

22-13-291
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W.P. 952-59

H. Q. GOLDER & ASSOCIATES LTD.

CONSULTING CIVIL ENGINEERS

H. Q. GOLDER
V. MILLIGAN
L. G. SODERMAN

2444 BLOOR STREET WEST
TORONTO 9, ONTARIO
767-9201
763-4103

September 10, 1963

Department of Highways, Ontario,
Materials and Research Section,
Parliament Buildings,
Toronto 5, Ontario.

Attention: Mr. K. Y. Lo, P. Eng.,
Supervising Foundation Engineer

RE: STABILITY OF EAST ABUTMENT
RIDEAU CANAL BRIDGE
OTTAWA QUEENSWAY

Dear Sirs:

Attached is a rough sketch showing the estimated location of the critical circle for the effective stress stability analysis of the east abutment of the Ottawa Queensway-Rideau Canal Bridge (Bridge No. 24). Please note that the circle is an estimate only. Our stability analyses originally considered the east abutment of the bridge because of the more critical combination of a greater height of fill and the lower grade for the NCC Drive. We still believe the west abutment to be inherently less stable than the east and trust that it will be instrumented also.

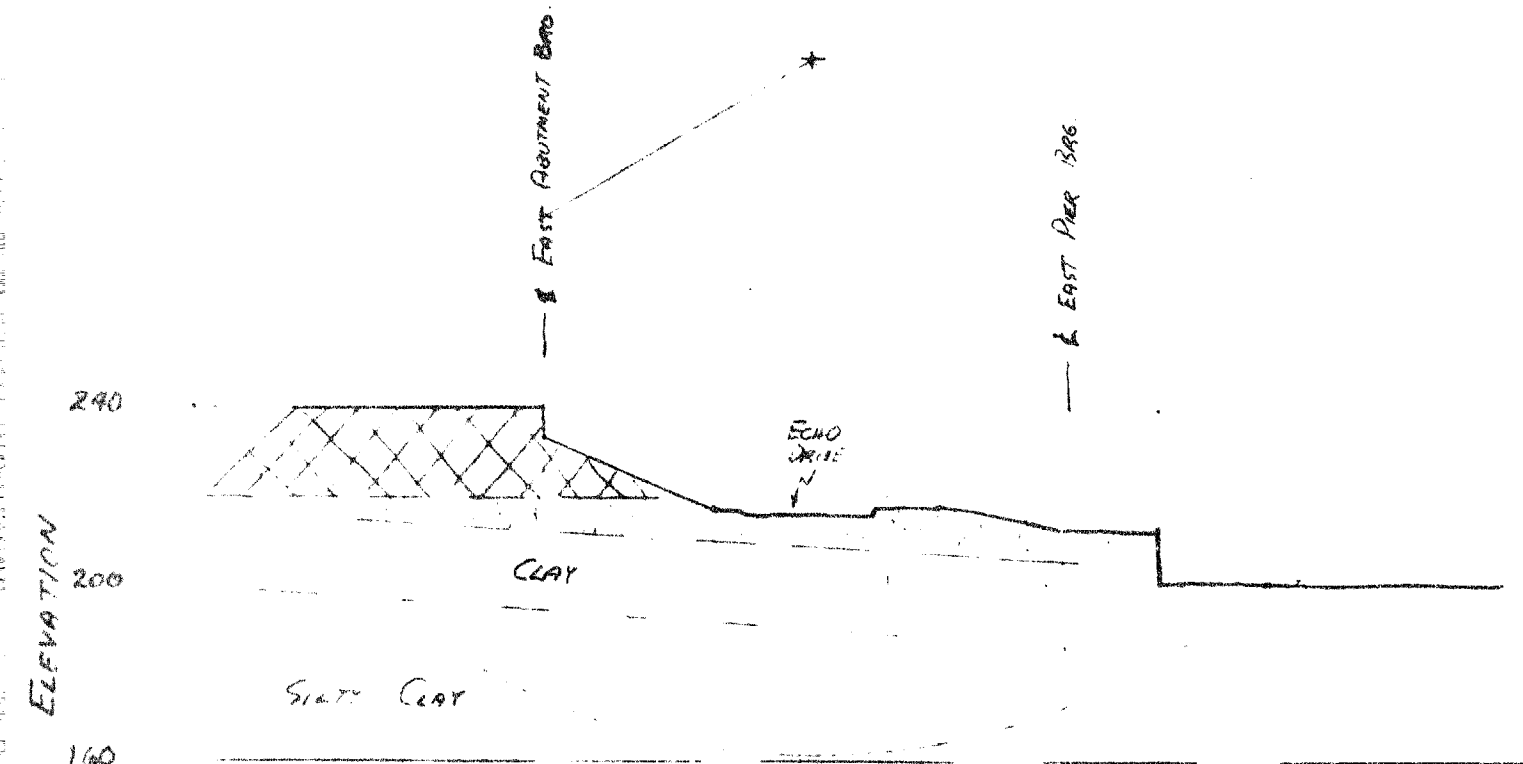
Yours faithfully,

H. Q. GOLDER & ASSOCIATES LTD.



A. A. Gass, P. Eng.

AAG:IMB
Enc.
6102-3



SCALE: 1" to 40'

OTTAWA QUEENSWAY
RIDEAU CANAL BRIDGE EAST ABUTMENT
ESTIMATED LOCATION OF CRITICAL CIRCLE
EFFECTIVE STRESS ANALYSIS

100
SHE 9/6

DE LEUW, CATHER & COMPANY
OF CANADA LIMITED
CONSULTING ENGINEERS
TORONTO OTTAWA ST. JOHN'S

2277 RIVERSIDE DRIVE
OTTAWA 8, ONTARIO
TELEPHONE 733-4160

Our Ref. Q-3b

September 9th, 1963

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

Attention: Mr. K. Lo



Dear Sir:

Re: Ottawa Queensway
Bridge No. 24 at Rideau Canal
W.P. No. 952-59 - District 9, Ottawa

Please find enclosed one print each of Sheets 5, 10,
11 and 12 of the grading, drainage and utility drawings through
the above bridge site as requested.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED


 L. J. Marshall, P. Eng.,
Chief Bridge Engineer.

LJM:nl
Encl.

DE LEUW, CATHER & COMPANY
OF CANADA LIMITED
CONSULTING ENGINEERS
TORONTO OTTAWA ST. JOHN'S

2277 RIVERSIDE DRIVE
OTTAWA 8, ONTARIO
TELEPHONE 733-4160

Our Ref. Q-3b
September 7th, 1963

Mr. A. Rutka,
Materials & Research Engineer,
Department of Highways of Ontario,
Parliament Buildings,
Toronto 2, Ontario.

Attention: Mr. K. Lo

Dear Sir:

Ottawa Queensway
Bridge No. 24 at Rideau Canal
W.P. No. 952-59 - District 9, Ottawa

Please find enclosed two (2) prints of final drawing D5069-13 and one print of sketch No. C45D-P28 for the above structure.

The above drawing and sketch may assist you in planning your piezometer layout.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED



for L. J. Marshall, P. Eng.,
Chief Bridge Engineer.

GSS:nl
Encls.

Our Ref. Q-15

September 6th, 1963

Mr. V. Milligan,
H. Q. Golder & Associates Limited,
Consulting Civil Engineers,
2444 Bloor Street West,
Toronto 9, Ontario.

Dear Sir:

Re: Ottawa Queensway
Bridge No. 24 at Rideau Canal

Please find enclosed one print each of final drawings No. B5067-1, 2, 3, 4 & 13, for the above structure. Also, we are enclosing one print of sketch No. C45D-P23 indicating the respective heights and construction sequence of the various fills.

You will recall our discussions of last fall and your letter of October 30th, 1962, concerning the stability of the approach fills. Would you please review this problem using the information shown on sketch No. C45D-P28. You will note that the overall heights of the approach fills have not changed, however, the profile of the N.C.C. Driveway has been raised and the construction of the approach fills has been staged with the abutment construction. These latter revisions may warrant an amendment to the recommendation contained in your Report 6182 under "Stability of Approach Embankments" and "Recommended Construction Procedure".

Further, the Department of Highways are now planning the layout of the piezometers. Therefore, would you please contact Mr. Rutka and discuss the location and construction purposes of the piezometers.

Your early reply would be appreciated.

Yours very truly,

DE LEW, GATHER & CO. OF CANADA LIMITED



for L. J. Marshall, P. Eng.,
Chief Bridge Engineer.

GSM:nl
Encl.

P.S. We have enclosed copies of the settlement observations at Queensway Bridges No. 37 & 23 for your information.

Our Ref. Q-1b

September 6th, 1963

Mr. V. Milligan,
H. Q. Golder & Associates Limited,
Consulting Civil Engineers,
2444 Bloor Street West,
Toronto 9, Ontario.

Dear Sir:

Re: Ottawa Queensway
Bridge No. 24 at Rideau Canal

Please find enclosed one print each of final drawings No. D5069-1, 2, 8, 9 & 13, for the above structure. Also, we are enclosing one print of sketch No. C45D-P28 indicating the respective heights and construction sequence of the various fills.

You will recall our discussions of last fall and your letter of October 30th, 1962, concerning the stability of the approach fills. Would you please review this problem using the information shown on sketch No. C45D-P28. You will note that the overall heights of the approach fills have not changed, however, the profile of the H.C.C. Driveway has been raised and the construction of the approach fills has been staged with the abutment construction. These latter revisions may warrant an amendment to the recommendation contained in your Report 6102 under "Stability of Approach Embankments" and "Recommended Construction Procedure".

Further, the Department of Highways are now planning the layout of the piezometers. Therefore, would you please contact Mr. Rutka and discuss the location and construction purposes of the piezometers.

Your early reply would be appreciated.

Yours very truly,

DE LEUW, CATHIER & CO. OF CANADA LIMITED

B. S. Saunders

for

L. J. Marshall, P. Eng.,
Chief Bridge Engineer.

GSS:nl
Encl.

P.S. We have enclosed copies of the settlement observations at Queensway Bridges No. 37 & 23 for your information.

D. H. O.
TORONTO
RECEIVED
SEP 12 1963

OFFICE
BRIDGE

Materials and Research Division

September 5, 1963

Mr. L. J. Marshall, P. Eng.,
Chief Bridge Engineer,
De Leuw, Cather & Co. of Canada Ltd.,
2277 Riverside Drive,
Ottawa 8, Ontario.

Dear Sir:

Re: -- Ottawa Queensway --
 Bridge No. 24 at Rideau Canal
 W.P. 952-59 - District 9, Ottawa
 Your Ref. Q-3b-472

Enclosed please find plan on which the instrumentation area has been marked by a red circle. I hope that this information will be sufficient for your present purpose. We will furnish you with further details of instrumentation, if required, at a later stage.

I shall be grateful if you will send us a plan showing the utilities so that we can start work on that area in the very near future.

Yours very truly,

KYL/MdeF

A. Rutka
MATERIALS & RESEARCH ENGINEER

cc: Foundations Office
Gen. Files

18/9/63

*Discussed with Gerry Saunders, instrumentation location
change to South Corner of West Abutment
Informed Saunders the decision on side
the above letter*

KYL

DE LEUW, CATHER & COMPANY
OF CANADA LIMITED
CONSULTING ENGINEERS
TORONTO OTTAWA ST. JOHN'S

2277 RIVERSIDE DRIVE
OTTAWA 8, ONTARIO
TELEPHONE 733-4460

Our Ref. Q-3b-472
September 2nd, 1963

Mr. A. Rutka,
Materials & Research Engineer,
Department of Highways of Ontario,
Parliament Buildings,
Toronto 2, Ontario.

Dear Sir:

Re: Ottawa Queensway
Bridge No. 24 at Rideau Canal
W.P. 952-59 - District 9, Ottawa

Enclosed please find two (2) copies each of drawings D5069-1, 2, 8 & 9 for the above structure. With reference to your letter of October 24th, 1962, would you please return one copy of the abutment drawings indicating your proposed piezometer layout.

The Grading Contract including this structure will be advertised on September 25th, 1963 (tentative).

It is expected that all pile driving will be completed during this coming winter.

Please advise us if we can be of any assistance in carrying out your instrumentation programme.

Yours very truly,

DE LEUW, CATHER & COMPANY OF CANADA LIMITED

B. S. Saunders
for L. J. Marshall, P. Eng.,
Chief Bridge Engineer.

GSS:nl
Encls.

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
October 24, 1962.

DeLew, Cather & Co., Ltd.,
2277 Riverside Drive,
Ottawa, Ontario.

Attention: Mr. L.J. Marshall:

Re: National Research Council,
Soil Studies, Ottawa Queensway.

Dear Sir:

With regard to the installations of piezometers at the Rideau Canal for the observation of pore pressure set up due to pile driving, we would appreciate if you can send us the final drawing of the pile foundations, so that we can start working on the layout of the piezometers.

The Department will supply and install all necessary piezometers for construction purposes at the Rideau Canal site. We shall also have our engineer at the site during pile driving to control the rate and sequence of pile driving operations.

Arrangements of instrumentation for the other structures at Metcalfe, Elgin and Main Streets, remain the same and National Research Council will be doing the instrumentation at these structures.

Yours truly,



A. Rutka,
Materials & Research Engineer.

AR:pa

c.c. L.Walker,
A.Stermac,
G.Wrong,
J.Gruspier.

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
October 15, 1962.

Mr. C. B. Crawford,
Head,
Soil Mechanics Section,
National Research Council,
Division of Building Research,
Ottawa 2, Canada.

Dear Carl: Re: Rideau Canal - Soil Studies
 Ottawa Queensway,
 Your File M43-17-13G-1

Thank you for your letter of October 10, 1962.
My letter of October 9th crossed your letter en route
and they both covered the same ground. After you receive
the drawings for the pile layout of the Queensway bridge
over the Rideau Canal from Leon Marshall, you will have
suggestions as to the location of the piezometers from
your particular interest. It may well be that your lay-
out will suffice for our needs in which case no additional
piezometers need be installed. If further piezometers
are required, we will discuss these with you, and specific
arrangements can be made to install more by ourselves, or
to have you install more as you so generously suggested.

We are very well satisfied with these arrangements.
You might let us know when you have reviewed your layout
so that we might come to Ottawa to discuss this project
with you. I feel that some interesting information will
be obtained and we are also looking forward to discussing
the detailed arrangements with you.

Yours sincerely,

AR

A. Rutka,
Materials & Research Engineer.

AR:pa
c.c. L.J. Marshall.

L. Walker,
A. Stermac,
G. Wrong,
J. Gruspier



CABLE ADDRESS "RESEARCH"

IN YOUR REPLY PLEASE QUOTE

FILE NO. M43-17-13G-1

YOUR REFERENCE

NATIONAL RESEARCH COUNCIL
CANADADIVISION OF
BUILDING RESEARCH

OTTAWA 2.

10 October 1962

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

Dear Alex:

Last Friday I spoke with Leon Marshall by telephone and described to him our telephone conversation of the previous week. He agreed with your suggestion that DNO should be the agency primarily responsible for assessing the construction implications that may develop due to pore pressures induced by pile driving at the Queensway bridge over the Rideau Canal.

As I explained to you, we regard the development and dissipation of pore pressures due to pile driving in the Leda clay as a valid research project and we are therefore interested in making these measurements. We would propose, of course, to install piezometers in locations arrived at by discussion with your staff and with De Leuw Cather. The piezometric readings may be taken by our staff or the resident engineer or both. As described in our Technical Note #381, we have in mind about 12 piezometers at each abutment. If this does not seem to be enough, we might be able to install some more or you may wish to install some on your own. Mr. Marshall has advised that final drawings showing the pile layout will be available in about six weeks and after that time we can make a suggested proposal for the location of piezometers. These should be installed well in advance of construction. We look forward to the possibility of discussing their location with you.

Yours sincerely,

Carl

Carl B. Crawford
Head
Soil Mechanics Section.

Copy to:
L. J. Marshall

CRG:fs

62-SM-73

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
October 9, 1962.

Mr. C. Crawford,
National Research Council,
Division of Building Research,
Ottawa 2, Ontario.

Dear Carl: Re: Soil Studies,
 Ottawa Queensway.

This will confirm our conversation of September 28, 1962, where I indicated that the Department and the consultant should assume full responsibility for the construction of the structure at the Rideau Canal. This will not involve any major change in our plan of piezometer installations, but it will mean that the Department and the National Research Council will work together as one unit. As H. Q. Golder & Associates carried out the original soils investigation, they will be consulted from time to time during the layout of the instrumentation programme and during the driving of the piles.

The details of the supply of the equipment and our working arrangements can be worked out between Mr. Stermac and yourself as soon as DeLeuw Cather have finalized on the layout of the piles.

I trust this slight re-arrangement will be satisfactory and we look forward to working closely with you once again.

Yours truly,



A. Rutka,
Materials & Research Engineer.

AR:pa

c.c. L. Walker,
A. Stermac,
G. Wrong.

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
October 9, 1962.

DeLew, Cather & Company,
Consulting Engineers,
2277 Riverside Drive,
Ottawa 8, Ontario.

Attention: Mr. L. J. Marshall.

RE: National Research Council, Soils
Studies, Ottawa Queensway,
Your letter September 26th.

Dear Sir:

I can appreciate your concern at the Rideau Canal structure, and in retrospect it does not seem fair to pass on the responsibility of the construction problems that might develop to the National Research Council. I have spoken to Mr. Carl Crawford, and I have written him accordingly (see letter attached). We have had several experiences with the National Research Council with their instrumentation programmes on Department work and I have been most happy with their approach, interest and co-operation. In general, very satisfactory work has been produced.

While our arrangements have always been very informal, it would be perhaps desirable to place the instrumentation programme on a formal basis and have the Department responsible for collecting the data. The National Research Council are prepared to invest all the money that is required for the instrumentation programme. We should take some advantage of this offer and I would suggest that the Department be responsible for the soils work. We would work as one unit with the National Research Council and we will bring in Golder & Associates to review

DeLeuw Cather & Co.,
Att'n Mr. L.J. Marshall.

October 9, 1962.

and approve of the instrumentation layout and to review the test results as the pile driving operations are in progress. I can envisage no problems since the most important part of the programme is to establish the limiting pore pressure criteria and to ensure that the pore pressures are not exceeded during construction. The readings will likely be taken by the National Research Council and ourselves, and they will be given to you on a regular basis. Mr. Crawford will likely be in touch with you to obtain your pile spacings so that he might have some idea of the initial piezometer installation.

There seems to be no difficulties as far as you are concerned, with the embankment at Station 425, and the settlement gauges at the three structures at Metcalfe, Elgin and Main Streets.

I trust that this adjustment in our thinking is satisfactory and meets with your approval.

Yours truly,



A. Rutka,
Materials & Research Engineer.

AR:pa

c.c. L. Walker,
A. Stermac,
G. Wrong.

DE LEUW, CATHER & COMPANY
OF CANADA LIMITED
CONSULTING ENGINEERS

TORONTO

OTTAWA

ST. JOHN'S

2277 RIVERSIDE DRIVE
OTTAWA 8, ONTARIO
REGENT 3-4180

Our Ref. 4366-Q-3b

September 26th, 1962

Mr. A. Rutka,
Materials & Research Engineer,
Department of Highways Ontario,
Parliament Buildings,
Toronto 2, Ontario.

Dear Sir:

Re: National Research Council - Soils Studies
Ottawa Queensway

With reference to the recent correspondence between C. B. Crawford and yourself, I would like to clarify one point which, I feel, is of importance.

The programme of testing and settlement readings in the full embankment at Station 425, is purely for N.R.C. research although the results would be most interesting to all concerned.

The settlement gauges in the three structures at Metcalfe, Elgin and Main Streets were recommended in the soils reports but are purely as a check on the predicted settlements, particularly as these varied so much between the two soils consultants involved.

The piezometer installations at the Rideau Canal structure, however, ~~are~~ primarily for construction control to avoid an embankment failure from high pore pressure caused by piling through the embankment. Originally, it was hoped to found the high level abutments on spread footings, with the canal piers on piles, for the end spans to act as long approach slabs. This would have allowed the abutment to settle with the embankment, if any should occur after completion of the concrete pavement.

During the soils investigation, however, it was shown that the factor of safety in the embankment was not sufficient to sustain the additional spread weight of the abutment. For the same reasons, the pile driving through the

Cont'd.....

embankment would require careful control, if necessary by driving in staggered sequence according to the rate of dissipation of the built up pore pressures. The Contractor will be made aware of this in the contract documents.

Although we have assigned a post graduate in soils from Princeton University to supervise this phase of construction, I am wondering if you feel we have sufficient control of a federal government agency to obtain the information we require as and when it is needed, as they invariably have other commitments. Even if the National Research Council is allowed to install the required number of piezometers for both embankments, I feel the soils consultant involved in the report for this Structure, H. Q. Golder & Associates Limited, should be brought into the picture during the entire programme of construction at this point. You may even consider it desirable for the Department to have control of the actual supply and installation of equipment.

There are so many agencies involved in the Queensway and the Rideau Canal, particularly being in the National Capital, that every precaution should be taken as this is the most critical soils section on this project.

I would suggest that your soils department review the original report from this point of view, to satisfy themselves that sufficient construction control can be maintained if the National Research Council are entirely responsible for this phase of the programme. I understood their main interest was in the full embankment testing as being a more typical case for research purposes and the other items were purely to assist the Department of Highways. Your comments would be appreciated.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED



Leon J. Marshall, P. Eng.,
Chief Bridge Engineer.

LJM:lm

File
ago

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
September 20, 1962.

Mr. C. B. Crawford,
Head,
Soil Mechanics Section,
National Research Council,
Division of Building Research,
Ottawa 2, Ontario.

Dear Carl:

Re: Ottawa Queensway

Thank you for your letter of September 17th and for your Technical Note 381 on the "Proposed Soil Structures on the Ottawa Queensway, Stage 4". I have reviewed your Technical Note and have subsequently had a discussion with you on September 20th. As you know I was originally concerned with the problem the contractor may have with the various pipes protruding through the fill; however, I am not nearly so concerned now that the settlement pads will be installed and no further work will be done until the embankment is completed.

I am of the opinion that the piezometer and settlement gauge installations along centre line should create no particular problems as they can be protected. It may be necessary to do some filling in by hand and perhaps compact this narrow strip with mechanical equipment. I can envisage no problems with the work on the settlement of the three structures or the piezometer installations at the Rideau Canal as far as the contractor is concerned.

All of the details can be worked out with our Consultants De Leuw Cather Company of Canada and with our District Engineer. If you have any particular problems we would be very pleased to look into them as they develop.

Yours sincerely,

al

A. Rutka,
Materials & Research Engineer.

AB:pa

c.c. L.J. Marshall,
L. Walker

H. MacMillan, T. Stermac,



CABLE ADDRESS "RESEARCH"

IN YOUR REPLY PLEASE QUOTE

FILE NO. M43-17-13G-1

YOUR REFERENCE

NATIONAL RESEARCH COUNCIL
CANADADIVISION OF
BUILDING RESEARCH

OTTAWA 2,

17 September 1962

Mr. A. Rutka,
Materials & Research Engineer,
Department of Highways,
Parliament Buildings,
Toronto 5, Ontario.

Dear Alex:

Further to my letter of 23 July in reply to yours of 16 July 1962, I now enclose two copies of our Technical Note 381 on "Proposed Soil Studies on the Ottawa Queensway, Stage 4", which has been prepared by K. N. Burn. This note describes the scope and locations of instruments which we plan to use in order to collect information on the performance of a typical earth fill and three bridge foundations on Leda clay.

I was pleased to see from your letter of 26 July that it would be possible to make special provisions in the contract documents outlining the locations of the test sites and also the contractor's responsibility for the instrumentation. We are very grateful for your support on this point and I am sure that you recognize the necessity for it. On our part we can make every effort to avoid interfering with the contractor and to protect the instruments but we need complete co-operation of the contractor if our efforts are not to be wasted.

As you see, a similar letter and copies of the Technical Note are being sent to DeLeuw Cather Company of Canada and to the City of Ottawa. Thank you very much for your personal support and interest in our proposed study.

Yours sincerely,

Carl

Copy to:
Mr. L. S. Marshall
Mr. S. B. Ayers

Carl B. Crawford
Head
Soil Mechanics Section.

Encl:

CBC:fs

62-84-19



TECHNICAL NOTE

NOT FOR PUBLICATIONFOR INTERNAL USEPREPARED BY K. H. BurnCHECKED BY CBCAPPROVED BY RFLDATE September 1962

PREPARED FOR Dept. of Highways of Ontario; De Leuw Cather and Co.
of Canada, and the City of Ottawa.

SUBJECTPROPOSED SOIL STUDIESON THE OTTAWA QUEENSWAY, STAGE 4

This note outlines the scope and locations of instrumentation proposed for soil studies of Stage 4 of the Ottawa Queensway. The purposes of the soil studies and details of the equipment are described.

The complete co-operation of the contractor is so essential to the success of the program that it is strongly recommended that the contractor be charged with responsibility for the safety of all field instrumentation. All reasonable precautions will be taken by the Division of Building Research in the design and installation of these instruments to reduce the possibility of damage to a minimum but it is suggested that the contract document should hold the contractor to be responsible for replacement costs if necessary.

PURPOSE

Stage 4 of the construction of the Ottawa Queensway includes sections of uniformly high fill, a number of overpass structures to be founded on spread footings, and a bridge over the Rideau Canal whose abutments and piers will be founded on steel piles. Accurate determinations of the engineering properties of the stiff but highly sensitive subsoil are essential for the improved and most economical design of such structures. Because of its sensitivity, even the slight amounts of disturbance caused by sampling and testing generally lead to values somewhat less in strength and greater in compressibility than appears to be the case in the field. Using

the best available sampling and testing techniques, the Division of Building Research is attempting to reduce the uncertainties in these values and so improve the estimation of field performance. This can only be done by comparisons of laboratory and field studies which include all factors pertinent to each design.

LOCATION AND INSTRUMENTATION

The Division of Building Research will attempt to obtain information on three types of structures on this section of the Queensway and special field installations will be provided for each. They are:

- (1) The high earth embankment between Main Street and Echo Drive at the east bank of the Rideau Canal. The purpose of the study at this location will be to compare actual settlements under loading with those computed from laboratory testing. This settlement should be small since the applied load will bring the total load to something less than the preconsolidation load. This site was selected because it gives the greatest loading, uniform in height and cross-section, over a distance sufficiently long to make end effects negligible.

The instrumentation will be located approximately at Station 425. (see Fig. 1) and will include:

- a) A deep bench mark.
- b) Four simple settlement gauges as shown to measure the compression of various layers.
- c) Concrete or steel pads installed just below the present ground surface to measure total settlement after construction of the embankment.
- d) Three piezometers in the compressible clay at various depths.
- e) A lined hole for measurements of lateral spread of the subsoil at the edge of the embankment.
- f) One electrical gauge to measure compression of the full depth of the subsoil.

- (2) Three of the bridge structures on spread footings:
a) Main Street (Bridge No. 23), Main Street (Bridge No. 25) and Metcalfe Street (Bridge No. 37).

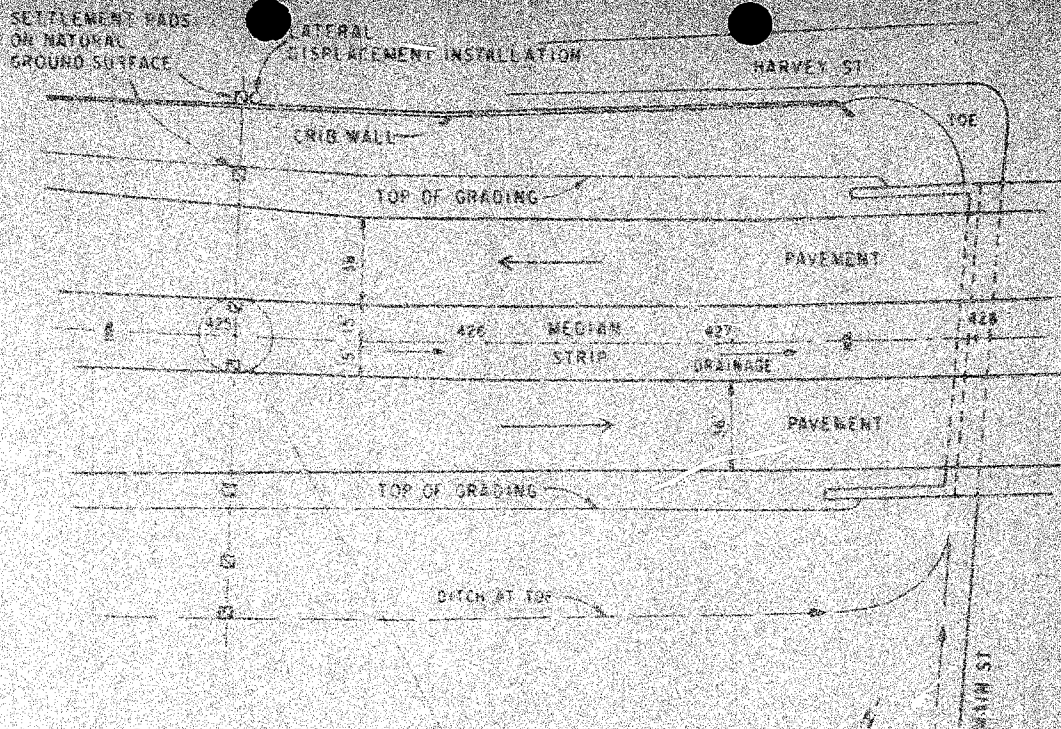
The purpose of the study here will be to compare actual settlements with computed values in the same manner as for the embankment. The instrumentation for these structures will comprise six or eight

settlement points of simple design on the footings and abutments of each one and a deep bench mark near each structure. The points at which settlements will be read can be agreed upon with the consulting engineers and the contractor at the time of construction. The deep bench marks will be located outside the working area at a location agreed to by the consulting engineers and the contractor. Levels will be taken on the footings until such time as the permanent points can be installed in walls above ground level. These will be either small recessed sockets or "Ram set" pins.

- (iii) The bridge over the Rideau Canal founded on piles. The main purpose of this study will be to check the excess pore water pressures generated in the soil by pile driving. As the pore pressures have a considerable influence on the stability of the abutments, the results from these observations will be made available immediately to the resident engineer. Instrumentation at this site will consist of about 12 piezometers to various depths at each abutment; their exact location will depend upon the layout of the piles. ||

SOIL CONDITIONS

Site conditions along this section of the Ottawa Queensway were carried out by the consulting firm of H. Q. Golder and Associates. It was considered necessary, however, to obtain more complete soils information in the immediate vicinity of the proposed settlement installation at Station 425. For this purpose two boreholes were made, from one of which samples of the subsoil were obtained using a special thin-walled piston sampler. The other was used to obtain undrained shear strengths with a vane borer. The locations of these boreholes are shown in Fig. 1. Samples were obtained continuously from 8 ft to 68 ft. Testing will proceed during the winter and, from the results, settlements will be computed. Three types of consolidation test will be tried: the standard procedure of loading in small increments; a method suggested by Skempton and Bjerrum of simulating the field stress conditions in the consolidation test; and a re-cycling method of loading to probable field stress, unloading and reloading. Settlement analyses based on the three test methods will be made for comparison with the measured settlements.



- LEGEND
- P - PIEROMETERS
 - S₁ - SETTLEMENT GAUGES
 - ES - ELEV. SET. GAUGES
 - DSM - DEEP BENCH MARK
 - SBM - SAMPLE BORE MARK
 - VBH - VANE BORE HOLE
 - SP - SETTLEMENT PADS

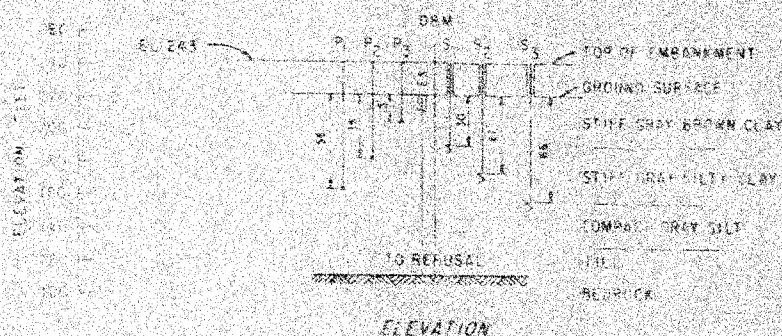
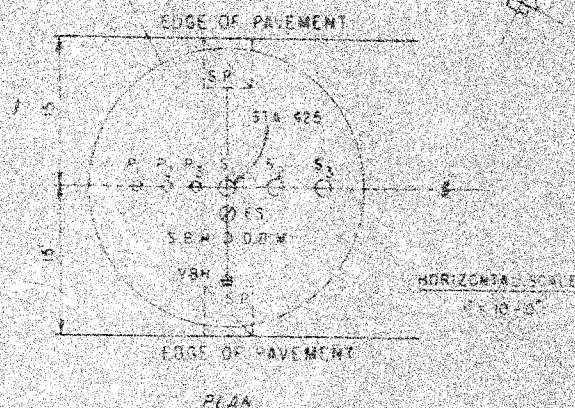


FIGURE 1
LOCATION OF PROPOSED INSTRUMENTATION
OTTAWA QUEENSWAY, STATION 425+00

DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT



NATIONAL RESEARCH COUNCIL
CANADA

CABLE ADDRESS "RESEARCH"

IN YOUR REPLY PLEASE QUOTE

FILE NO. **M43-17-130-1**

YOUR REFERENCE

DIVISION OF
BUILDING RESEARCH

OTTAWA 2.

23 July 1962

Mr. A. Rutka,
Materials & Research Engineer,
Department of Highways,
Parliament Buildings,
Toronto 5, Ontario.

Dear Alex:

Thank you very much for your letter of
16 July 1962 advising of your support for our proposed
research on the Queensway construction near Elgin Street.
Last week we completed our vane testing and sampling and
we will now proceed with a report outlining the proposed
instrumentation in detail.

With best regards,

Yours sincerely,

Carl

Carl B. Crawford
Head
Soil Mechanics Section.

CBC:fs

ah

62-6051

Mr. A. Rutka,
Materials & Research Engr.

Mr. K. Y. Lo,
Foundation Section.

July 24, 1962.

INSTRUMENTATION FOR
QUEENSWAY STRUCTURES.

WF 949-59

Subsequent to a discussion with N.R.C. and De Leuw Cather & Co., a proposal for the instrumenting of the Queensway structures has been made by N.R.C. in a letter dated June 29, 1962. For construction control purposes, we shall probably be interested in the piezometer installations at Rideau Canal, only.

An item which has not been incorporated in the program, and is of practical rather than academic interest, is the installation of settlement plates on the top of the fill. Observation of the settlement of the top of the fill will give us an indication as when to place the concrete pavement. The cost of such installation will be very small compared to the whole project and involves very little extra work. It is suggested the installation of these plates should be incorporated in the program. This matter was discussed with the Consultant (De Leuw Cather) and the installation may be carried out by the same.

KYL/MdeF


K. Y. Lo,
SUPERVISING FOUNDATION ENGR.

cc: Mr. K. Y. Lo
Foundations Office ✓
Gen. Files.

COPY

For the information of

Mr. A. Stermac

Materials & Research Division,
Parliament Buildings,
Toronto 5, Ontario,
July 16, 1962.

Mr. C. B. Crawford,
Head, Soil Mechanics Section,
National Research Council,
Division of Building Research,
Ottawa 2, Canada.

Dear Carl:

Re: Your File No. 18-3-17-139-1

Thank you for the copy of your letter to Mr. L. J. Marshall of June 29, 1962. Your proposed programme is quite extensive and when completed should yield some very good information on the characteristics of the clay in the Ottawa area. We will be very glad to assist in any way we can. De Low Cuthers have already sent us the necessary drawings.

Your installations will not be used for construction control purposes, except perhaps for the one at the canal where the piezometers will be placed to measure pore water pressure during and following the pile driving operations. We do not at this time, anticipate any problems at the canal site, but if the stability of the area is endangered we would like to use the pore water pressure results to adjust the construction techniques and procedures, if and when this is required. In this connection we would like to be kept advised of these particular results during the progress of the work.

Special provisions can be included in the contract documents outlining the locations of the test sites, and also the contractor's responsibility for the instrumentation. We greatly appreciate your interest and activity in this programme, and we are looking forward to receiving the results. We propose to undertake other installations at other sites throughout the Province, and

Mr. C. B. Crawford.

July 16, 1962.

we should in this way obtain some good information on the characteristics of the soil over a fairly wide area.

Yours sincerely,



A. Rutka,
Materials & Research Engineer.

AR:pa

c.c. Mr. L. J. Marshall.

Mr. L. E. Walker,
Mr. H. McMillan,
Mr. A. Stermac,
Mr. G. Wrong,
Mr. J. Gruspier,
Files.



COPY FOR

CABLE ADDRESS "RESEARCH"

IN YOUR REPLY PLEASE QUOTE

FILE NO. 43-17-130-1

YOUR REFERENCE

NATIONAL RESEARCH COUNCIL
CANADADIVISION OF
BUILDING RESEARCH

OTTAWA 2.

29 June 1962

Mr. L. J. Marshall,
De Louw Gether & Co. of Canada Ltd.,
2277 Riverside Drive East,
Ottawa 1, Ontario.

Dear Mr. Marshall:

Following our meeting with Mr. Lo of DHO and Mr. Saunders and yourself of De Louw Gether & Co. on 20 June, we have received your letter of 21 June with which you enclosed four soil reports concerning the Rideau Canal section of the Queensway.

We have given further consideration to the question of installing special instrumentation in advance and during construction of this section of the Queensway and this is detailed as follows:-

1. Instrumentation beneath earth fill between Echo Drive and Main Street (approximately at Station 425).
 - a) Deep bench mark.
 - b) One electrical type gauge to measure compression of entire subsoil.
 - c) Three or four simple gauges to measure compression of various layers.
 - d) Concrete or steel pads installed just below present ground surface in order to measure change in elevation after fill construction.
 - e) Two or three piezometers in compressible clay layer.
 - f) Possibly instrument to measure lateral spread of subsoil at toe of fill.

Notes:

This site was chosen because it gives the greatest loading with simple fill dimensions. The purpose of the test will be to compare computed settlement with actual settlement

Mr. L. J. Marshall

27 June 1962

YOUR REFERENCE

NATIONAL RESEARCH COUNCIL

under loading just above the preconsolidation load. The possibility of installing one electrical gauge between Eastman and O'Connor Streets (approximately Station 406) has been considered and if convenient this gauge would be installed. We did not think it worthwhile to make two elaborate field installations in this general area.

* 2. Bridge structures on spread footings.

It is proposed to install one deep bench mark plus six or eight settlement points on the footings for bridges at Main Street (No. 25), Elgin Street (No. 23) and Metcalfe Street (No. 37).

Note:

The purpose of these installations is similar to the earth fill study in an effort to compare computed settlement with actual settlement.

3. Bridge over canal founded on piles (No. 24).

It is intended to install piezometers at each abutment to measure pore water pressure during and following pile driving. The location of the piezometers will depend on the design layout of the piles. Approximately one dozen piezometers will be installed at each abutment in order to measure pore pressures at various depths and distances from the pile groups. Some effort will be made to measure settlement of the west approach fill because the fill loading is expected to equal or exceed the preconsolidation load in the subsoil.

4. Field boring and sampling at approximately Station 425.

a) Continuous spin-walled piston sampling to determine:-

- i. complete profile of water content, Atterberg limits, grain size and salt content.
- ii. a minimum of one unconfined and one unconsolidated undrained triaxial test on each sample.
- iii. a minimum of one routine consolidation test, one special loading test and one cyclical loading test on each sample.

b) Complete field vane profile near the sampling boring.

Mr. L. J. Marshall

- 1 -

29 June 1962

Note:

This sampling and testing will supplement information already available and will be used for estimation of field performance.

If this programme has your approval, we would like to do the boring work during the week of 9 July. It may be convenient at that time to install a deep bench mark in the borehole but the remainder of field work will be delayed until we can prepare a detailed proposal showing layout and cross sections of field instrumentation. We would very much appreciate it if you could put a clause in the contract specifications to the effect that the general contractor would be responsible for the safety of all field installations to the extent of paying for replacement if damaged. We would naturally take every precaution to ensure the safety of the instruments ourselves but on the basis of recent experience, we believe that this clause is necessary if the research effort is not to be wasted.

We greatly appreciate this further opportunity for co-operative field research with you and the Department of Highways and look forward to its successful completion.

Yours sincerely,

Carl B. Crawford

Carl B. Crawford
Head
Soil Mechanics Section.

XBC:28

Copy to:
Mr. Alex Ruth

62-5378

INSTRUMENTATION AT OVERPASSES ALONG QUEENSWAY -

at (a) O'Connor St.

(b) Metcalfe

(c) Elgin

(d) Rideau Canal

and (e) Main St.

Date: 20 June 1962.

Place: (a) De Leuw Cather & Co., Ottawa - preliminary talk
8.30 - 9.00 a.m.

(b) National Research Council - 9.30 - 12.00

Present: J. Saunders)
) De Leuw Cather & Co.
 L. Marshall)

Carl Crawford)
Bill Eden) National Research Council.
Ken Burn)

K. Y. Lo Department of Highways, Ontario.

It was agreed that N.R.C. instrument any sections which they want to for their own interest, and D.H.O. supplement any sections required for construction purposes. It was made clear that results obtained by N.R.C. should be made available to D.H.O. immediately, especially when construction reaches a critical stage. As far as construction is concerned, instrumentation requires settlement plates only for the fill and piezometers only for pile driving at the banks of Rideau Canal. At this section, the piles are to be driven to till first and the fill placed later on according to the rate of dissipation of pore pressure set up by pile driving.

It was agreed that N.P.C. write up the details of instrumentation for review and suggestions.

20 June 1962

MEETING WITH L. WALKER, DISTRICT ENGINEER AT OTTAWA

2.30 - 3.00 p.m. - June 20, 1962.

(a) Informed him of the results of discussion with
N.R.C. and De Leuw Cather on instrumentation
along Queensway overpasses.

(b) Discussion Cumberland slide with him.

cc: Mr. A. Stermac
Principal Foundation Engineer
Department of Highways
Toronto, Ontario.

3531

May 1962

Our Ref. 2649-Q-3b

April 25th, 1962.

Mr. F. I. Hewson,
Consultant Liaison Engineer,
Bridge Division,
Department of Highways of Ontario,
Parliament Buildings,
TORONTO, Ontario.

Dear Mr. Hewson:

Re: Settlement Gauges - Ottawa Queensway

As you are aware, we are now approaching construction of the downtown section of the Queensway where we have deep deposits of Leda Clay. In view of tests carried out by NRC at the Montreal Road Bridge embankment, the Soils Engineers are now assuming far less settlement than that predicted by normal methods. However, the exact reduction is still a question of debate.

August 72
Ged.

As suggested by Larry Soderman, the Metcalfe Street and O'Connor Street structures are being founded on spread footings on the assumption that the structures could settle with the embankment and any differential settlement would be negligible. I believe that Mr. Stermac would probably be interested in installing embankment settlement gauges as part of the Department's research program in this field.

450-59

450-59

Apart from that, Mr. Gordon McRostie has suggested in his report for the Metcalfe Street structure that settlement gauges should be provided. We have suggested for ease of reading that these should be placed near the centre of the structure through the footings under the sidewalk below the structure. If the initial casing could be installed by the Department and a datum rod provided, McRostie and Associates are prepared to drill out the casing, install the rod, and take all necessary readings. Any statistics which they will be able to collect would be supplied to the department for their information.

Will you please let me know if the Department has any policy on this research work either by yourselves or by private consultants, as I feel this is a unique opportunity to obtain useful data on the Leda clay which

has rather unique properties.

7/15
October 17

Apart from the above research work, it has been recommended by Golder & Associates in their report for the canal bridge that piezometers, and settlement gauges, should be installed to keep a check on the pore water pressure in the clay during the driving of the piles through the embankment. This is more of a construction necessity rather than academic research and I understand from previous conversation that you are in favour of this installation. An embankment slip due to lack of control during the driving of the piles could have a serious effect on the completion of the canal structure. Apart from official approval, I will be interested in any installation details which your Soils Department would require.

Yours very truly,

DE LEUW, CATHER & CO. OF CANADA LIMITED

Leon J. Marshall.

Leon J. Marshall, P. Eng.,
Chief Bridge Engineer.

RF 34160

LJM:gs

cc: Mr. A. G. Stermac.

- Bridge # 21 Bank
~~Atter~~ St and Greenway
- Bridge # 22 O'Connor St and Greenway W.P. 949-59
- Bridge # 23 Elgin St and Greenway
- Bridge # 24 Rideau Canal & Greenway
- Bridge # 25 Main St & Greenway
- Bridge # 37 Metcalfe St and Greenway W.P. 950-59

1962 MAY 16 AM 11:13

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C.M.R.

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OTTA DOWN 4 MAY 16/62 1050A VR

L E WALKER, DIST ENG

THE COST FOR PREPARING PLAN AND CROSS SECTIONS OF SLIDE AT CUMBERLAND
SHOULD BE CHARGED TO MATERIALS & RESEARCH DIVISION.

A G STERMAC, MATERIALS & RESEARCH

CS

HC

1962 MAY 15 AM 8:59

DOWN CHAT 2 MAY 15 900A URGENT

A STERMAC FOUNDATIONS

RE: CONT 61-221 D.R. 471 BEAR CREEK BRIDGE

WE ARE USING D12 AND ON WEST PIER ARE GETTING 3.1 BLOWS PER INCH
IS THIS SATISFACTORY

P A PEACOCK CONST ENGR

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OTTA DOWN 11 MAY 8/62 412P VR

L E WALKER, DIST ENG

FOUNDATION SECTION WILL START FAILURE INVESTIGATION MAY 10TH
CRAWFORD ADVISE OF INVESTIGATION.

A G STERNACK, MATERIALS & RESEARCH ✓

CS

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1962 MAY 8 AM 8:34

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DOWN OTTA 1 MAY 8/62 825 A

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MAT & RES

HAVE STORMAC GET IN TOUCH WITH CRAWFORD OF NATIONAL RESEARCH
COUNCIL WHEN HE IS IN OTTAWA. CRAWFORD WILL INVESTIGATE SLIDE WEST
OF CUMBERLAND ALSO

L. E. WALKER

DIST ENGR

*Section 16 Dist Engr is
in Ottawa. He will get in
touch with Crawford tomorrow.*

W.P. 8:45

#63-F-108

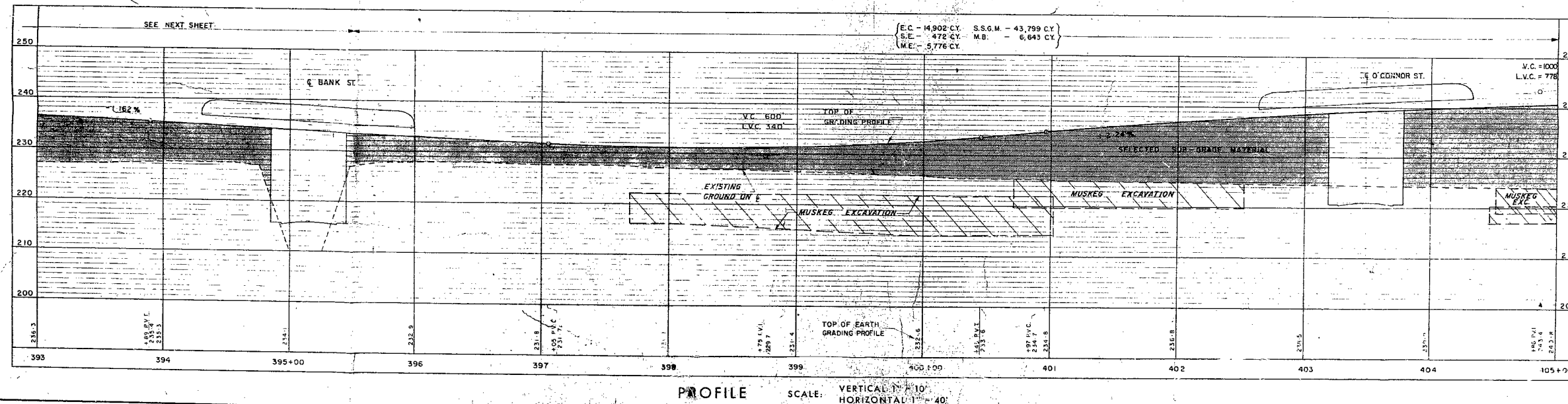
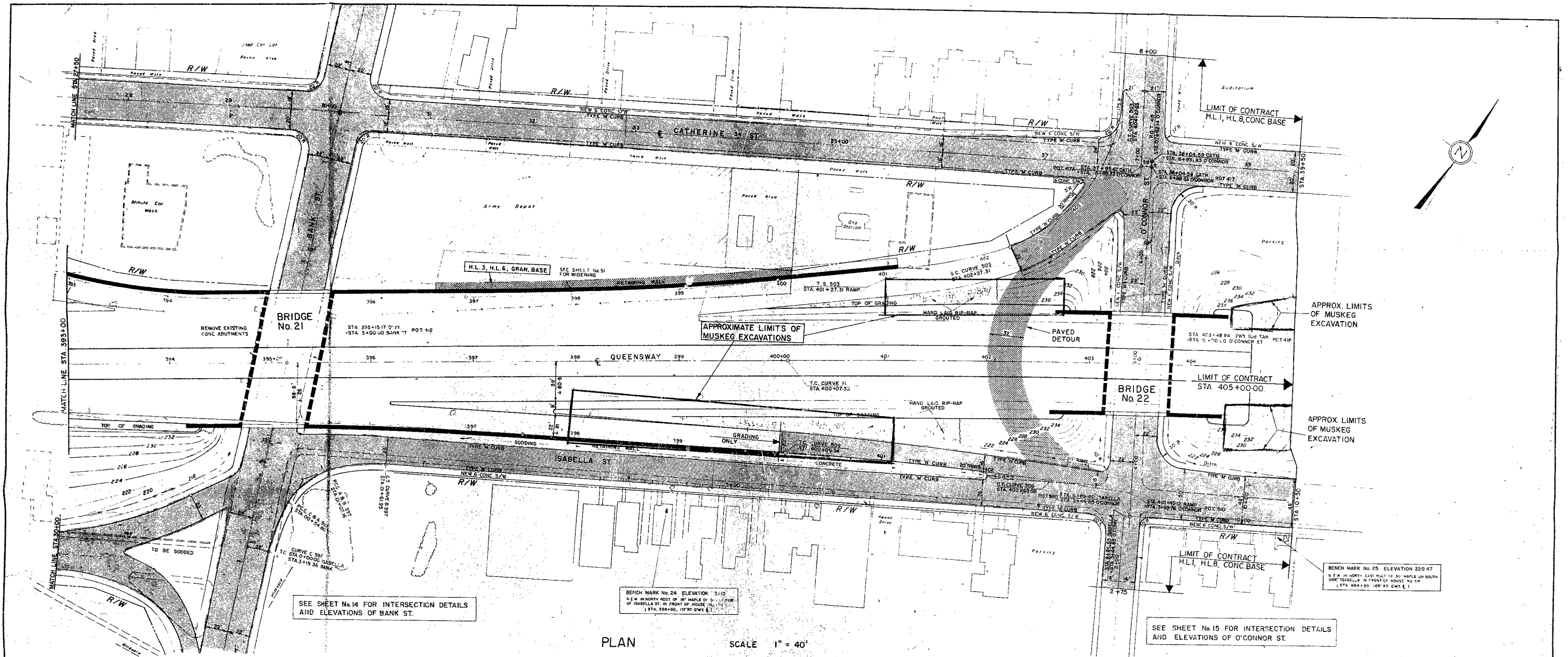
WP#952-59.

RIDEAU.

CANAL BRIDGE

OTTAWA

QUEENSWAY.



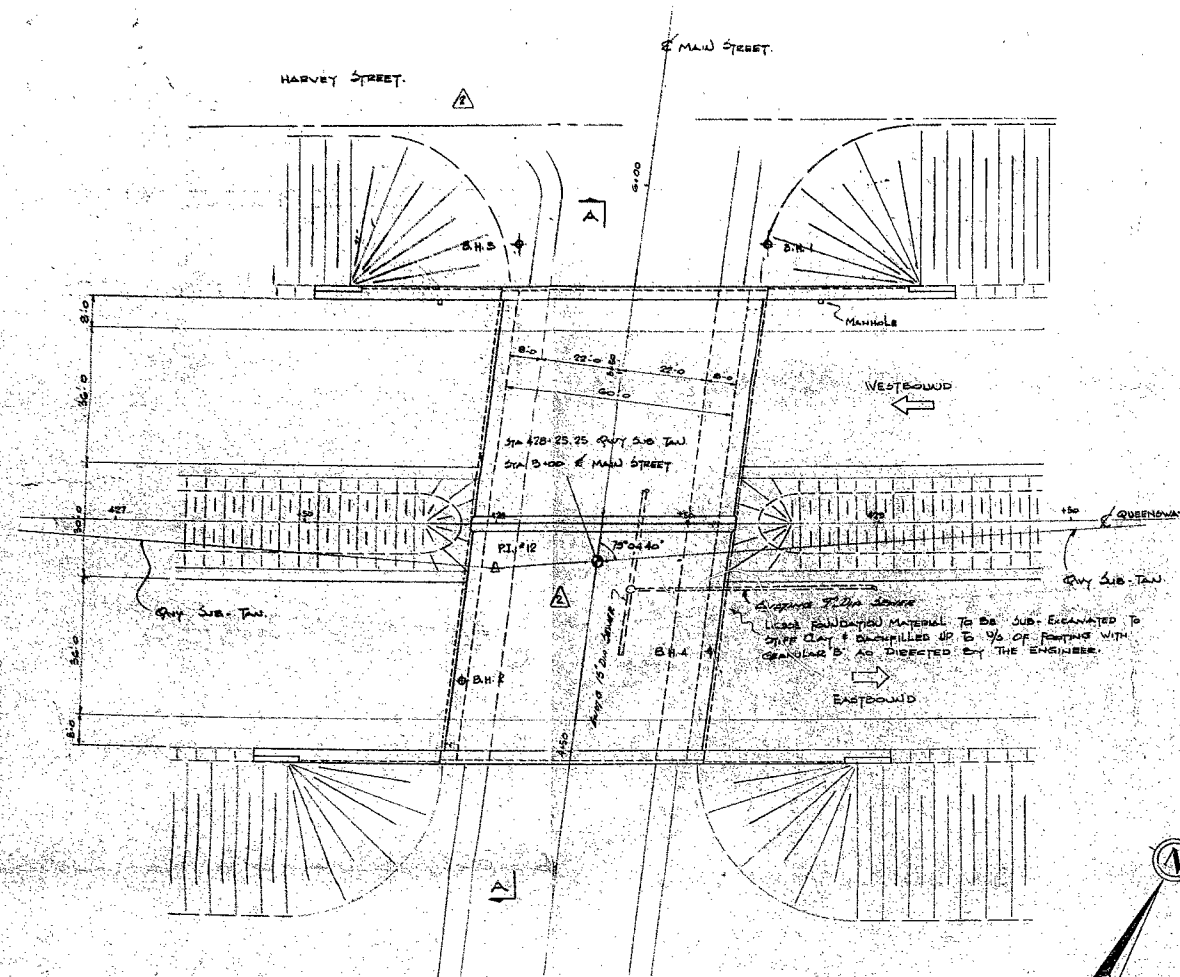
Bridge # 22, O'Connor St & Queensway

Bridge # 21 Bank St & Queensway

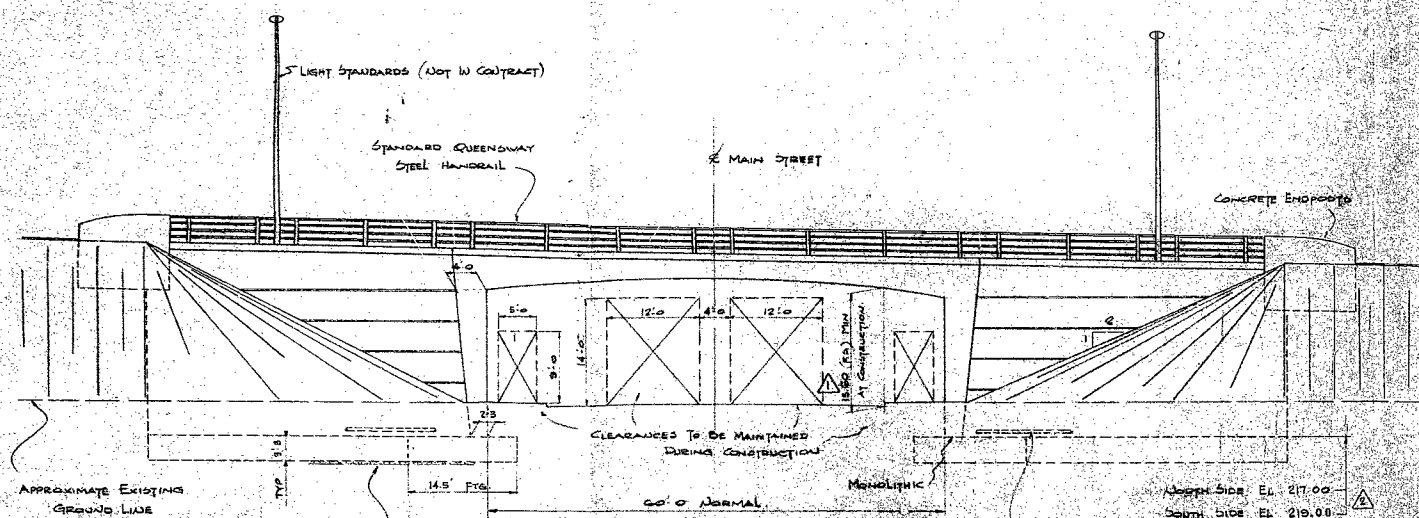
| No. | Revisions | By | Date |
|--|---|-------------------------------|--------|
| 1 | B. Entrance Ramp From Chamberlain St. Removed | GGT | May/62 |
| DEPARTMENT OF HIGHWAYS OF ONTARIO | | | |
| OTTAWA QUEENSWAY LIMITED-ACCESS HIGHWAY | | | |
| OTTAWA CANADA | | | |
| PLAN & PROFILE | | | |
| STA 393+00 TO STA 405+00 | | | |
| DE LEUW CATHY & CO. OF CANADA LIMITED Consulting Engineers | | DEPT. OF HIGHWAYS OF ONTARIO | |
| Designed by: C.K.C. | | Director of Planning & Design | |
| Drawn by: J.H.T. | | DWG. No. | |
| Checked by: G.G.T. | | Sheet 9 of | |
| Date: MARCH 1/1962 | | Scale: as shown | |

W.P. 952-59

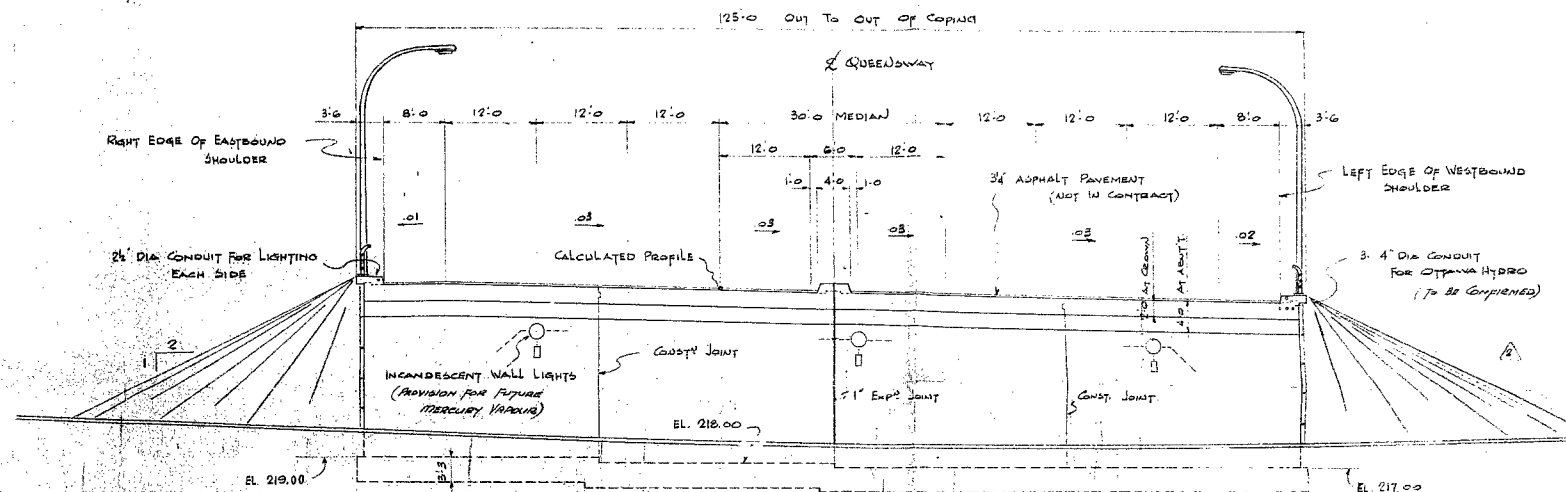
C44W-14



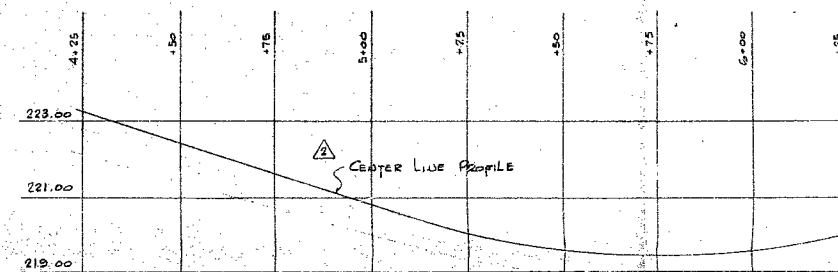
BRIDGE PLAN
SCALE: 1" = 20'0"



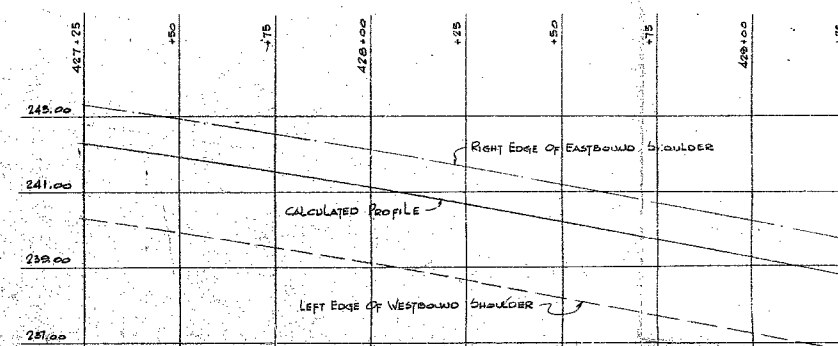
ELEVATION - SOUTH SIDE
(North Side Similar Except For End Walls)
SCALE: 1" = 10'0"



SECTION A-A
(N.Y.D.)



MAIN STREET PROFILE SCALE: VERT. 1" = 2'0" HORIZ. 1" = 20'0"



QUEENSWAY PROFILE SCALE: VERT. 1" = 2'0" HORIZ. 1" = 20'0"

| B.H. 1 | B.H. 2 | B.H. 3 | B.H. 4 |
|--------|------------------------------|-----------------------------|--------------------------|
| 230.0 | | | |
| 220.0 | SAND | | |
| 210.0 | FILL | FILL | SAND |
| 200.0 | STIFF GRAY CLAY SOME SILT | STIFF BROWNISH GRAY CLAY | STIFF CLAY |
| 190.0 | | | |
| 180.0 | STIFF GRAY CLAY | STIFF SILTY GRAY CLAY | STIFF SILTY GRAY CLAY |

BOREHOLE LOG

NOTES:

- DESIGN SPECIFICATIONS: A.A. S.H.O. SPECIFICATIONS FOR HIGHWAY BRIDGES - 1957
- LINE LOAD: H20-516-44
- CONCRETE STRENGTH: 3000 P.S.I. THROUGHOUT.
- FOUNDATIONS: SPREAD FOOTINGS ON CLAY (FIRST ALLOW BRG. CAPACITY 3000 P.S.F. + TO BE CONFIRMED IN SOILS REPORT BEING PREPARED BY H.R. GELBERG & ASSOC. (B.A. 1423)
- SUPERSTRUCTURE: R.C. RIGID FRAME.
- PIEZOMETERS AND SETTLEMENT GAUGES TO BE INSTALLED NEAR WEST ABUTMENT BEFORE BACKFILLING COMMENCES.
- CONSTRUCTION OF THIS BRIDGE IS INCLUDED IN THE ROADWAY CANAL TO CONCORD AVE. GRADING CONTRACT.

| GENERAL REVISIONS | | DATE |
|---|---|--|
| No. | REVISIONS | |
| 1 | VERTICAL CLEARANCE AT MAIN ST. CROSSING | 4/27/62 |
| DEPARTMENT OF HIGHWAYS OF ONTARIO | | |
| OTTAWA QUEENSWAY LIMITED-ACCESS HIGHWAY CANADA | | |
| BRIDGE NO. 25 AT MAIN ST. PRELIMINARY PLAN | | |
| DE LEUW CATHAR & CO. OF CANADA LIMITED Consulting Engineers | | DEPT. OF HIGHWAYS OF ONTARIO Director of Planning & Design |
| Designed by: G.S.S. | Date: APR. 27, 62 | W/GS. No. D5070-PI |
| Drawn by: P.E. | Scale: AS SHOWN | Sheet 1 of 1 |
| Checked by: G.S.S. | | |

DISTRICT NO. 9
W.P. NO. 953-59

W.P. 952-59

CASE-PI