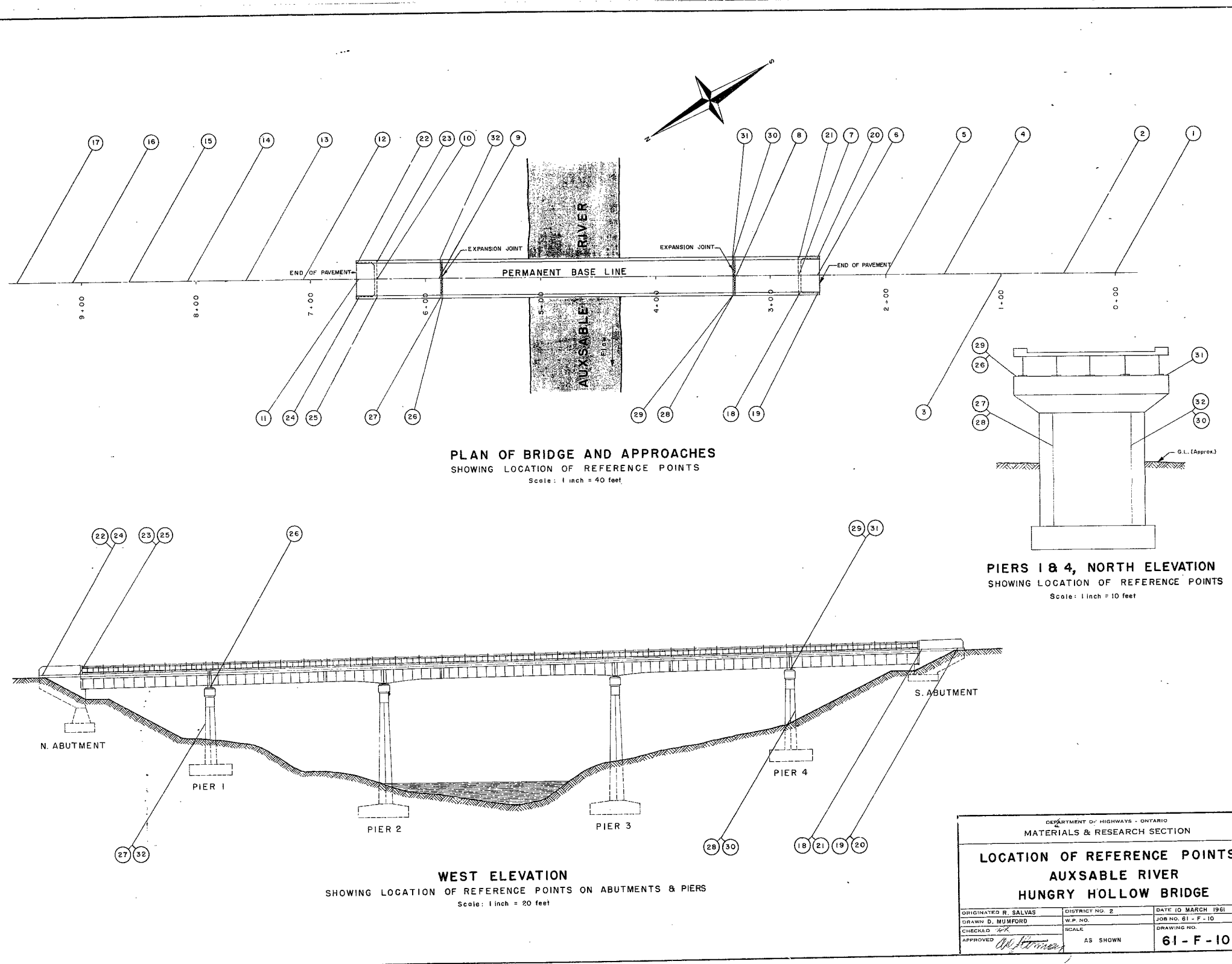


#61-F-10
HUNGRY
HALLOW BR.
AUSABLE R.
LAMBTON &
MIDDLESEX
COUNTIES



Mr. T. S. Caldwell,
District Municipal Engineer,
London, Ontario.

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

Attention: Mr. W. E. Cooke,
Assistant Mun. Engr.

January 10, 1967

Re: Hungry Hollow Bridge,
Ausable River,
Lambton & Middlesex Counties,
District #2 (London).

With regard to your memo of January 6, 1967, and the telephone conversation of January 10, 1967, regarding the above subject, we wish to make the following comments:

The elevations of a number of observation points taken in December 1966, differ somewhat from the elevations recorded during 1961, indicating that some movements have taken place. Whether the movements occurred slowly during the period of five years, or whether they were of a recent nature, cannot be established because of the lack of intermediate readings.

Although it is granted that some movements could have taken place, there is still the possibility that the difference in elevations is due to the bench mark movement, or to the fact that different crews took the readings in 1961 and 1966.

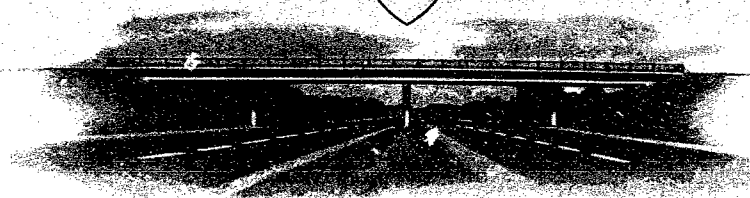
Now, being winter and with the ground frozen, we would not expect any further movements to take place before spring. We would, therefore, suggest that nothing be done at this time, but that a meeting be held at the site sometime in May or June of this year. On this occasion, a very thorough visual inspection will be made and all the pertinent information reviewed. Based on this work, it will be, we feel, easier to decide whether certain additional measures have to be undertaken.

We would appreciate it if you would record that on your calendar and get in touch with us when you feel that the weather and site conditions are such that a meeting would be desirable.

AGS/hdeF

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

cc: Foundations Office
Gen. Files



DEPARTMENT OF HIGHWAYS

London-----Ontario
Jan. 6, 1967
P. O. Box 217

Mr. A. S. Stermac,
Principal Foundation Engineer,
Materials and Testing,
Downsview, Ontario.

Dear Sir:

RE: HUNGRY HOLLOW BRIDGE
Ausable River
Lambton & Middlesex Counties
District 2

We are enclosing a tabulation of levels taken on the north and south abutments and piers of the structure, in the last week of December 1966. These are compared to the elevations of the same points taken on completion of the structure during the February 1961 investigation and district checks made in May, June and July of the same year.

As noted in a memo from Mr. L. G. Soderman, August 8, 1961, the Materials and Testing investigation was terminated when the surveys indicated no significant movement. However, we believe the changes in elevation now, are significant enough to warrant your divisions' re-appraisal, as provided for in your letter of August 8, 1961.

The May, June and July 1961 levels were taken along with horizontal measurements by district personnel. The December 1966 levels were taken by a Middlesex County crew.

It is possible that the reference points 27, 28, 30, 32 described in the April 19, 1961 foundation investigation as painted green crosses may have been changed to cut crosses, since the December 1966 levels were taken to hundredths rather than to tenths approximately, as in the original survey.

Yours truly,

W.E. Cooke
W.E. Cooke

ASSISTANT DISTRICT MUN. ENGINEER

WEC:DP

c. c. for J. Roy
F.B.D. Arnold

FOUNDATION INVESTIGATION

HUNGRY HOLLOW BRIDGE

Job 61-F-10

December 23, 1966

Reference Point Number	Orig.	1961 May 4	1961 June 13	1961 July 26	Dec. 1966 Elevation
18	117.96	117.96	117.96	117.97	118.01
19	118.35	118.35	118.36	118.36	118.40
20	118.09	118.10	118.11	118.12	118.14
21	117.92	117.92	117.94	117.94	117.97
22	110.03	110.03	110.03	110.02	110.02
23	110.36	110.36	110.36	110.36	110.35
24	110.09	110.09	110.09	110.10	110.10
25	110.48	110.48	110.48	110.49	110.50
27	89.1				89.24 C.C. North side West end North pier
28	90.8				90.53 C.C. South side West end South pier
30	90.8				90.52 C.C. South side East end South pier
32	89.1				89.26 C.C. North side East end North pier

Mr. W. L. Fraser,
District Engineer,
London, Ontario.

August 8, 1961.

MOVEMENT - ABUTMENTS & PIERS

Materials & Research Section,
(Foundations Office).

Attention: Mr. T. S. Caldwell.

Re: Hungry Hollow Bridge,
Aux Sable River, Lambton and
Middlesex Counties, District 2.

You may recall that some movement of the north abutment and north pier was reported in July, 1960. At the time, it was suspected that this movement could be caused by the instability of the slopes of the Aux Sable River at this location. In February, 1961, the above-noted structure was instrumented for the purpose of measuring any further movement of the abutments or piers.

Surveys were carried out at the bridge in April, May, June and July of this year. The results of the surveys were received and reviewed in this Office.

It can be concluded from the results of the survey that little or no movement of the abutments or piers has taken place since April, 1961. The small movements noted were inconsistent and probably within the limits of accuracy of the survey. We are therefore recommending the following:-

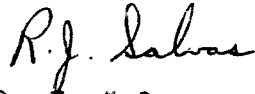
- 1) No large scale remedial measures requiring a change from the present foundation and subsoil loadings are required. Minor remedial measures such as bringing the rocker bearings back into plumb, are left to the discretion of the District since they do not involve the foundation or subsoil conditions.
- 2) If any further movements are observed from a visual observation, this Office should be notified.

cont'd. /2 ...

- 3) A complete survey should be carried out during October, 1961 and April 1962, in accordance with our report dated April 19, 1961.
- 4) If any further movement is observed either by visual observation or by the subsequent surveys, a detailed study of the stability of the slopes will be undertaken by this Section.

This memo will conclude our work on this project unless further assistance is requested by your Office.

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



(R. J. Salvas,
PROJECT FOUNDATION ENGR.)

RJS/MdeF

cc: Messrs. T. S. Caldwell
J. Roy
Foundations Office
Gen. Files.



ONTARIO
DEPARTMENT OF HIGHWAYS

MEMO FILE 28-2

Memo to Mr. W. L. Fraser, **Date** April 19, 1961.
District Engineer,
London, Ontario. **Subject** _____

From Mr. L. G. Soderman. 61-F-10

Attention: Mr. T. S. Caldwell.

Re: Hungry Hollow Bridge
Ausable River, Lambton and
Middlesex Counties, Dist. #2.

The above noted bridge has been instrumented for the purpose of observing movement of the abutments and piers. For a resume of events leading to this work, the reader is referred to a letter from H. Q. Golder & Associates Limited to Mr. L. G. Soderman dated January 12, 1961, a copy of which is attached to this report.

As suggested in the letter of January 12, 1961, the centreline of the bridge was made a permanent base line. Permanent station points consisting of 1"x1"x48" steel bars were driven at approximately 50 ft. intervals at the bridge approaches. The tops of these bars are approximately 3 inches below the ground surface. PK nails were driven into the bituminous pavement on the bridge and these can also be regarded as permanent points. In all, 32 reference points were established. The descriptions and locations of these points are given in Appendix I. For convenience and clarity, the location of the points is shown on drawing 61-F-10A attached to this report.

Stability of Slopes of Ausable River

Horizontal movement of the slopes of the Ausable River can be detected by chaining between reference points on the permanent base line on the approaches. Since the tops of the reference points in the approaches are below ground surface, it will be necessary for the survey party to be equipped with pick-axe and shovel. The approximate locations of the points

Stability of Slopes of Ausable River (Cont'd.)...

can be determined by chaining from the reference points on the bridge.

Movement of Abutments

In order to measure movement in the abutments, two bolts were grouted in each wingwall of each abutment. Horizontal control is attained by chaining along the base line and by taking offsets to the bolts. Vertical control is obtained by taking precise level readings on the bolts.

Movement of Outer Piers (Piers 1 and 4)

The movement of the top of the piers adjacent to the abutments can be detected as follows. A transit is set up on the permanent base line above the pier on one of the reference points. The angle between the base line and a plumb-bob string held over the reference point on the top of the pier is then measured. The distance from the transit to the plumb-bob string is measured. With these measurements, the horizontal position of the reference point on the top of the pier can be computed. It should be noted that it is necessary to pass the plumb-bob string through a hole in the expansion plate and for this purpose a man will have to be lowered to the top of the pier from the bridge deck.

Vertical movements can be detected by taking precise level readings on all corners of the tops of the piers.

In order to determine whether rotational movement is taking place at the piers, the following method is suggested. A groove has been cut in concrete curb above the pier and this has been boxed out in red paint. The grooves are at right angles to the base line at reference point locations. A heavy plumb-bob (16 oz.) on a long string is then lowered over the side of the deck and the string is held in the groove. The point below the plumb-bob is located and marked on the ground surface. The above procedure is then repeated at the other end of the pier. Next, a string is laid out between these two points on the ground and the distance from the string to the reference points on the pier is measured.

Movement of Inner Piers (Piers 2 and 3)

No method of detecting horizontal movements at these piers has been established since these locations did not appear to be critical. However, vertical movements should be checked by means of precise level readings on all outside corners of the tops of the piers.

Summary

A method of detecting horizontal and vertical movements has been established. Check surveys should be carried out in April, May and June of this year. A copy of the survey notes should be sent to the Foundations office after each survey.

In June or July, the situation will be reviewed and if any remedial measures are required, these can be put into effect during the summer months.

Attach.

RJS/tt

c.c. T. S. Caldwell (3) Supervising Foundation Engineer

J. Roy

Files

Foundation Files (2)✓

A. G. Stermac
A. G. Stermac

R. J. Salvas

Per: R. J. Salvas
Project Foundation Engineer

APPENDIX I

APPENDIX I

Description and Location of Reference Points

<u>Reference Point</u>		<u>Elevation</u>	<u>Description and Location</u>
1	0 + 00	129.51	1"x1"x48" steel bar in west shoulder of south approach.
2	0 + 49.84	127.06	1"x1"x48" steel bar about 7 ft. west of $\frac{1}{2}$ of south approach.
3	1 + 00.21	123.65	1"x1"x48" steel bar about 2 ft. west of $\frac{1}{2}$ of south approach.
4	1 + 49.65	120.92	1"x1"x48" steel bar near $\frac{1}{2}$ of south approach.
5	2 + 00.23	118.69	Same as 4.
6	2 + 60.04		1 1/4" PK nail driven into bituminous pavement on $\frac{1}{2}$ of bridge.
7	2 + 75.96		Same as 6.
8	3 + 30.65		1 1/4" PK nail driven into bituminous pavement on $\frac{1}{2}$ of bridge about 18" south of south expansion joint.
9	5 + 88.20		1 1/4" PK nail driven into bituminous pavement on $\frac{1}{2}$ of bridge about 18" north of north expansion joint.
10	6 + 42.51		Same as 6.
11	6 + 58.94		Same as 6.
12	7 + 06.17	109.15	1"x1"x48" steel bar near $\frac{1}{2}$ of north approach, top of bar is about 3" below surface.

<u>Reference Point</u>	<u>Chainage</u>	<u>Elevation</u>	<u>Description and Location</u>
13	7 + 56.84	109.24	1"x1"x48" steel bar near E of north approach, top of bar is about 3" below surface.
14	8 + 07.31	110.19	Same as 13
15	8 + 57.03	112.46	"
16	9 + 07.05	115.00	"
17	9 + 56.89	118.35	"
18	2 + 75.96	117.96	Hexagonal head bolt grouted in concrete near north end of sidewalk at west guard rail approach at south abutment.
19	2 + 60.04	118.35	Hexagonal head bolt grouted in concrete near south end of sidewalk at west guard rail approach at south abutment.
20	2 + 60.04	118.09	Same as 19 except in east guard rail approach.
21	2 + 75.96	117.92	Same as 18 except in east guard rail approach.
22	6 + 58.94	110.03	Hexagonal head bolt grouted in concrete near north end of sidewalk at east guard rail approach at north abutment.
23	6 + 42.51	110.36	Hexagonal head bolt grouted in concrete near south end of sidewalk at east guard rail approach at north abutment.
24	6 + 58.94	110.09	Same as 22 except in west guard rail approach.
25	6 + 42.51	110.48	Same as 23 except in west guard rail approach.
26	5 + 85.47		Cross, cut in concrete on top side of pier 1 below hole in 1/4" checkered plate at north expansion joint on curb.

<u>Reference Point</u>	<u>Chainage</u>	<u>Elevation</u>	<u>Description and Location</u>
27	5 + 87.66	89.1 (approx.)	Green cross painted on Pier 1, north side, west end, about 15ft. below top of pier.
28	3 + 31.31	90.8 (approx.)	Green cross painted on south side of pier 4, at west end, about 18.7 feet below top of pier.
29	3 + 33.71		Cross, cut in concrete on top of Pier 4 at west end below hole in 1/4" checkered plate at south expansion joint on curb.
30	3 + 31.29	90.8 (approx.)	Same as 28 except at east end.
31	3 + 33.63		Same as 29 except at east end.
32	5 + 87.66	89.1 (approx.)	Same as 27 except at east end.

Ref. Bench Mark

The reference bench mark is a 1"x1"x48" steel bar 418.94 ft. west of $\frac{1}{2}$ of bridge at approximately Sta. 6 + 60. The bar was driven to refusal which is thought to be a layer of limestone bedrock about 12" in thickness. The elevation of the top of the bar was taken as 100.00.

H. Q. GOLDER & ASSOCIATES LTD.

CONSULTING CIVIL ENGINEERS

H. Q. GOLDER
V. MILLIGAN

2446A BLOOR ST. W.
TORONTO 9
RO. 7-9201

January 12th, 1961.

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

Attention: Mr. L. G. Soderman, P. Eng.,
Principal Foundation Engineer

RE: OBSERVATION OF ABUTMENT STABILITY,
HUNGRY HOLLOW BRIDGE,
AUSABLE RIVER,
LAMBERTON-MIDDLESEX COUNTIES.

Dear Sirs:

The above bridge was inspected in September, 1960 by the writer with Mr. N. M. Warner of R. J. Dunn and Associates, and, later, by Dr. Golder with Mr. Soderman. The purpose of these inspections was to assess the significance of reported movements of the north abutment of the bridge.

It is understood that at the time of completion of the bridge in the spring of 1960 a slight movement of the wing walls of the north abutment was suspected. This was checked by a survey on July 11th, 1960 when it was found that the abutment had apparently shifted about 3/4 inch east of its original location. Measurements of the gap in the finger plate at the first pier south of the abutment (Pier 1) indicated that this movement had been slightly rotational; the gap at the east curb measured 3/4 inches and at the west curb measured 1 1/2 inches. Levels taken on July 11th, 1960 indicated that there had been a differential settlement of about 1-3/4 inches across the abutment from west to east. These measurements were confirmed in September. Further indication of lateral movement of the abutment was given by the fact that the rocker bearings for the approach span on Pier 1 were out of plumb. No evidence of movement of piers or the south abutment was detected.

January 12th, 1961

Based on the superficial inspection of the bridge and the adjacent slopes of the Ausable River, it was agreed that the cause of the movement did not appear to lie in a general instability of the slope. It was considered more likely that the movement was due to a post-construction adjustment which is now probably complete.

However, in view of the frequent incidence of general slope instability along the Ausable River, it was considered advisable to initiate a system of observations in order to establish whether or not movement of the abutment is continuing. Then, if movements are still taking place, it would be necessary to carry out a detailed study of the stability of the slope in order to decide on possible remedial measures.

It will be the purpose of the remainder of this letter to suggest a system of observation. This scheme will be outlined in some detail, but it is recommended that final details be worked out at a meeting between representatives of interested parties, perhaps at the site.

In order to establish lateral control on the bridge, it is suggested that the construction centre line of the bridge be made a permanent base line. Permanent station points consisting of steel posts driven into the ground or embedded in concrete to a depth of about 5 feet should be established at about 50 foot intervals along the line to a distance of about 300 feet from each end of the bridge. Hubs should also be established on this line and near the curb on the bridge, particularly on each abutment and approach span. Horizontal control is then attained by chaining along the base line and by taking offsets to the various hubs established on the bridge at regular time intervals. Vertical control would be established by taking precise levels on the various hubs on the bridge; these levels should be reference to permanent bench marks established at the extremities of the base line.

In addition to the above control system, it is suggested that arrangements be made for plumbing the piers adjacent to each abutment (Piers 1 and 4). These arrangements should be such that the same points are plumbed each time. The plumbing of the piers should establish whether or not a general instability of the slope is affecting the piers.

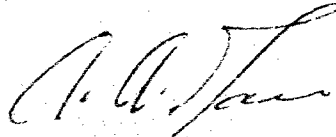
These control measures should be put into effect before the end of February, 1961 so that observations can commence before the critical period of spring break-up. Observations should be taken at monthly intervals unless significant movement is observed; in which case the time interval between surveys should be shortened to two weeks. Towards the middle of the summer the accumulated observations should be reviewed in order to determine whether or not further action would be required. Pending this review, we would like to receive copies of the observations as they are made in order to ensure that no excessive movements dictating immediate action are taking place.

January 12th, 1961.

We trust that these suggestions will be sufficient for your present requirements. We will be pleased to discuss the matter further with you at your convenience.

Yours very truly,

H. Q. GOLDER & ASSOCIATES LTD.

A handwritten signature in dark ink, appearing to read 'A. A. Gass', written in a cursive style.

A. A. Gass, P. Eng.

AAG:IMB
6017