

67 - F-53

Hwy. #20

WEST ENTRANCE
TO THE HAMLET
OF SMITHVILLE

M.F. 25-20, 10

J. J. G. G.

Mr. H. Greenland,
District Engineer,
Hamilton - District #4.

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

Attention: Mr. D. A. Waller,
Maintenance Engr.

July 17, 1967

Road Subsidence at the West Entrance to the
Hamlet of Smithville, Ontario, Hwy. #20.
W.J. 67-P-53 -- District #6 (Toronto).

The Foundation Section was verbally requested to carry out an investigation of a road subsidence in the hamlet of Smithville on June 19, 1967, by Mr. Lexne Bradt of Hamilton District. Following, is a report of our findings together with our recommended remedial measures.

The site is located at the west end of the hamlet of Smithville. The affected area of road subsidence is about 200 ft. long and concerns the south half of the road only, which is adjacent to a natural side slope some twenty feet high. Evidence of lateral movement is present in the misalignment of the guide rail posts, but the relative shallowness of this is demonstrated by the fact that trees on the top of the side slope are unaffected. Similarly unaffected is a hydro pole close to the guide rail posts. Subsidence has been occurring for a number of years and is a permanent maintenance problem.

Two borings were carried out during the field work at the approximate centre of the area. Borehole 1 was located at the south side of the pavement, and Borehole 2 was located at the north side. In addition, a 7-ft. deep pit was excavated on the south shoulder.

At the north side (B.H. 2), approximately 1 foot of pavement overlies about 3 inches of sand and gravel which is underlain by at least 16 feet of very stiff to hard silty clay to clayey silt with sand and traces of gravel. This latter has a moisture content ranging from 14% - 25%. At the south side (B.H. 1), about 3 ft. of pavement overlies 3 - 4 ft. of soft to firm silty clay with sand and traces of gravel, which is followed by at least 21 feet of similar material with a very stiff to hard consistency. The moisture content in the upper 3 feet of the silty clay layer ranges from 24% to 30%, whilst below this level, it averages about 25% to a depth of about 15 ft. below ground level.

cont'd. /2 ...

Mr. H. Greenland,
District Engr. - Hamilton.
Attn: Mr. D. A. Waller, Maint. Engr.

- 2 -

July 17, 1967

Recommendations:

It is our opinion that the cause of the road subsidence can be attributed to the aforementioned 3 - 4 feet of silty clay underlying the south half of the pavement. This material becomes softened still more by the seepage of water through the crack along the road centre-line, and tends to displace sideways. To remedy the situation and effect a satisfactory repair which will be serviceable until the road is rebuilt (1970), the following steps are recommended:

- (1) Excavate the south half of the pavement over the affected area, including the shoulder, down to the very stiff to hard material. This should be recognizable and should not prove to be deeper than 7 feet below pavement surface.
- (2) Place well compacted earth fill similar to the material in the road bed, but at the optimum moisture content, to within 21 inches of profile grade. It is essential that good compaction be achieved; otherwise, the present situation will re-occur after the repair.
- (3) Place 21 inches of compacted granular material over the earth fill and provide sufficient French drains to keep it completely drained at all times.
- (4) Provide 3 inches of hot-mix asphalt surfacing.
- (5) If, for some reason, item (2) cannot be complied with, granular material should be used instead of the earth fill.

In any event, the pavement will probably crack after the winter, along the junction of the old and new. This, however, should not result in subsidence and, hence, will not be serious.

KCS/ndsf

E. G. Selby
E. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Starnac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. E. J. Orr
T. J. Kovich

Foundations Files
Gen. Files

JG

Mr. H. Greenland,
District Engineer,
Hamilton - District #4.

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

Attention: Mr. D. A. Waller,
Maintenance Engr.

July 17, 1967

Road Subsidence at the West Entrance to the
Hamlet of Smithville, Ontario, Hwy. #20,
W.J. 67-P-53 -- District #6 (Toronto).

4 (Hamilton)

The Foundation Section was verbally requested to carry out an investigation of a road subsidence in the hamlet of Smithville on June 19, 1967, by Mr. Lorne Bradt of Hamilton District. Following, is a report of our findings together with our recommended remedial measures.

The site is located at the west end of the hamlet of Smithville. The affected area of road subsidence is about 200 ft. long and concerns the south half of the road only, which is adjacent to a natural side slope some twenty feet high. Evidence of lateral movement is present in the misalignment of the guide rail posts, but the relative shallowness of this is demonstrated by the fact that trees on the top of the side slope are unaffected. Similarly unaffected is a hydro pole close to the guide rail posts. Subsidence has been occurring for a number of years and is a permanent maintenance problem.

Two borings were carried out during the field work at the approximate centre of the area. Borehole 1 was located at the south side of the pavement, and Borehole 2 was located at the north side. In addition, a 7-ft. deep pit was excavated on the south shoulder.

At the north side (B.H. 2), approximately 1 foot of pavement overlies about 3 inches of sand and gravel which is underlain by at least 16 feet of very stiff to hard silty clay to clayey silt with sand and traces of gravel. This latter has a moisture content ranging from 14% - 25%. At the south side (B.H. 1), about 3 ft. of pavement overlies 3 - 4 ft. of soft to firm silty clay with sand and traces of gravel, which is followed by at least 21 feet of similar material with a very stiff to hard consistency. The moisture content in the upper 3 feet of the silty clay layer ranges from 24% to 30%, whilst below this level, it averages about 25% to a depth of about 15 ft. below ground level.

cont'd. /2 ...

Mr. H. Greenland,
District Engr. - Hamilton.
Attn: Mr. D. A. Waller, Maint. Engr.

- 2 -

July 17, 1967

Recommendations:

It is our opinion that the cause of the road subsidence can be attributed to the aforementioned 3 - 4 feet of silty clay underlying the south half of the pavement. This material becomes softened still more by the seepage of water through the crack along the road centre-line, and tends to displace sideways. To remedy the situation and effect a satisfactory repair which will be serviceable until the road is rebuilt (1970), the following steps are recommended:

- (1) Excavate the south half of the pavement over the affected area, including the shoulder, down to the very stiff to hard material. This should be recognizable and should not prove to be deeper than 7 feet below pavement surface.
- (2) Place well compacted earth fill similar to the material in the road bed, but at the optimum moisture content, to within 21 inches of profile grade. It is essential that good compaction be achieved; otherwise, the present situation will re-occur after the repair.
- (3) Place 21 inches of compacted granular material over the earth fill and provide sufficient French drains to keep it completely drained at all times.
- (4) Provide 3 inches of hot-mix asphalt surfacing.
- (5) If, for some reason, Item (2) cannot be complied with, granular material should be used instead of the earth fill.

In any event, the pavement will probably crack after the winter, along the junction of the old and new. This, however, should not result in subsidence and, hence, will not be serious.

KCS/ndef

H. G. Selby
H. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. E. J. Orr
T. J. Kovich

Foundations Files ✓
Gen. Files

MEMORANDUM

To: Mr. H. Greenland,
District Engineer,
District No. 4 (Hamilton).

FROM: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Attn: Mr. D. A. Waller,
Maintenance Engineer

DATE: June 26, 1969

OUR FILE REF.

IN REPLY TO

SUBJECT: Re: Road Subsidence at the West Entrance
to the Hamlet of Smithville, Ontario,
Hwy. 20, District No. 4 (Hamilton)
W.J. 67-F-53 --

On June 25, 1969, the undersigned, accompanied by Mr. K. G. Selby, Supervising Foundation Engineer, met Mr. L. Bradt, Hamilton District Office (Maintenance), at the above mentioned site to review and discuss the problems that have arisen since certain remedial work was carried out in this area in 1968.

The stretch of road that was subsiding was the subject of a field investigation by the Foundation Section during June of 1967. A letter describing the findings of this investigation and containing recommendations for remedial measures, was submitted to the District on July 17, 1967. In the summer of 1968, remedial measures were undertaken. However, it appears that our recommendations regarding the removal of the material under the shoulder and the installation of an effective drainage system (French drains) of the backfilled material, were not fully implemented. Further movements have since occurred.

The Eastbound lane of the highway that was subsiding before the remedial measures were carried out, is presently in good shape, except for a few places along the edge of pavement where settlements have taken place. The shoulder, though, shows many signs of distress. The shoulder material that was placed at the time of the remedial measures, has moved both vertically and horizontally towards the river. It is estimated that the maximum movement in either of those directions is in the order of 3 ft. In order to maintain the shoulder, new granular material was placed and presently fresh tension cracks are visible in it.

The material that was excavated from beneath the Eastbound lane, was placed or dumped on the existing slope. This material is presently soft and soggy, indicating a very high groundwater table. There are many obvious signs of movements of the slope, the most striking one being the inclined trees.

Mr. H. Greenland,
District Engineer,
District No. 4 (Hamilton).

2

Attn: Mr. D. A. Waller, Maint. Engr.

June 26, 1969

Re: Road Subsidence - Smithville, Ont. - Hwy. 20 - (cont'd.) ...

Mr. Bradt explained and described the remedial measures that were carried out in 1968, and also mentioned two things, both of which seem to be of considerable significance in evaluating and explaining the causes for the present unstable conditions:

1. When the material from under the Eastbound lane was excavated and pushed, dumped or spread on the existing slope, a tension crack appeared in the excavation somewhere in the vicinity of the edge of pavement.

This would clearly indicate that the existing slope was loaded to the point where the factor of safety was very close to unity.

2. According to one source of information, the river has shifted its course in the past. Apparently the river channel has moved some 70 ft. to the north (towards the road) in the last 50 - 60 years.

If this information is correct, it can be concluded that the stability of the slope is being constantly decreased by the slow but constant loss of ground at the toe of the slope.

In addition to the two above mentioned causes contributing to the instability of the slope, the high groundwater table, as evidenced by the softness and sogginess of the surface material, is also playing a significant role.

In view of the aforementioned, we would recommend that the following remedial measures be undertaken:

(1) As much material as possible should be removed from the slope, in particular, from its upper portion.

(2) Counterfort drains 18 - 24 inches wide should be dug, extending from the edge of shoulder down to the river's edge. They should be deeper (6 - 8 ft.) at the top, shallower (2 - 3 ft.) at the bottom, and should be spaced approx. 15 ft. centres.

Mr. H. Greenland,
District Engineer,
District No. 4 (Hamilton).

Attn: Mr. D. A. Waller, Maint. Engr.

June 26, 1969

Re: Road Subsidence - Smithville, Ont. - Hwy. 20 - (cont'd.) ...

(3) Rip-rap for the protection of the toe of the slope, should be placed along the entire length of the unstable section of the bank. This recommendation is subject to the verification of the information concerning the shifting of the river channel.

The foregoing recommended measures were discussed with Mr. Bradt, and it was agreed that they could be carried out.

Should you wish to discuss any aspects of this job, please feel free to call this office.

AGS/MdeP

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

cc: Messrs. E. J. Orr
T. J. Kovich

Foundations Files ✓
Gen. Files

401 & Keele St.
Downsview, Ontario

June 26, 1967

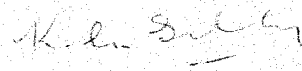
Johnston Drilling Co. Lt d.
377 Munster Ave.
Toronto, Ontario

Dear Sirs:

This is to confirm our request of June 20, 1967
for the supply of a Diamond Drill together with all neces-
sary equipment, as specified under the terms of our Contract
Agreement, at Smithville, Ontario.

This project bears job number 67-F-53.

Yours truly,



KGS:mt

K. G. Selby
Supervising Foundation Engineer
for: A. G. Stermac
Principal Foundation Engineer