ADDED, POSTERIOR OLD FOOTINGS ADDED
12-11-60 C.992
12-11-60 B.N.376

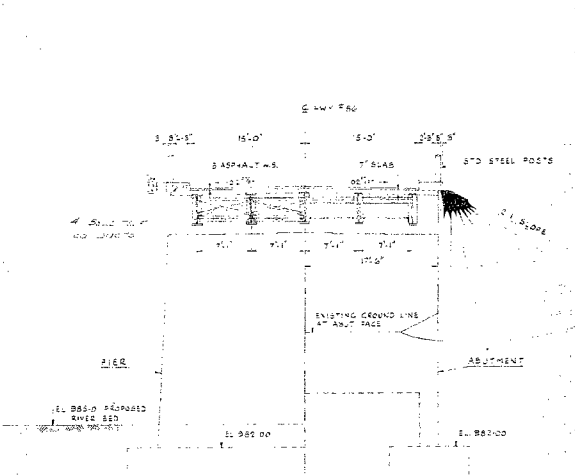
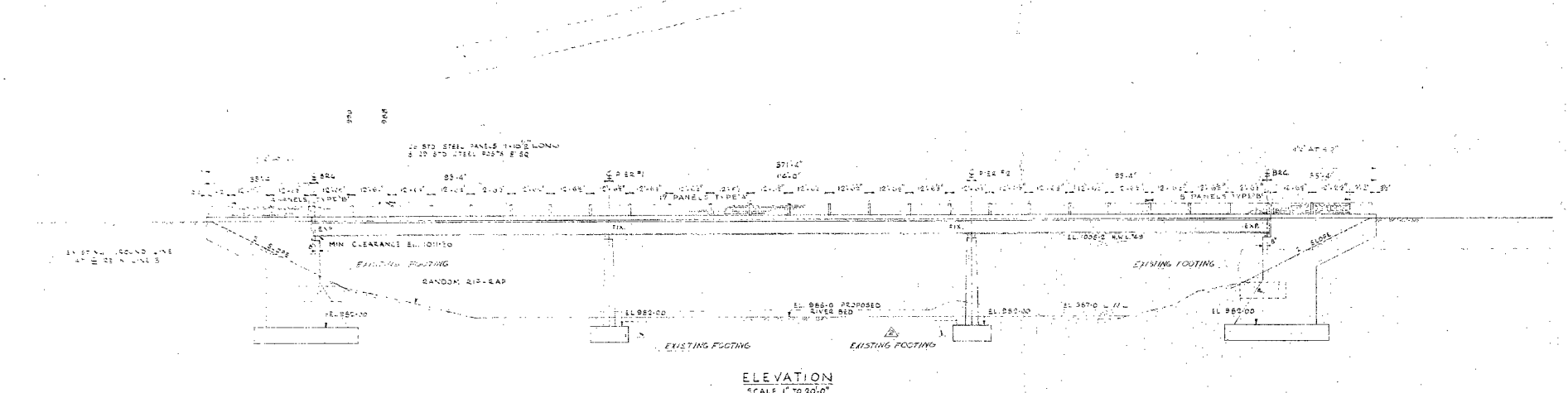
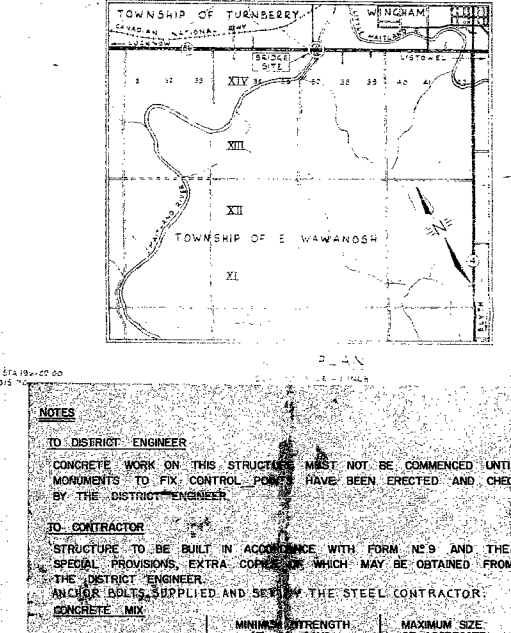
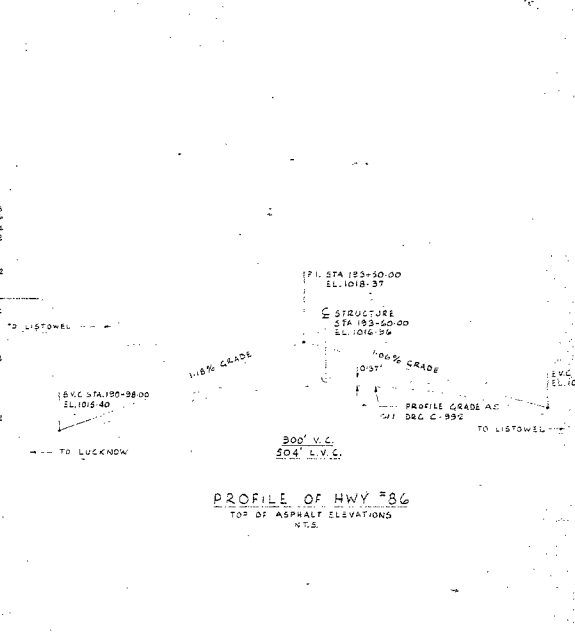
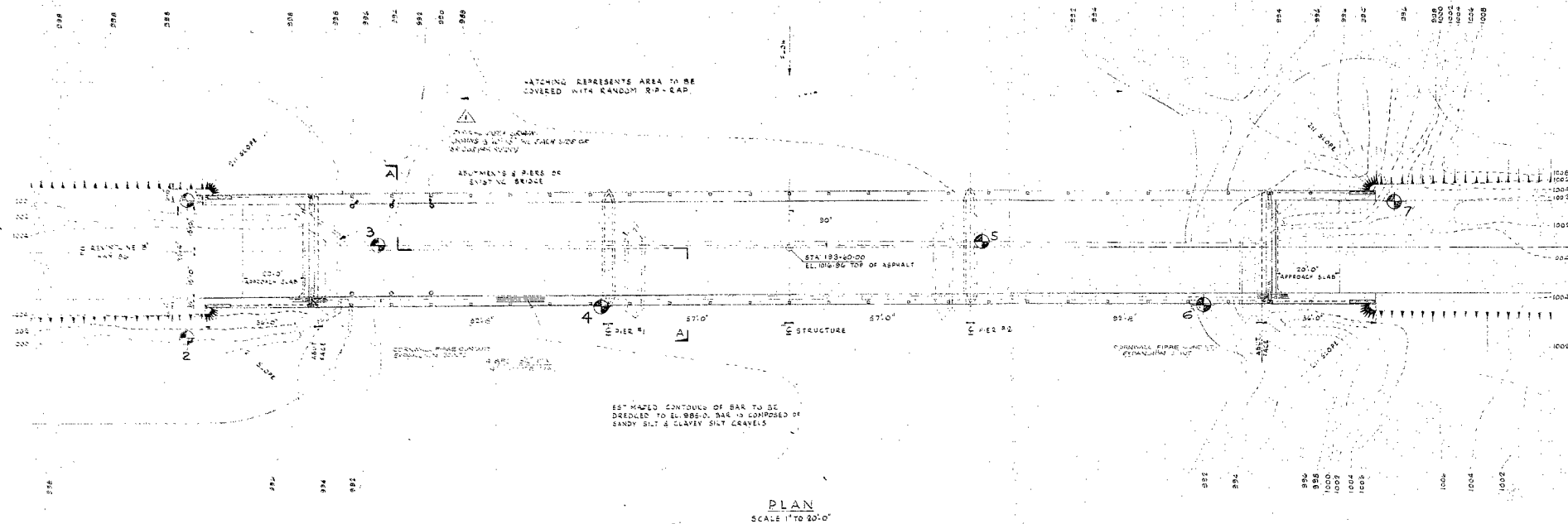
REFERENCE PLANS
12-11-60
12-11-60
12-11-60
12-11-60

CONTRACT NO. 12-11
LOADING 12-11
DRAWING NUMBER 12-11

DATE JUNE 1961

PRINT RECORD

NO.	FOR	DATE
1	FOR	12-11-60
2	FOR	12-11-60
3	FOR	12-11-60
4	FOR	12-11-60
5	FOR	12-11-60
6	FOR	12-11-60
7	FOR	12-11-60
8	FOR	12-11-60
9	FOR	12-11-60
10	FOR	12-11-60



NOTES

TO DISTRICT ENGINEER
CONCRETE WORK ON THIS STRUCTURE MUST NOT BE COMMENCED UNTIL MONUMENTS TO FIX CONTROL POINTS HAVE BEEN ERECTED AND CHECKED BY THE DISTRICT ENGINEER.

TO CONTRACTOR
STRUCTURE TO BE BUILT IN ACCORDANCE WITH FORM NO. 9 AND THE SPECIAL PROVISIONS, EXTRA CODES OF WHICH MAY BE OBTAINED FROM THE DISTRICT ENGINEER.
ANCHOR BOLTS SUPPLIED AND SET BY THE STEEL CONTRACTOR.
CONCRETE MIX

	MINIMUM STRENGTH AT 28 DAYS	MAXIMUM SIZE OF AGGREGATE
FOOTINGS	5000 P.S.I.	1 1/2"
ALL OTHER CONCRETE	5000 P.S.I.	3/4"

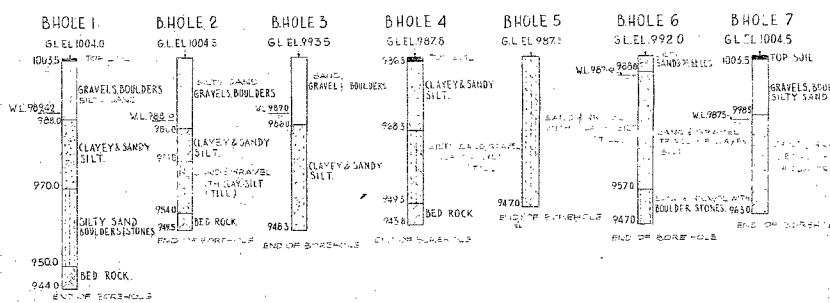
APPROVED MIXTURES SUPPLIED BY THE CONTRACTOR WILL BE ADDED TO ALL CONCRETE AS SPECIFIED BY THE ENGINEER.

BOILING DATA
THE COMPLETE SOIL INVESTIGATION REPORT BA 1174 MAY BE EXAMINED AT THE BRIDGE OFFICE. DOWNVIEW THE DEPARTMENT DOES NOT GUARANTEE THE ACCURACY OF THIS REPORT OR THE ABRIDGED VERSION SHOWN ON THESE PLANS.

CLEAR COVER ON REINFORCING STEEL
FOOTINGS 2" ±
ABUTMENT 2" ±
DECK 1/2"
HANDRAILS ENDPOSTS 2"

CONSTRUCTION NOTES
ALL EXPOSED EDGES TO BE CHAMFERED 1" X 1" EXCEPT AS NOTED.
ALL CONSTRUCTION JOINTS MUST BE APPROVED BY THE BRIDGE ENGINEER.
THE GENERAL CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BRIDGE SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF PLUS OR MINUS 1/8 INCH. IF THEY ARE CAST TOO HIGH THEY SHALL BE BUSH HAMMERED DOWN BY THE GENERAL CONTRACTOR. IF THEY ARE CAST TOO LOW THE GENERAL CONTRACTOR SHALL PROVIDE FULL BEARING SHIMS TO BRING THEM UP TO THE CORRECT ELEVATIONS. THE USE OF GROUT IS PROHIBITED.
THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT THE FINAL DECK ELEVATIONS CONFORM WITH THE ELEVATIONS SHOWN.
NO CONCRETE SHALL BE PLACED ABOVE BRIDGE SEAT UNTIL CONCRETE IN DECK HAS BEEN PLACED.

- LIST OF DRAWING**
- D-4846-1 GENERAL
 - D-4846-2 FOOTINGS
 - D-4846-3 DIM FOR ABUT'S WALLS & PIER & ENDPOSTS
 - D-4846-4 REIN FOR ABUT'S WALLS, PIERS, & ENDPOSTS
 - D-4846-5 DETAIL OF BRG'S & EXPANSION JOINTS
 - D-4846-6 DETAILS OF DECK
 - D-4846-7 STRUCT STL DETAILS
 - D-4846-8 REIN STL SCHEDULE
 - D-4846-9 HANDRAIL DETAILS



PRINT RECORD

NO.	FOR	DATE
1	FOR	1/2/61
2	FOR	1/2/61
3	FOR	1/2/61
4	FOR	1/2/61
5	FOR	1/2/61
6	FOR	1/2/61
7	FOR	1/2/61
8	FOR	1/2/61
9	FOR	1/2/61
10	FOR	1/2/61

REVISIONS

NO.	DATE	BY	DESCRIPTION
1	1/2/61	H.S.G.	ADDED DECK DRAIN'S ADDED TO POSTION OLD FOOTING ADDED

DEPARTMENT OF HIGHWAYS - ONTARIO
BRIDGE OFFICE - TORONTO

ZETLAND BRIDGE
OVER MAITLAND RIVER
(S.E. CORNER OF TOWNSHIP OF WINGHAM)

THE KING'S HIGHWAY NO. 6 - 1/2 MILE S. DIST. NO. 2
CD. HURON
TWP. TURNBERRY & WAWANOSH LOT 12 & 13 CON. 2 & 14

GENERAL PLAN

APPROVED
Carl Long
BRIDGE ENGINEER

DESIGN ENGINEER
Carl Long

DESIGN	CHECK	DATE	CONTRACT NUMBER	LOADING	DRAWING NUMBER
DESIGN	CHECK	1/2/61	102-11	H 20	D-4846-1
DRAWING	CHECK	1/2/61		H 20	
TRACING	CHECK	1/2/61		H 20	
DATE	JUNE 1961			H 20	

27 12 60-L

Mr. A. M. Teye,
Bridge Engineer.
Materials & Research

January 27, 1961.
D.H.O. FOUNDATION INVESTIGATION
(W.P.15-60,) W.J. 60-F-92

Attention: Mr. S. McCombie.

Re: Zetland Bridge Structure over Maitland
River, on Hwy. 86, Twp. of Turnberry and
E. Wawanosh, County of Huron, Dist. #13.

Attached to this letter we are forwarding to you the above-mentioned report for your further use. We believe that you will find in the report all the necessary information. However, should there be any other question in connection with the above-mentioned structure that you would like to discuss please feel free to call on our office.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per:

A. Stermac

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/tt

Attach.

c.c. Messrs. A. M. Teye (2)
H. A. Tregaskes
H. D. McMillan
G. K. Hunter
D. Foster
E. E. Saint
A. Watt
Foundations Office
Gen. Files ✓

TABLE OF CONTENTS

- 1) INTRODUCTION
- 2) DESCRIPTION OF SITE & GEOLOGY
- 3) DESCRIPTION OF FIELD & LABORATORY WORK
- 4) SUBSOIL CONDITIONS
 - (4.1) General
 - (4.2) Clayey Silt & Sandy Silt
 - (4.3) Silty Sand & Gravels
 - (4.4) Bedrock
- 5) WATER CONDITIONS
- 6) DISCUSSION & RECOMMENDATION
- 7) SUMMARY
- 8) MISCELLANEOUS

Foundation Investigation

For

Zetland Bridge Structure over
Maitland River, on Hwy. #86,
Twp. of Turnberry and E. Havanosh,
County of Huron, N.J. 60-F-92,
W.P.15-60, District #3.

1) INTRODUCTION:

A bridge structure has been planned to be rebuilt over Maitland River, approximately 2.4 miles E. S. of Jct. Hwy. #4 and Hwy. #86, in the County of Huron (Sta. 193+60 at E, Plan #2687-1). At this location proposed new Line B, of Hwy. #86 passes between lots 17 and 37.

A subsoil investigation was carried out at the site of this structure and this report contains the field and laboratory findings and recommendations for its foundation.

2) DESCRIPTION OF SITE & GEOLOGY:

The area on either side of Hwy. #86 is generally undulating and overgrown with grass, weeds and trees in some places. Building structures exist on either side, in the vicinity of the bridge. The concrete in piers and abutments of the existing bridge structure is spalling.

Boulders exist in abundance near the bridge structure as well as in the river bed. Flow of water in the river is in a N. East to S. West direction. A wire fence runs straight along the length of the bridge on its East side and approximately 30' from the centreline.

Geologically the site under consideration is located in the area of Kame Moraines. The Moraines of Southern Ontario were built either by

2) DESCRIPTION OF SITE & GEOLOGY: (Cont'd)...

a broad stream of ice advancing through the lowlands of Lake Ontario and Lake Erie or by the ice-sheet advancing from the north and pushing forward as a lobe in the basin of Lake Huron. The upland of peninsular Ontario has an elaborate array of moraines and spillways around it, the centre-place in this series being the Horse-shoe Port-Huron morainic system.

The Hattland River which enters Lake Huron, drains an area of approximately 1,000 square miles. Near Wingham, the valley of the river is insignificant in depth, as it winds its way through gravel trains and swamps between the drumlins. From Wingham, the river swings southwestwards through the morainic hills of Kawaroth township.

3) DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of seven sampled boreholes. The locations of the boreholes were chosen from the given Plan of the site (E2687-1) showing planned revisions. Huge boulders existing at the site had to be avoided, in setting up the standard core drilling machines used for the exploration programme. Conventional wash boring procedure was followed. Samples were recovered at depths required by means of a split spoon sampler. A 2" I.D. thinwalled Shelby sampler was used at one time, when the subsoil condition permitted, to obtain an undisturbed sample. Due to the typically gravelly nature of the subsoil, recovery of samples was generally poor. The dimension of the spoon sampler and the energy used in driving it, conform to the requirements of the Standard Penetration Test. Use of AXI and BXT core barrels had to be made for recovering rock samples.

Samples were visually examined and identified in the field before

3) DESCRIPTION OF FIELD & LABORATORY WORK: (Cont'd)...

being transported to the laboratory. Upon receipt in the laboratory, routine index tests and grain size distribution curves of a few typical samples were determined. Laboratory and field test results have been summarized and are given in Appendix I.

4) SUBSOIL CONDITIONS:

(4.1) General: The investigation has shown, the general stratification of the subsoil to be irregular. In borings 1, 2 and 7 which were drilled from an higher elevation (1004.5'), roadfill and bouldery material was found up to 14' to 16' depth. This fill material consists of a heterogeneous mixture of silty sand, gravels and boulders, which is generally in a dense state of packing. In borings 3 and 6, this fill material was traced to a depth of 4' to 6'.

Below the above-mentioned layer of fill material, subsoil generally consists of clayey silt and sandy silt followed by a layer of silty sand, gravel and boulders. Below these layers pitted dolomite or dolomitic limestone was recovered in borings 1, 2 and 4.

In the order of stratigraphic succession, the following soil types are defined.

(4.2) Clayey Silt and Sandy Silt:

Below the topsoil and roadfill material, a layer of clayey silt and sandy silt was encountered. This layer is quite distinct in borings 1, 2 and 4 and its depth varies from 12' to 18' (up to Elev. 970'). In the remaining borings, though, clayey silt material is present, it is not

4) SUBSOIL CONDITIONS: (Cont'd)...

(4.2) Clayey Silt and Sandy Silt:

to a marked depth and there is no definite boundary between it and the lower layer containing gravels.

In general, the density of the layer can be described as medium dense. It contains on the average 64 p.c. Silt, 23 p.c. clay and 13 p.c. sand. Moisture content is approximately 18 p.c.

(4.3) Silty Sand and Gravels:

This layer of sand and gravel with a small amount of clay and silt as a binding material, was encountered in all the borings.

The thickness of this layer is approximately 20', in borings 1, 2 and 4 where it is separated from the above-mentioned layer of clayey silt.

In the remaining borings, its thickness is approximately up to 40'. Due to the presence of excess gravel and boulder stones in some places, the recovery of the material, while sampling, was poor and no estimate can be made as to the percentages of its constituent materials.

In general, the density of this layer is dense to very dense with increasing depths, but a couple of isolated pockets of medium dense material were also encountered in borings 4 and 6.

(4.4) Bedrock: Below the layer of sand, gravel and boulders, dolomitic limestone or pitted dolomite bedrock was encountered. It was recovered in borings 1, 2 and 4 at respective elevations of 950', 954' and 949.5'. In the remaining borings except in boring 7, hard rock surface was encountered

(4.4) Bedrock: (Cont'd)...

at approximately the same elevations as above, but no core-drilling was undertaken to recover the bedrock.

In boring 7, drilling was stopped in the sand and gravel layer at an elevation of 763'.

5) GROUND WATER CONDITIONS:

Observation and measurements carried out during boring and sampling operations indicate that the water table lies between elevations 987' and 989'. Exact water level elevations for each borehole are given in the logsheets appended to this report.

An artesian water condition was observed in boring 4, at approximate elevation of 950'. Level of water was observed to rise 1' above the ground level in the casing.

Level of water in the river was found to vary, depending on the rainfall in the vicinity. The maximum level of water in the river was observed to be of approximate elevation 991' and the minimum at 987', during the period of this investigation.

6) DISCUSSION AND RECOMMENDATIONS:

First considering the N. W. abutment footing and referring to the bore logs for borings 1 and 2 appended to this report, it can be seen that the upper layer of boulders and gravels below the roadfill, is competent to take the load of the proposed structure.

From the average 'N' value of 45, considering this layer as a

6) DISCUSSION & RECOMMENDATIONS: (Cont'd)...

cohesionless material, an allowable bearing load of 2.5T/sq. ft. can be applied to spread footings approximately 6' wide, at elev. 992' or below and taking into account a factor of safety of 3.

Considering the S.E. abutment footing and referring to boring 7, it is found that the layer of sand and gravelly material is competent to take the load of the proposed structure. From the average minimum 'N' value of 50, an allowable bearing load of 3.0T/sq. ft. can be applied to spread footings approx. 6' wide at an elev. 992' or below and taking into account a factor of safety of 3.

Similarly, for the centre supports (borings 3, 4, 5 and 6), an allowable bearing load of 2.5T/sq. ft. can be applied to spread footings founded at elev. 982' or below.

Settlements resulting from the application of the above-mentioned recommended bearing pressures will be within tolerable limits. It is our opinion that the settlement will be negligible because the ground is already preloaded by the existing structure.

Pending on the water conditions at the site during construction the excavation and dewatering may or may not present a serious problem. In case of a high level, it is most likely that the pier foundation excavations would have to be carried out under water and a tremie concrete slab poured. If an attempt would be made to pump the water out of the excavation prior to pouring the tremie concrete, a serious danger of "piping" occurring would be created. It is also highly improbable that sheeting could be used effectively due to the presence of relatively large boulders which create an

Cont'd /7 ...

6) DISCUSSION & RECOMMENDATIONS: (Cont'd)...

obstacle to driving.

In case of a low water table (elev. 987' or lower), the water from the excavation could be pumped out without creating dangerous piping conditions. If the inflow of water into the excavation cannot be controlled with pumps again underwater concreting would have to be resorted to.

Because of the above-mentioned difficulties resulting from a high water table, it is strongly recommended that the construction of the structure be scheduled for the period of the lowest water table. A considerable saving could thus be achieved.

No problems are foreseen in connection with the stability of approach fill slopes.

7) SUMMARY:

a) Subsoil of the investigated site below the top soil and roadfill material and boulders, consists of clayey silt and sandy silt followed by a layer of sand, gravel and boulders with some clayey silt, above pitted dolomite or dolomitic limestone bedrock.

b) Subsoil conditions are such that spread footing support can be obtained. Recommended footing elevations are:

972' or below for the Abutments and

982' or below for the centre supports.

An allowable bearing pressure of 2.5T/sq. ft. can be used for the S.E. Abutment and centre supports and 3.0T/sq. ft. can be used for the S.W. Abutment. Settlements consequent upon application of these bearing pressures will be within tolerable limits.

Cont'd /8 ...

7) SUMMARY: (Cont'd)...

d) Dewatering problems at the site may be encountered during construction. Recommendations contained in the report should be considered when decisions referring to foundation excavations and concrete pouring are being made.

e) No approach fill stability problems are anticipated.

8) MISCELLANEOUS:

The field work was commenced on Nov. 16, 1960, and completed by December 1, 1960, under the supervision of Mr. B. Ghadiali of our Section. Equipment was owned and operated by Longyear Co. of North Bay, Ontario.

REPORT PREPARED BY:

for

M. Savat

B. Ghadiali,

Project Foundation Engr.

January 1961.

REPORT APPROVED BY:

A. G. Stermac

A. G. Stermac,

Foundation Office Engr.

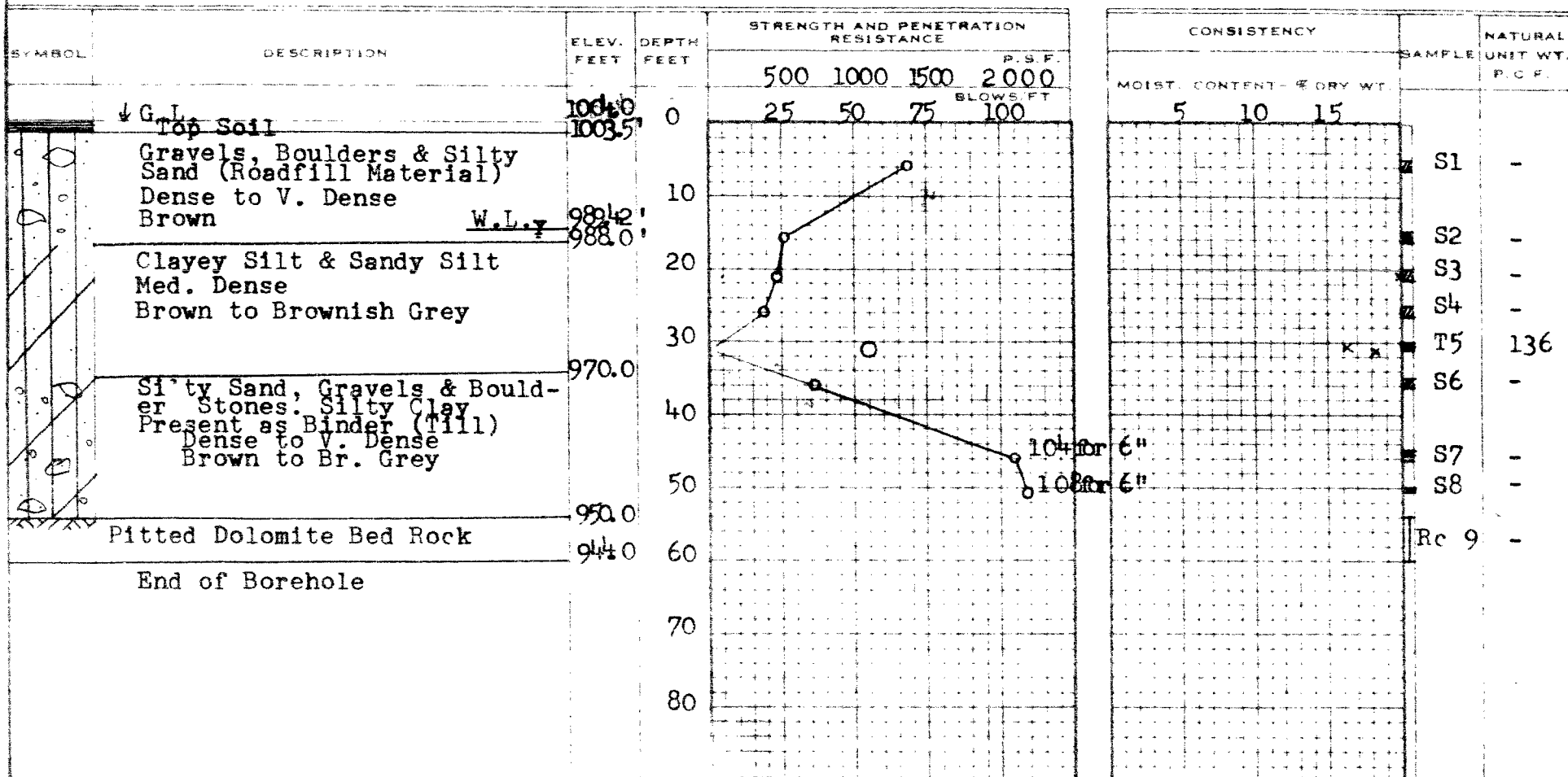
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 1
 JOB 60-F-92 STATION 191 + 70 (22' Lt)
 DATUM 1004.0' COMPILED BY BK.
 BORING DATE Nov. 16/60 CHECKED BY B.M.G.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
 VANE TEST (C) AND SENSITIVITY (S) +
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT X
 PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO

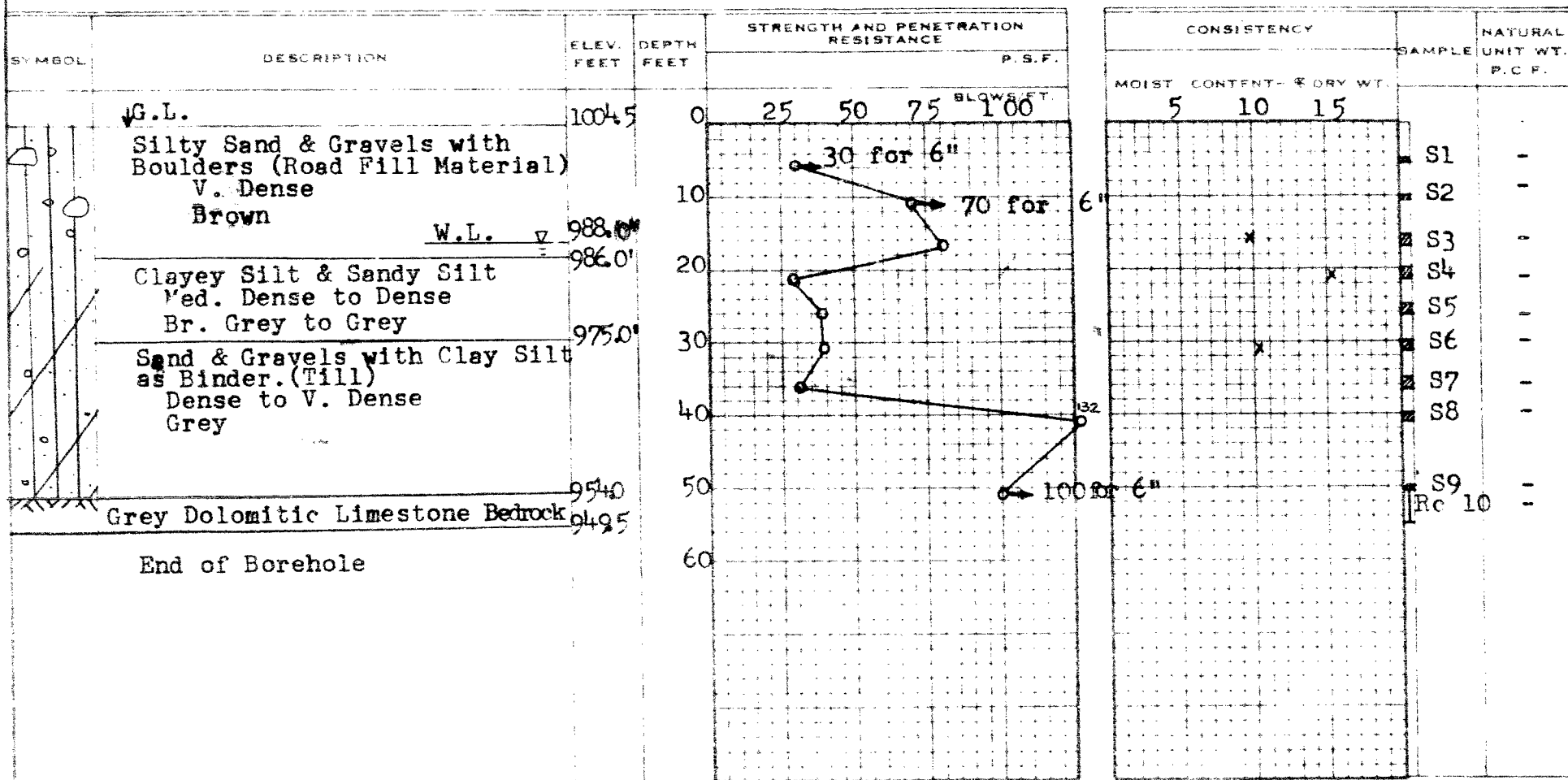
MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 2
 JOB 60-F-92 STATION 191+ 70 (21'Rt)
 DATUM 1004.5' COMPILED BY B.K.
 BORING DATE Nov. 21/60 CHECKED BY B.M.G.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — ○
 VANE TEST (C) AND SENSITIVITY (S) — +
 NATURAL MOISTURE AND LIQUIDITY INDEX — X
 LIQUID LIMIT — —
 PLASTIC LIMIT — —



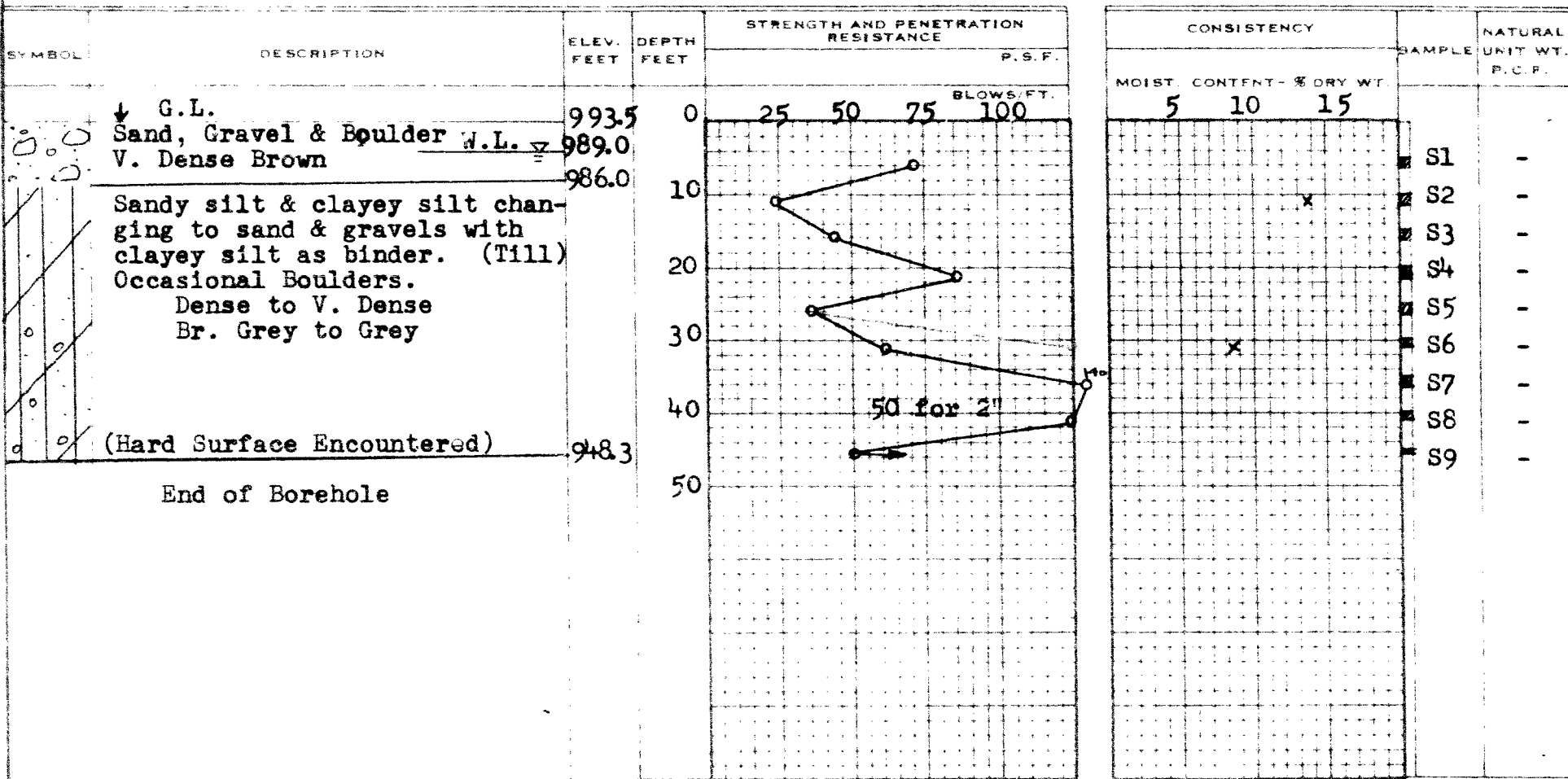
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.F. 15-60 BORE HOLE NO. 3
JOB 60-F-92 STATION 192 + 30 (8' LT)
DATUM 993.5' COMPILED BY B.K.
BORING DATE Nov. 21/60 CHECKED BY B.M.G.

LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 4

JOB 60-F-92 STATION 193 + 00 (10' Rt)

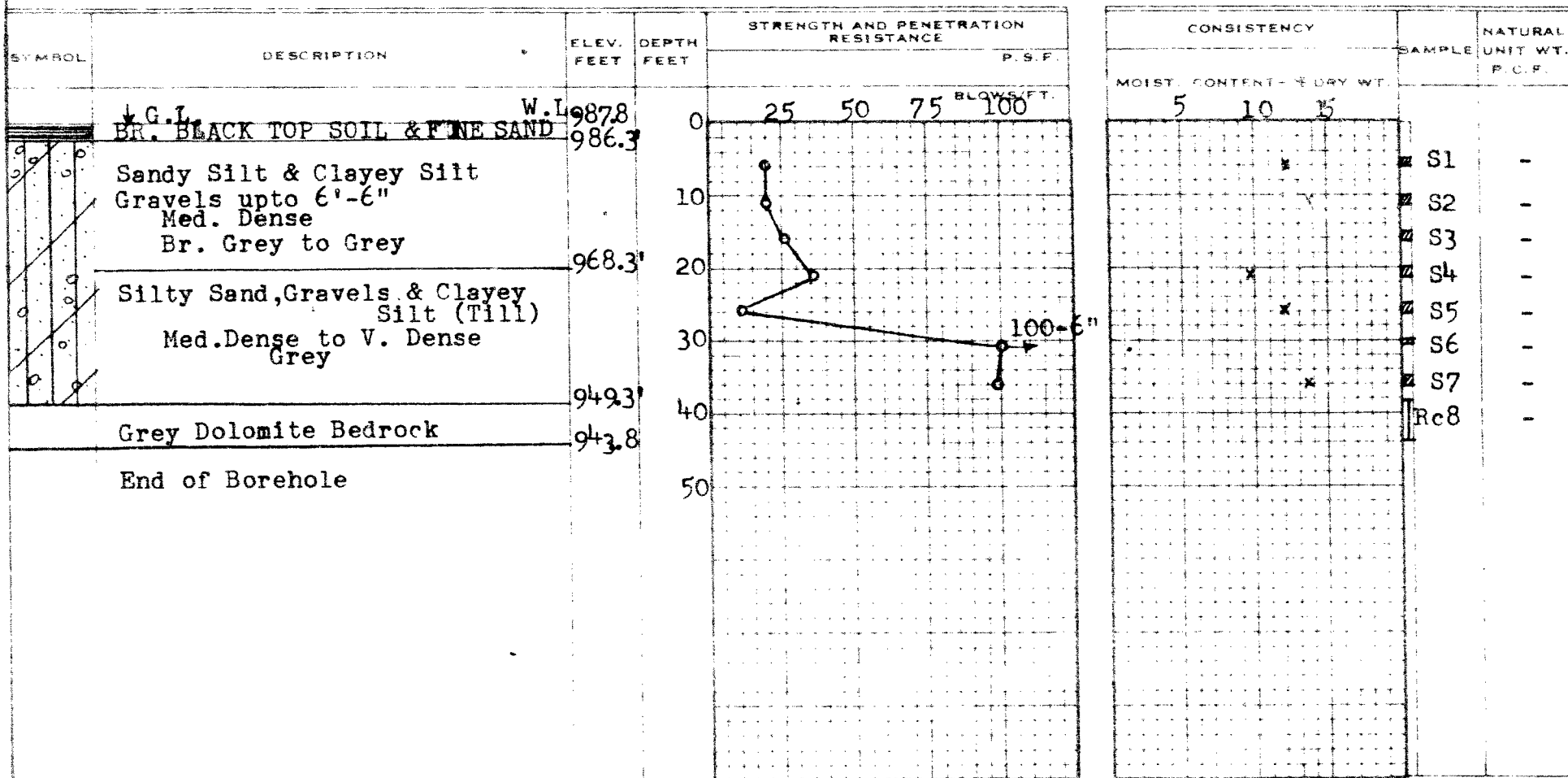
DATUM 987.8' COMPILED BY B.K.

BORING DATE Nov. 23/60 CHECKED BY B. M. G.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONTAINED COMPRESSION (Qu) — ○
 VANE TEST (C) AND SENSITIVITY (S) — +
 NATURAL MOISTURE AND LIQUIDITY INDEX — X
 LIQUID LIMIT — —
 PLASTIC LIMIT — —



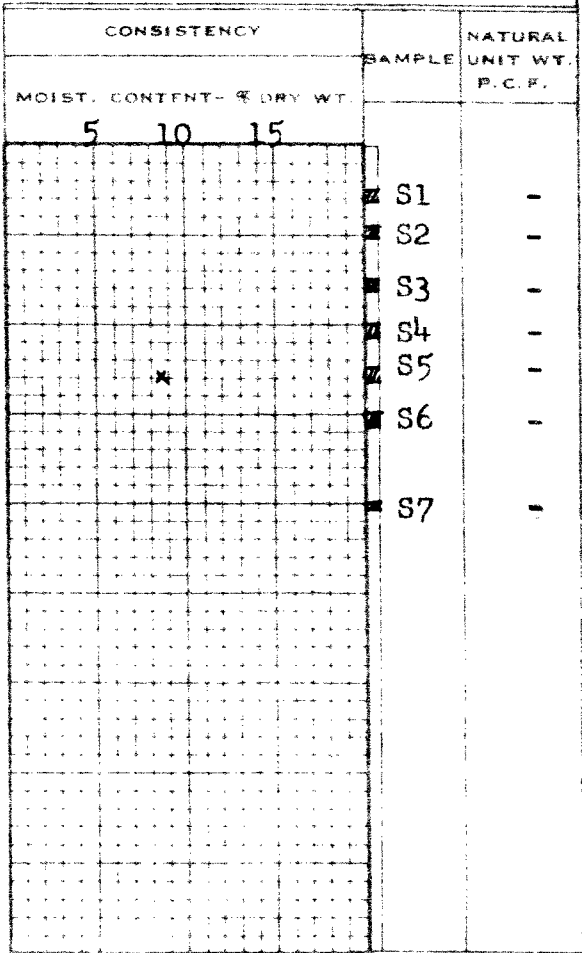
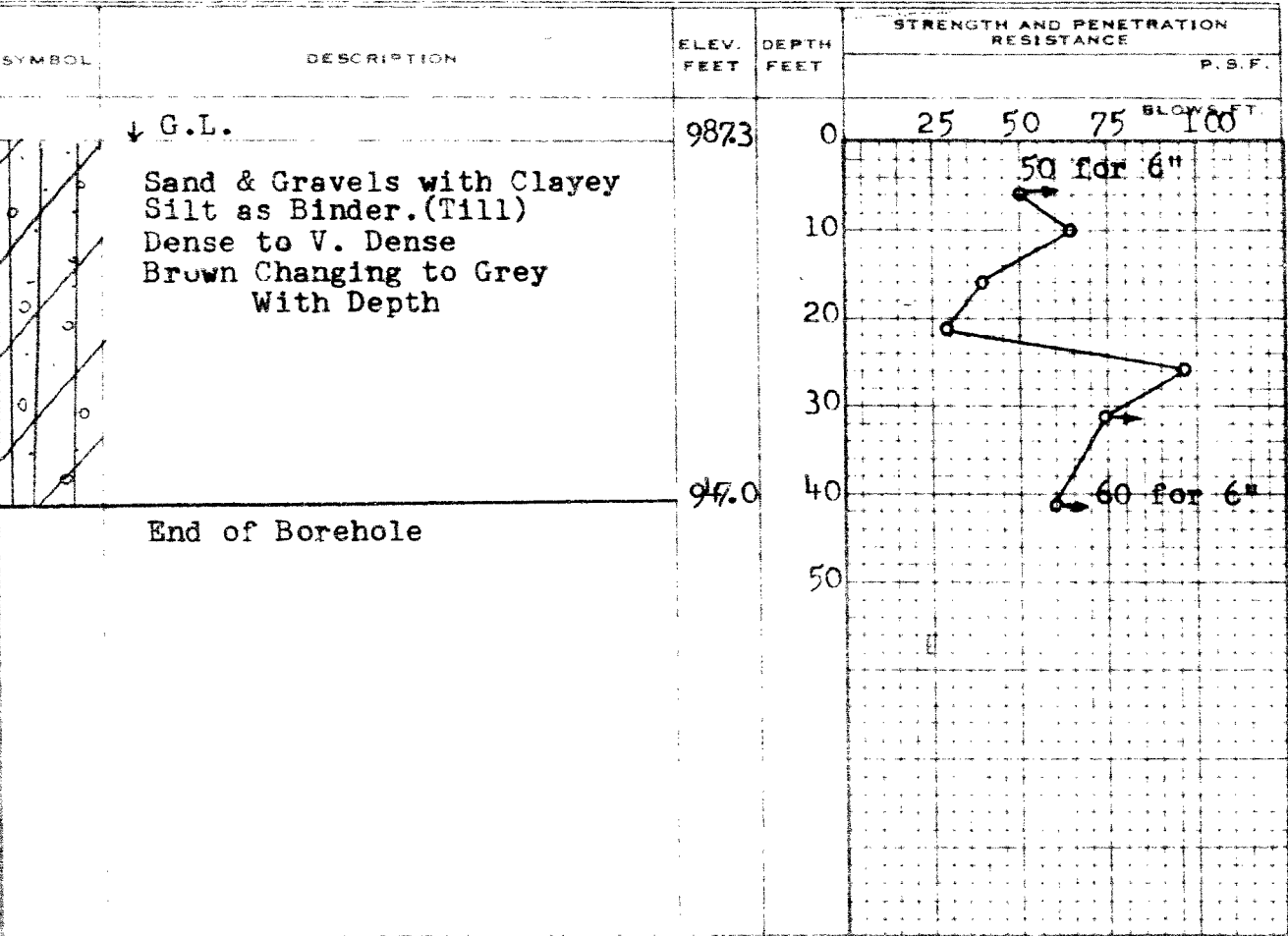
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 5
JOB 60-F-92 STATION 194+20(10' Lt)
DATUM 987.3' COMPILED BY B.K.
BORING DATE Nov. 28/60 CHECKED BY B.M.G.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX LI
LIQUID LIMIT X
PLASTIC LIMIT



DEPARTMENT OF HIGHWAYS - ONTARIO

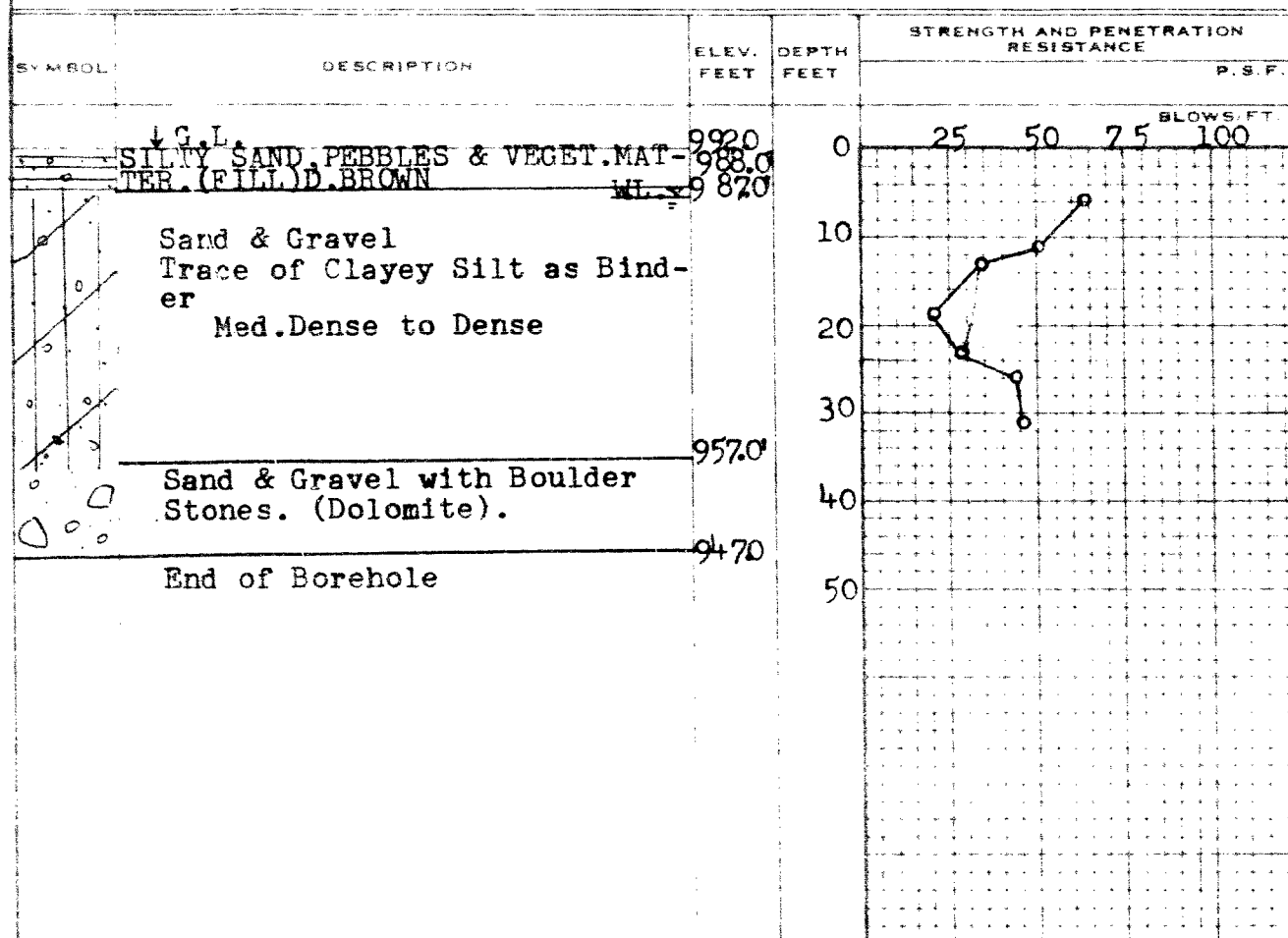
MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 6
 JOB 60-F-92 STATION 194+90(10'Rt)
 DATUM 992.0' COMPILED BY B.K.
 BORING DATE Nov. 29/60 CHECKED BY B.M.G.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) \bigcirc
 VANE TEST (C) AND SENSITIVITY (S) $+$
 NATURAL MOISTURE AND LIQUIDITY INDEX \times
 LIQUID LIMIT \bigcirc
 PLASTIC LIMIT $-$



CONSISTENCY	SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.		
	S1	-
	S2	-
	S3	-
	S4	-
	S5	-
	S6	-
	S7	-
	Rc8	-
	Rc9	-
	Rc10	-

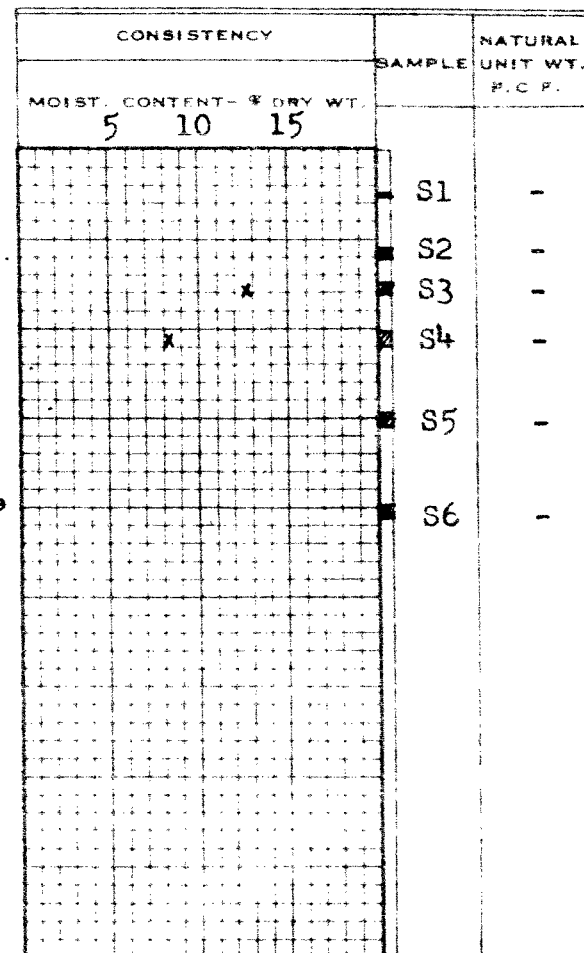
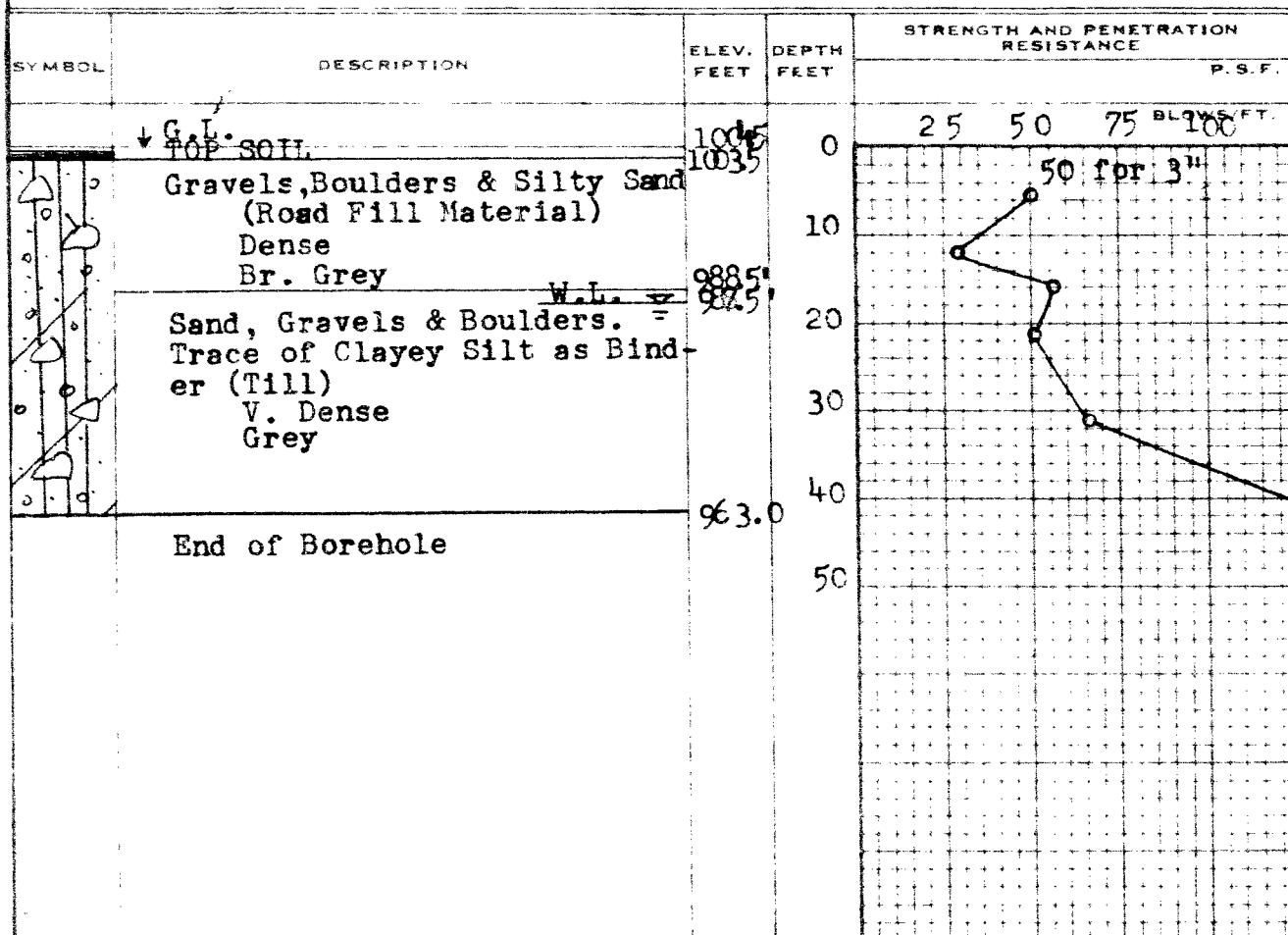
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS AND RESEARCH SECTION

W.P. 15-60 BORE HOLE NO. 7
 JOB 60-F-92 STATION 195 + 50 (22' Lt)
 DATUM 1004.5' COMPILED BY B.K.
 BORING DATE Nov. 24/60 CHECKED BY B.M.G.

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 2" SHELBY
 CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
 VANE TEST (C) AND SENSITIVITY (S) +
 NATURAL MOISTURE AND LIQUIDITY INDEX LI
 LIQUID LIMIT X
 PLASTIC LIMIT



JOB 60-F-92

W.P. 15-60

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-92

W.P. 15-60

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-92

W.P. 15-60

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-92

W.P. 15-60

[illegible]

JOB 60-F-92

W.P. 15-60

[illegible]

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-92

W.P. 15-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
7	S5	29.5'-31'	Sand & Gravels with Clayey Silt. (Till) V. Dense. Grey	66	-	-	-	-	-	
	S6	40'-41.5'	" " " " " "	139	-	-	-	-	-	
			S Denotes Split Spoon T " Shelby tube Rc " Rock Core							

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-F-92

W.P. 15-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
7	S5	29.5'-31'	Sand & Gravels with Clayey Silt. (Till) V. Dense. Grey	66	-	-	-	-	-	
	S6	40'-41.5'	" " " " " "	139	-	-	-	-	-	
			S Denotes Split Spoon T " Shelby tube Rc " Rock Core							

23-62-60

Mr. L. R. Eadie,
Superintendent of Engineering
Audit,
Room 314C, Lab. Bldg.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials and Research Division.
October 25, 1962.

Force Account Certificate No. 1,
Contract #62-60,
Hwy. #86, District #3,
Zetland River Bridge.

Further to Mr. McKim's memo to you, dated October 22nd, 1962, it appears that some additional explanations could be helpful.

It is true that at a meeting in Mr. H. A. Tregaskes' office, attended by Messrs. E. Panter, A. P. McKim and myself, the conclusion was reached that the Department should pay for the additional cost of the well points.

One of the main reasons for this decision was the fact that no other bidder provided for dewatering, any considerably larger sum than the contractor who was the successful bidder, and it was therefore concluded that probably the information presented by the Department was either not adequate or not clear.

Also, because in the past, similar problems were treated in the above-mentioned way, i.e., that the Department absorbed the cost, and this probably not being a very clear-cut case, no exception was made.

However, it remains our opinion that the unfavourable conditions were created by the contractor's action. Mr. McKim in his memo, quotes a sentence of the foundation report which, if read by itself, could lead to an erroneous conclusion. The sentence reads: "In case of a low water table (elev. 937.0' or lower) the water from the excavation could be pumped out without creating dangerous piping conditions." Since the water level in the river at the time of the construction was at elevation 937' or 938', it would appear that boiling should not have occurred.

The above-quoted sentence from the foundation report has to be read in conjunction with the recommended footing elevations as they appear on page 7 of the report. For the centre supports the recommended footing elevation is 932' or below. Naturally, the boiling provision refers to elev. 932', and for any deeper excavation, the river water level would have to be accordingly lower.

Mr. L. R. Eadie,
Supt. of Engineering Audit.

October 25, 1962.

We would admit that the above-mentioned presentation is not the best possible one, but since the possibility of boiling was mentioned, a more precise study of the report should have been made, and with a little effort, the meaning would have become apparent to the Contractor.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeP

cc: Messrs. H. A. Tregaskes
A. E. McKim
A. Putke
L. D. Barrett

Foundations Office L
Gen. Files.

Mr. A. Rutka,
Materials & Research Engineer,
Materials & Research Section,

Mr. L.R. Radie
Superintendent of Engineering
Audit,
Room 314C, Lab. Bldg.,

A.E. McKin,

October 22, 1962

Force Account Certificate No.1,
Contract #62-60,
May #86, District 3,
Zetland River Bridge,

Further to Mr. Stermac's memorandum of October 15 and your memorandum of October 1 to Mr. Tregaskes, the Bridge Division would like to make the following comments.

The events leading to the "quick" condition are as outlined in Mr. Stermac's memorandum. However we cannot agree with his statement that the unfavourable conditions created in the excavation were the responsibility of the contractor and were caused by incorrect construction procedure. While the soil report does warn of a serious problem of excavation and unwatering during high water, it does make the following statement. "In case of a low water table (elev. 987' or lower) the water from the excavation could be pumped out without creating dangerous piping conditions."

We understand that the water level in the river was 987' at the time of construction.

A meeting was held in Mr. Tregaskes' office which Mr. Stermac and I attended before it was decided to proceed with unwatering by well points, and it was agreed that the Dept. should pay for the additional cost of the well points.

We heartily agree with the last two paragraphs of Mr. Stermac's memorandum and would be very pleased to see a meeting arranged with all sections concerned to try and improve the present practice and policy.

A.E. McKin
Bridge Control Engineer

AEMCK/dm
c.c. H.A. Tregaskes
A. Rutka
L.D. Barrett

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

Mr. L. B. Eadie,
Superintendent,
Engineering Audit.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

October 15, 1962.

Force Account Certificate No. 1,
Contract 62-60

We are in receipt of a copy of your memo dated October 1st, to Mr. H. A. Tregaskes, Construction Engineer, concerning the above-mentioned Force Account Certificate. In connection with the part the Foundation Section has played in this particular contract, we would like to make the following comments:

A request to visit the site was received by this Section on June 21, 1962. The next day, Friday, June 22nd, Mr. A. G. Stermac, Principal Foundation Engineer, visited the site and acquainted himself with the conditions at the site.

The Contractor was working at that time on the excavation of the west pier foundation and had encountered 'quick' conditions. The excavation was carried out with a backhoe and the water was removed from the excavation by pumping. Since the pier location was partly within the river bed, an earth cofferdam was built and the river diverted. The river water elevation was about 988 at the time of the field visit, while piping and excavation bottom instability was observed when the excavation reached approx. elevation 980. At this elevation, a certain change of soil type was also observed, the material below being more silty and sandy, the one above being clayish.

From the above-mentioned elevations, it can be seen that an unbalanced hydraulic head of approx. 8 ft. - (988.0 to 980.0), was created in the excavation. As more pervious material, more susceptible to boiling (silt and sand), was encountered at elevation 980, instability of excavation bottom was a natural occurrence.

The possibility of boiling and excavation bottom instability was mentioned in the Foundation Report (W.J. 60-F-92), prepared by this Section and submitted in January, 1961. At that time, the use of tremie concrete was suggested because it was felt that the use of sheet piling would prove to be ineffective due to

Mr. L. R. Eadie,
Superintendent,
Engineering Audit.

October 15/62.

the presence of boulders in the upper layer.

The reasons for the encountered instability as outlined above, were also explained to the Contractor at the site. However, he did not agree with our explanation, insisting that the instability is due to artesian water conditions.

An artesian condition was reported in the Foundation Report in B.H. #4, which is at this pier location. However, the artesian condition was not registered before the borehole reached approx. elevation 950 - i.e., just before bedrock. This being some 30 ft. below the excavation bottom, it was ruled out as the cause of the boiling and piping.

The boiling and piping disturbed and loosened the subsoil to a certain extent, and two alternatives were therefore considered as remedial measures:

Piles driven to bedrock or refusal in the till layer, or well points to dry out and reconsolidate the ground allowing spread footings to be built as designed. The latter was chosen and applied with satisfactory results. The lowering of the ground water table at the west abutment location with the well points in operation around the west pier excavation, is evidence that artesian pressures were not the cause of boiling and piping.

Steel sheet piling was not considered because of two reasons: first, the presence of boulders that could invalidate their use, and second, the sheet piles, if driven to required depth, would enable excavating without further boiling, but would not contribute in any way, to the improvement of soil density decreased by boiling.

It was and it still is our opinion that the unfavourable conditions created in the excavation were the responsibility of the Contractor and were caused by incorrect construction procedure. It was our impression that the Contractor is unaware that a boiling condition can be created by an unbalanced hydraulic head and therefore, the presence of the 3-ft. higher river water level just adjacent to the excavation, caused no concern to him.

It has been our impression in a number of instances in the past, that the causes and mechanics of boiling or piping, are completely unknown to the Contractors and, consequently, they neither realize when and how this could and would occur. Because

cont'd. /3 ...

Mr. L. M. Eadie,
Superintendent,
Engineering Audit.

October 15/62.

of this, they very often do not take the necessary steps, nor do they use the correct construction procedures and sequences. This, of course, is also very often reflected in the way they bid on the jobs. Not having bid correctly on a job because of not having realized the problems that can be encountered, should not backfire on the Department, but on the Contractor. The lowest bids should be the result of competence, skill, ability and ingenuity of the bidder - not of his ignorance and incompetence.

This matter, it appears to us, requires further study and clarification, and we feel that a meeting at which all the concerned agencies of the Department would participate, could contribute to the improvement of the present practice and policy.

AGS/MdeF

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. H. A. Tregaskes
A. M. Toye
A. Putka
L. T. Barrett
J. M. Crannie

Foundations Office
Gen. Files.

Mr. H.A. Tregaskes,
Construction Engineer,
LABORATORY BUILDING.

L.R. Eadie,
Engineering Audit.

October 1, 1962

Force Account Certificate #1-
Contract 62-60

The above noted Force Account was received in this office September 27, 1962, in the sum of \$6,230.79. Since the contract contains an item for "Unwatering" which in effect states, that for the lump sum bid he shall supply all equipment and perform all work necessary to pour the concrete in the dry, we reviewed the matter further to determine why separate payment was being made.

Attached is a copy of J.M. Crannie's Office Audit Report of September 21, 1962, which discusses this subject and indicates that an artesian water condition in the excavations created the difficulty in unwatering. The Foundation Section was consulted and it was their opinion that well pointing was the only feasible solution to the problem. This work was carried out and is presently being submitted as a Force Account. The basis of reasoning is, of course, that the condition was abnormal and not indicated in the information to bidders and was, therefore, not included in the Contractor's estimate of costs. We have reviewed all the bid prices for unwatering on the contract and of ten bids received the average bid for this item was approximately \$2,600. One bid was for \$11,320., which was well out of line with the other bids and, excluding this particular bid, the average of the other nine bidders would have been approximately \$1,680. Since Mowbray bid \$1,500, his price was very close to the average and it is obvious that he did not anticipate the costs encountered.

However, there is a notation on Bridge drawing #D-4846-1 in the contract which states, that a complete soil investigation report B.A.1174 may be examined at the Bridge Office since the information contained on the bridge drawings is abridged and is not guaranteed. The drawing itself shows the location of the seven bore holes, with a side elevation diagram of each bore

continued.....

October 1, 1962

hole, indicating the elevations and nature of the various materials encountered. This particular information on the drawing does not necessarily indicate any severe water problem, although it does indicate that material is of a sandy, silty nature, which naturally could be susceptible to weeping or piping under pressure. The information in report B.A. 1174 is more specific, and we refer you to pp.5,6 and 7 specifically, from which we take the following quotations; "An artesian water condition was observed in boring 4, at approximate elevation of 950'. The level of water was observed to rise 1' above the ground level in the casing. - Pending on the water conditions at the site during construction the excavation and dewatering may or may not present a serious problem. In case of a high level it is most likely that the pier foundation excavations would have to be carried out under water and a tremie concrete slab poured. If an attempt would be made to pump the water out - a serious danger of "piping" occurring would be created. - In case of a low water table, (elevation 987' or lower), the water - could be pumped out without creating dangerous piping conditions. If the inflow of water into the excavation cannot be controlled with pumps, again unwatering concreting would have to be resorted to."

It would seem that a Contractor reading this information should have serious thoughts about the water problem, especially with regard to the information on bore hole 4, which had artesian pressure to an elevation of approximately 989'. Possibly the drawings themselves did not emphasize the problem enough, and indeed no provision appears to have been made for tremieing concrete, which was a suggested possibility in the soils investigation. On the other hand, the solution used is entirely different than originally proposed.

As you are aware there have been other similar instances where the Contractor has resorted to well-point dewatering and has been paid his costs. Although this well-pointing appears to be a definite departure from common unwatering methods there are no doubt other instances where the change is not as radical, but might involve digging deep sumps and increase the rate of pumping which, by the same basis of reasoning, could merit extra payment by Force Account. We submit the foregoing information for your consideration.

cc. A.M. Tpye,
A. Rutka,
L.D. Barrett,
J.W. Crannie
DMH/m.

D.M. Hopper, for
L.R. Eadie, Superintendent,
Engineering Audit.

OFFICE LOCATION -
DOWNSVIEW AVE.,
KEELE ST. - HIGHWAY 401
TORONTO, ONTARIO.



ONTARIO
DEPARTMENT OF HIGHWAYS

POSTAL ADDRESS -
DEPARTMENT OF HIGHWAYS
PARLIAMENT BUILDINGS,
TORONTO 5, ONTARIO.

October 10, 1962

Mr. A. Stermac,
Principal Foundations Engineer,
Department of Highways,
DOWNSVIEW, Ontario.

Dear Sir:

Re: Force Account Payment for
Unwatering Contract #62-60,
Stratford District

Attached find the pertinent portions of Mr. J.M. Crannie's report on the above contract, referred to in our memo to Mr. Tregaskes, dated October 1, 1962, as requested by yourself.

You will note that Mr. Crannie raises the query as to whether we should make full payment under the lump sum for unwatering, since it is possible that the amount of normal pumping has been reduced by the use of the well-point system. Possibly you could offer some opinion yourself on this matter.

Yours truly,

A handwritten signature in cursive script, appearing to read "D.M. Hopper".

D.M. Hopper, for
L.R. Eadie, Superintendent,
Engineering Audit.

DMH/m.
att.

ITEM #54 - FABRICATE & PLACE CUT-WATERS:

Tender: Lump Sum

P.Q.R.: 100%

This item, is recorded in book #1, page 63, noting the date cut-waters fabricated and placed July 30th, 1962, Payment of 100% approved.

FORCE ACCOUNTS:

August 7th, and 24 1962 -

Force account time allowed for cutting steel bars, delivered to the contract too long to be used in the structure. Force account standby time, for contractor's equipment on the contract awaiting instructions on an investigation being made to determine the method for the foundations. Standby time allowed for front end loader and drag-line. Standby time allowed only while the units were not working.

Time allowed 10½ hours per day for June 22, 25, 26, 27, 28 and 29. Total allowance for these dates for the drag-line and front end loader is 63 hours. Additional standby time, allowed the front end loader - July 3, 7½ hours; July 4, 3 hours - Total drag-line 63 hours. Loader 73½ hours.

There are force account records on file starting with the June 29th, and running to July 18th, 1962. These records indicate the delivery of the well point equipment and the unloading June 29th. On the dates worked, from June 29th, to July 18th, The District Inspector on the contract has maintained two separate records.

The first record or daily work order sheet notes; the well point equipment on the contract plus the labour supplied through the construction equipment company. The other record or daily work order sheet notes, the prime contractor's labourer and equipment used in conjunction with the well point dewatering operations. The time allowed for equipment and labour shown on the daily work order records agrees with the time shown in the Concrete Inspector's Diary. It was noted; that a special diary was set up to cover all work in connection with the dewatering by the well point system. This diary indicates, the equipment used and labour and all records pertaining to this operation.

The reason for the well point system being used to dewater on this contract in addition to the unwatering item was due; to the circumstances where the contractor could unwater the foundation site but could not stabilize the soil to allow concrete to be placed. This was investigated by The Department's Foundation Section and it was decided to use the well point system to dewater the foundation locations in addition to the unwatering. In reviewing this force account with regards to the difficulties encountered in the unwatering operation especially where it is noted where the contractor should unwater the foundation but not stabilize the soil to permit the footing to be poured.

It would appear correct that force account payment should be allowed for stablizing the soil. However; a ruling is requested on this force account on the following points.

Since the unwatering item, will be allowed in full to the bid price and since force time will be allowed for the well point system to stablize the soil should the contractor be allowed force account payment for the pumps used in conjunction with the well point system, or should only the equipment supplied by the Construction Equipment Company well point be noted for payment by force account. The force account records indicate that the contractor pumps are allowed on the force account and although, their operation did decrease the time required for dewatering by the well point system inasmuch, as they pumped off surface water draining in and lowered the water table until such time as the well point system went into operation for complete dewatering. Their operation would appear to be classified only under unwatering and it would appear that payment for such should be included in the tender item. The force account records also note, that one man accompanied the well point equipment from the construction equipment company and it was necessary for one man on the contract at all times while the well point equipment was in operation hours per day.

When this employee was not on the contract, the prime contractor's men completed the two 24 hour period and labourers' hours had been allowed on the force account for the contractor's men.

End Of Report.

J. Cronie.



ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. Stan Sherrington, *Date* August 2nd, 1961.
Foundation Section,
Materials & Research. *Subject* W.P. 15-60 - Maitland
Mr. L. D. Barrett, Dist. Engr.,
From District No. 3, Stratford, Ont. River Bailey Bridge.

Attached please find sketch of piles driven at the above mentioned location, noting the assumed rock elevation at each pile.

Material used was 10" x 10" "H" piling, the first 15' to 20' drive at 3 blows to the inch with the balance to refusal at 4 to 6 blows.

The equipment used was a D-12 Diesel Hammer rated at 22,500 ft. lbs. Considerable difficulty was experienced with the piles twisting.

L. D. Barrett

L. D. Barrett,
District Engineer.

JBM:sb



PILE DRIVING - ZETLAND BRIDGE
FINAL DECK ELEVATION 1011.6
TOP OF PILE 1008.4

WEST CRIB



LUCKNOW END

IIII
4 3 2 1

STA. NO. 192+92

PILE 1	ROCK ELEV. 947.4
PILE 2	ROCK ELEV. 949.4
PILE 3	ROCK ELEV. 951.4
PILE 4	ROCK ELEV. 948.4

IIII
4 3 2 1

STA. NO. 194+12

PILE 1	ROCK ELEV. 950.4
PILE 2	ROCK ELEV. 949.4
PILE 3	ROCK ELEV. 948.4
PILE 4	ROCK ELEV. 947.4

EAST CRIB



Cont 62-60

July 4th 1962

West pier

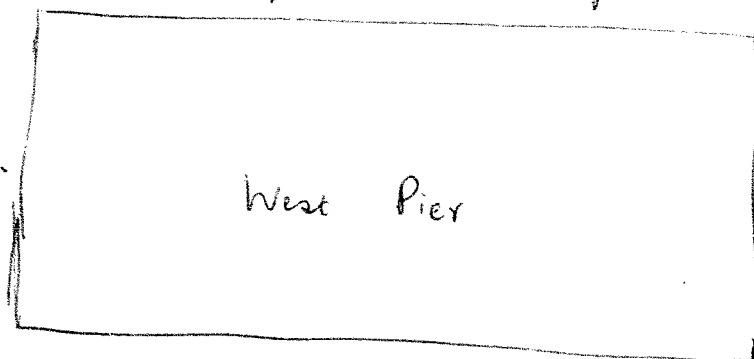
62-A-92 Maitland River Bridge Hwy 86

Total number of points 35

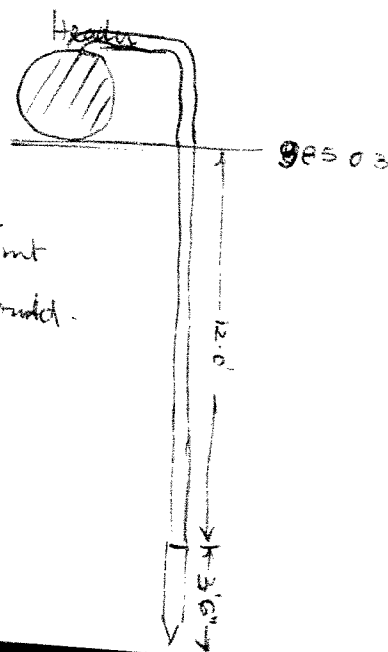
vacuum on the pump 24 p.s.i.
" on the header } 21 p.s.i.
near the pump } ~~19~~

Discharge 120 gal/min -
for 35 points.

Points are spaced at 4.0' apart. --> flow of water
in River.



point
21 p.s.i.
Elev 985.03 (ground)



Note: W.L. in the point
11.0' below ground.

Elev 985.03 - 11.0
= 974.03

Bottom of footing 976.0

● Pumping started on July 3rd 1962 at 7 P.M.

W.L. at ^{before} ~~the time of~~ pumping 987.03

W.L. on July 4th 1962 @ 2 P.M. 974.03

Excavation for footings started @ 1 P.M. July 4th 1962

Excavation on one side completed to footing Elev 978.00
@ 2:30 P.M. No water in the excavation. The material is
generally very dry.

Well point equipment

2 pumps \$ 387.00 each \$ 774.00

50 points \$ 6.97 each \$ 349.00

100 ft header pipe \$ 0.96 / ft \$ 154.00

Sanding shell \$ 46.00

Jetting equipment plus hose \$ 300.00

\$ 1,623.00

The above prices refer to one month rental
(which is the minimum)

Charges for one man to install the system
and to make sure that it mechanically
operates would be \$ 5.00 per hour plus
living expenses

Fuel charges plus mobilisation and
demobilisation

Re: Bailey Bridge placed
beside existing bridge.

Information received
from C. Morris - Stratford
Oct. or July 7.

4-10x10 Piles were driven on
each side with an approx
pen. of 1" per blow using
a 22,000 ft lb D12.

Driven to rock (hammer
bouncing). Piles tended to
twist while driving. Piles
driven on a sand fill placed
out into river - no evidence
of artesian water coming out
around piles.

blows/1" for first 30'
6 blows/1" " balance

G.G.G.

5 $l_{max} = 64'$
57'



3 record

Wingham 640 J-3

5-10-62

Equipment rental 2 month	\$ 3,239 ⁰⁰
Mobilisation and demobilisation	\$ 240 ⁰⁰
Fuel	\$ 300 ⁰⁰
Equipment operator (8 weeks)	\$ 3,000 ⁰⁰
Laborers (3 for 8 weeks)	\$ 2,160 ⁰⁰
Miscellaneous	\$ 800.00
	<u>9,739.00</u>

Crane (\$15 ⁰⁰ hour)	3,600 ⁰⁰
(4 weeks, 6 days/week, 10 hours/day)	
	<u>\$ 13,339⁰⁰</u>

George Whitfield

\$ 500/hour + living expenses (\approx \$1200/day)

10 hour day = \$500 + \$1200 = \$6200/day

6 day week = \$ 37200

8 weeks = \$ 2,97600 \approx \$ 3,00000

Laborers

\$ 1.50/hour 10 hour/day = \$ 1500/day

3 laborers $3 \times 1500 =$ \$4500/day

3 laborers for one week (6 days) = \$ 27000/week

8 weeks 3 laborers

\$ 2,16000

Crane

\$ 1500/hour

10 hour day \$ 15000

6 days a week \$ 90000

4 weeks

\$ 3,60000

Equipment

1st month

\$ 1,753 00

2nd month

\$ 1,486 00

\$ 3,239 00

Mobilisation

Flat \$ 12 00 / hour

5 hours to go

\$ 60 00

5 hours to come back
and unloading

\$ 60 00

8" pump \$ 387.00

31" points \$ 217.00

125' of header pipe \$ 125.00

Sampling shell \$ 46.00

Jetting equipment plus hose \$ 300.00

Man to install equipment \$ 1200.00

2205.00

CONTRACT 62-60

MAINTLAND RIVER BRIDGE - HWY # 86
DIST # 3. STRATFORD

SUMMARY OF LABOR COSTS

- FOR Dewatering Footings

TOTAL NO OF DAYS = 20

TOTAL NO OF MEN = 14 (All classifications and
different hourly rates)

AVG NO OF MEN/DAY = 3

TYPE OF MAN	MAN - HRS	AVG COST/HR (Dollars)	TOTAL COST
FOREMAN	149	6.50	967 16
CARPENTER	45 1/2	2 31	105. 10
LABORER	187 1/2	1.60	300 00
PLUMBER	179	1.73	309. 10

TOTAL LABOR COST = \$1,681.36



ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. A. G. Stermac Date September 10, 1962
Principal Foundation Engineer Subject Re: Contract #62-60 Maitland
Mr. L. D. Barrett, Dist. Engr.
From District #3, Stratford River Bridge, Highway 86

Enclosed please find copy of invoice for De-Watering
Footings submitted by Mowbray Construction Company
Limited as per your request dated August 3, 1962.

L. D. Barrett
L. D. Barrett
District Engineer

BP:nw

Enclosure

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 480

Wingham, Ontario

August 10th, 1962.

Mr. L.D. Barrett,
District Engineer,
Department of Highways,
Box 8,
Stratford, Ontario.

Re: Contract 62-60
Hwy. #86 Zetland Bridge

INVOICE

De-Watering Footings as per instructions from
Department of Highways.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
June 29/62	Unloading Well Point Equip.			
	✓ 1 Foreman 2 Hrs. @ \$3.18 per hr.	6.36		
	✓ 1 Labourer 2 Hrs. @ \$2.31 per hr.	4.62		
	✓ 1 YD. Lorain Crane 1 Hr. @ \$15.65 per hr.			15.65
	✓ Float hauling materials to Jobsite 30 Ton Float 7 Hrs. @ \$12.15 per hr.			91.05
June 30/62	Placing Well Point System			
	✓ 1 Carpenter 7.5 Hrs. @ \$2.31 per hr.	17.32		
	✓ 1 Labourer 10.0 Hrs. @ \$1.63 per hr.	16.30		
	✓ 1 Labourer 5.5 Hrs. @ \$1.69 per hr.	9.29		
	✓ 1 YD. Lorain Crane 5.0 Hrs. @ \$15.65 per hr.			78.25
	✓ 1 1/2 YD. Front End Loader 5.5 Hrs. @ \$9.70 per hr.			53.35
	✓ 2" Centrifugal Pump 3.0 Hrs. @ \$p.60 per hr.			1.80
	✓ 4" Diaphragm Pump 3.0 Hrs. @ \$0.95 per hr.			2.85
	✓ 24000 G.V.W. Truck 2.0 Hrs. @ \$5.00 per hr.			10.00
	✓ Operator Mileage 16 Miles @ \$0.10 per mile			1.60
	✓ Labourers Mileage 8 Miles @ \$0.10 per mile			.80
	Total.....	\$53.89	-----	\$255.35

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 459

Wingham, Ontario

Page 2

August 10th, 1962.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
Total forward		53.89	-----	255.35
June 30/62	Gas for Jet Pumps			
✓	5.0 Gals. @ \$0.39 per gal.		1.95	
✓	Sand for Well Points			
	4.5 c.y. @ \$1.57 per c.y.		7.06	
✓	1 Foreman 3.5 Hrs. @ \$6.50 per hr.	55.25		
	Travelling Time Foreman			
	4 Hrs. @ \$6.50 per hr.	26.00		
✓	60 Point Well System			
	Monthly Rental \$1795.07 plus 15%			2,064.33
July 2/62	Well Point System			
✓	1 Carpenter 13.0 Hrs. @ \$2.31 per hr.	30.03		
✓	1 Labourer 13.0 Hrs. @ \$1.63 per hr.	21.19		
✓	1 Labourer 7.5 Hrs. @ \$1.40 per hr.	10.50		
✓	1 1/2 YD. Front End Loader			
	1.5 Hrs. @ \$9.70 per hr.			14.55
✓	1 YD. Lorain Crane 11.5 Hrs. @ \$15.65 per hr.			179.98
✓	4" Centrifugal Pump 0.5 Hrs. @ \$2.60 per hr.			16.90
✓	2" Centrifugal Pump 4.0 Hrs. @ \$0.60 per hr.			2.40
✓	4" Diaphragm Pump 10.0 Hrs. @ \$0.95 per hr.			9.50
✓	24000 G.V.W. Truck 4.0 Hrs. @ \$5.00 per hr.			20.00
	Mileage Operator & Men			
✓	43 Miles @ \$0.10 per mile			4.30
	Gas for Well Pumps 22 Gals. @ \$0.39 per gal.		8.58	
✓	Sand for Well Points			
	18 c.y. @ \$1.57 per c.y.		28.26	
✓	1 Foreman 12.5 Hrs. @ \$6.50 per hr.	81.25		
✓	Travelling Time Foreman			
	4 Hrs. @ \$6.50 per hr.	26.00		
	Total.....	\$304.11	45.85	2,567.81

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 488

Wingham, Ontario

Page 3

		August 10th, 1962.		
DATE	DESCRIPTION	LABOUR	MATERIAL	EQUIPMENT
Total forward		304.11	45.95	2,567.81
July 3/62	Well Point System			
	1 Carpenter 12.5 Hrs. @ \$2.31 per hr.	28.87		
	2 Labourers 12.5 Hrs. @ \$1.52 per hr. 25.0 Hrs.	38.00		
	1 Pump Operator 2.0 Hrs. @ \$1.74 per hr.	3.48		
	1 1/2 YD. Front End Loader 3.0 Hrs. @ \$9.70 per hr.			29.10
	1 YD. Lorain Crane 11.5 Hrs. @ \$15.65 per hr.			179.97
	4" Diaphragm Pump 19.5 Hrs. @ \$0.95 per hr.			18.92
	2" Centrifugal Pump 4.0 Hrs. @ \$0.60 per hr.			2.40
	24000 G.V.W. Truck 4.0 Hrs. @ \$5.00 per hr.			20.00
	Mileage Operator, Labourers and Pump Operator 52 Miles @ \$0.10 per mile			5.20
	Gas Well Point System 70 Gals. @ \$0.39 per gal.		27.30	
	Sand for Well Points 16.5 c.y. @ \$1.57 per c.y.		25.90	
	1 Foreman 15.5 Hrs. @ \$6.46 per hr.	100.13		
July 4/62	Well Point System			
	1 Carpenter 1.0 Hrs. @ \$2.31 per hr.	2.31		
	2 Labourers 2.0 Hrs. each 4.0 Hrs. @ \$1.52 per hr.	6.08		
	1 Pump Operator 2.0 Hrs. @ \$1.74 per hr.	11.92		
	1 1/2 YD. Front End Loader .5 Hrs. @ \$9.70 per hr.			4.85
	1 YD. Lorain Crane 3.5 Hrs. @ \$15.65 per hr.			54.77
	Gas for Well Pump 24 Gal. @ \$0.39 per gal.		13.26	
	Gas for Standby Pump 45 Gals. @ \$0.39 per gal.		17.55	
	1 Foreman 15.5 Hrs. @ \$6.46 per hr.	100.13		
Total.....		557.03	129.36	2,883.02

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 400

Wingham, Ontario

Page 4

August 10th, 1962.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
Total forward		597.03	129.86	2,883.02
July 5/62	Well Point System			
✓	1 Pump Operator 11.0 Hrs. @ \$1.74 per hr.	19.14		
✓	Gas for Well Point System 35.0 Gals. @ \$0.39 per gal.		13.65	
✓	Oil for Well Point System 2 Qts. @ \$0.40 per Qt.		.80	
✓	1 Foreman 12.5 Hrs. @ \$6.46 per hr.	80.75		
July 6/62	Well Point System			
✓	1 Pump Operator 18.0 Hrs. @ \$1.74 per hr.	31.32		
✓	Gas for Well Point System 45.0 Gals. @ \$0.39 per gal.		17.55	
✓	Oil for Well Point System 1 Qt. @ \$0.40 per Qt.		.40	
✓	1 Foreman 6.0 Hrs. @ \$6.46 per hr.	38.76		
	Travelling Time Foreman 3.5 Hrs. @ \$6.46 per hr.	22.61		
July 7/62	Well Point System			
✓	Pump Operators 24.0 Hrs. @ \$2.03 per hr.	48.72		
✓	Gas for Well Point System 45.0 Gals. @ \$0.39 per gal.		17.55	
July 8/62	Pump Operator 3.0 Hrs. @ \$1.34 per hr.	10.72		
July 9/62	Well Point System			
✓	1 Carpenter 11.5 Hrs. @ \$2.31 per hr.	26.56		
✓	1 Skilled Labourer 5.0 Hrs. @ \$1.79 per hr.	8.95		
✓	2 Labourers 6.0 Hrs. each 12.0 Hrs. @ \$1.34 per hr.	16.08		
✓	2 Labourers 7.0 Hrs. each 14.0 Hrs. @ \$1.49 per hr.	20.86		
✓	1 Labourer 11.5 Hrs. @ \$1.40 per hr.	16.10		
✓	1 YD. Lorain Crane 11.0 Hrs. @ \$15.65 per hr.			172.15
✓	1 1/2 YD. Front End Loader 8.0 Hrs. @ \$9.70 per hr.			77.60
✓	4" Diaphragm Pump 5.0 Hrs. @ \$0.95 per hr.			4.75
	Total	937.60	179.81	3,137.52

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 400

Wingham, Ontario

Page 5

August 10th, 1962.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
Total forward		937.60	179.81	3,137.52
July 9/62	Well Point System			
	✓ 2" Centrifugal Pump 5.0 Hrs.			
	② \$0.60 per hr.			3.00
	✓ Gas for Jet Pump 15.0 Gals.			
	② \$0.39 per gal.		5.85	
	✓ 1 Foreman 12.0 Hrs. @			
	\$6.46 per hr.	77.52		
	Travelling Time Foreman			
	2.5 Hrs. @ \$6.46 per hr.	16.15		
July 10/62	Well Point System			
	✓ 1 Foreman 13.5 Hrs. @			
	\$6.46 per hr.	87.21		
	✓ 1 Labourer 12.5 Hrs. @			
	\$1.63 per hr.	20.37		
	✓ 2 Labourers 10.5 Hrs. @			
	21.0 Hrs. @ \$1.37 per hr.	28.77		
	✓ 1 YD. Lorain Crane 11.5 Hrs.			
	② \$15.65 per hr.			179.98
	✓ 1 1/2 YD. Front End Loader			
	3.0 Hrs. @ \$9.70 per hr.			29.10
	✓ 4" Centrifugal Pump 8.0 Hrs.			
	② \$2.60 per hr.			20.80
	✓ 4" Diaphragm Pump 14.0 Hrs.			
	② \$0.95 per hr.			13.30
	✓ 24000 G.V.W. Truck 5.0 Hrs.			
	② \$5.00 per hr.			25.00
	✓ Mileage for Operator & Men			
	32 Miles @ \$0.10 per mile			3.20
	✓ Gas for Jet Pump 10.0 Gals.			
	② \$0.39 per gal.		3.90	
	✓ Oil for Jet Pump 1 Qt. @			
	\$0.40 per Qt.		.40	
	✓ Sand for Well Points			
	24.0 c.y. @ \$1.57 per c.y.		37.68	
July 11/62	Well Point System			
	✓ 2 Labourers 10.5 Hrs each			
	21.0 Hrs. @ \$1.52 per hr.	31.92		
	✓ 1 Labourer 7.0 Hrs. @			
	\$1.34 per hr.	9.38		
	✓ Pump Operator 3.0 Hrs. @			
	\$1.34 per hr.	4.02		
	✓ 1 YD. Lorain Crane 10.0 Hrs.			
	② \$15.65 per hr.			156.50
	✓ 1 1/2 YD. Front End Loader			
	3.0 Hrs. @ \$9.70 per hr.			28.10
	✓ 24000 G.V.W. Truck 4.5 Hrs.			
	② \$5.00 per hr.			22.50
	✓ 4" Diaphragm Pump 10.0 Hrs.			
	② \$0.95 per hr.			9.50
	Total	1,212.94	227.64	3,628.49

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 400

Wingham, Ontario

Page 6

August 10th, 1962.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
Total forward		1,212.94	227.64	3,628.49
July 11/62	4" Centrifugal Pump			
✓	2.5 Hrs. @ \$2.60 per hr.			6.50
✓	Mileage for Operator			1.60
✓	16 Miles @ \$0.10 per mile			
✓	Gas for Jet Pump 45.0 Gals. @ \$0.39 per gal.		17.55	
✓	Oil for Pump 1 Qt. @ \$0.40 per Qt.		.40	
✓	Sand for Well Points 16,0 c.y. @ \$1.57 per c.y.		25.12	
✓	1 Foreman 14.0 Hrs. @ \$6.46 per hr.	90.44		
July 12/62	Well Point System			
✓	Pump Operator 10.0 Hrs. @ \$1.34 per hr.	13.40		
✓	Gas for Well Pumps 45.0 Gals. @ \$0.39 per gal.		17.55	
✓	1 Foreman 14.0 Hrs. @ \$6.46 per hr.	90.44		
July 13/62	Well Point System			
✓	Pump Operator 17.0 Hrs. @ \$1.34 per hr.	22.68		
✓	Gas for Well Point Pumps 25.0 Gals. @ \$0.39 per gal.		9.75	
✓	1 Foreman 6.0 Hrs. @ \$6.46 per hr.	38.76		
—	Travelling Time Foreman 2.5 Hrs. @ \$6.46 per hr.	16.15		
July 14/62	Well Point System			
✓	Pump Operator 10.0 Hrs. @ \$1.34 per hr.	13.40		
✓	Gas for Well Pumps 35 Gals. @ \$0.39 per gal.		13.65	
July 15/62	Well Point System			
✓	2 Pump Operators 12.0 Hrs. each 24.0 Hrs. @ \$1.94 per hr.	46.56		
✓	Gas for Well Point Pumps 35.0 Gals. @ \$0.39 per gal.		13.65	
✓	Oil for Pump 1 Qt. @ \$0.40 per Qt.		.40	
July 16/62	Well Point System			
✓	2 Pump Operators 12.0 Hrs. each 24.0 Hrs. @ \$1.81 per hr.	43.44		
	Total	\$1,588.21	325.71	3,636.59

MOWBRAY CONSTRUCTION COMPANY LIMITED

BRIDGE CONTRACTORS

BOX 480

Wingham, Ontario

Page 7

August 10th, 1962.

<u>DATE</u>	<u>DESCRIPTION</u>	<u>LABOUR</u>	<u>MATERIAL</u>	<u>EQUIPMENT</u>
Total forward		1,588.21	325.71	3,636.59
July 16/62	✓ Gas for Well Point Pumps 35.0 Gals. @ \$0.39 per gal.		13.65	
	✓ Oil for Well Pump 1 Qt. @ \$0.40 per Qt.		.40	
July 17/62	Well Point System			
	✓ 2 Pump Operators 12.0 Hrs. each 24.0 Hrs. @ \$1.66 per hr.	39.84		
	✓ Gas for Well Pumps 35.0 Gals. @ \$0.39 per gal.		13.65	
	✓ Oil for Well Pumps 1 Qt. @ \$0.40 per Qt.		.40	
July 18/62	Well Point System			
	✓ Pump Operator 7.0 Hrs. @ \$1.34 per hr.	9.28		
	✓ 3 Labourers 2.5 Hrs. each 7.5 Hrs. @ \$1.38	10.35		
	✓ 2 Labourers 7.0 Hrs. each 14.0 Hrs. @ \$1.34	18.76		
	✓ 1 Labourer 4.0 Hrs. @ \$1.63 per hr.	6.52		
	✓ 1 Labourer 6.0 Hrs. @ \$1.40 per hr.	8.40		
	✓ 10 Ton Mobile Crane 6.5 Hrs. @ \$18.15 per hr.			117.97
	✓ 1 1/2 YD. Front End Loader 4.0 Hrs. @ \$9.70 per hr.			38.80
	✓ Gas for Well Pumps 10.0 Gals. @ \$0.39 per gal.		3.90	
	✓ Oil for Well Pumps 1 Qt. @ \$0.40 per Qt.		.40	
	✓ Float hauling materials from Jobsite 30 Ton Float 8 Hrs. @ \$12.15 per hr.			97.20
	Total	1,681.36	358.11	3,890.56
	Plus 15% Overhead & Operating Costs	252.20	53.72	
		1,933.56	411.83	3,890.56

Total.....\$6,235.95