

GEOCRES No. 30M3-124DIST. 4 REGION W.P. No. CONT. No. EMBANKMENT FAILUREW. O. No. 73-11070 (x)STR. SITE No. -HWY. No. 406LOCATION EMBANKMENT INSTABILITY, EASTSIDE OF HWY 406No of PAGES - 1=====  
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

Mr. C.R. Robertson,  
District Engineer,  
District No. 4.  
Hamilton.

Foundations Office,  
Design Services Branch,  
West Building,  
Downsview.

Mr. H. Dotts,  
District Maintenance Engineer. October 5, 1973.

Instability of Embankment,  
East Side of Hwy. 406,  
W.O. 73-11070 (X),  
District No. 4 (Hamilton).

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In response to a verbal request from the District and further confirmed in a memo (dated August 30, 1973) by Mr. C. Mirza, Regional Materials Engineer, a site inspection and subsequently a field investigation have been carried out by the Foundations Office. The purpose of this investigation is to determine the causes of embankment failure and suggest remedial measures. The details are discussed herein.

The failure occurred in the embankment on the east side of the northbound lane of Hwy. 406, just south of Westchester Street exit ramp. At this location Hwy. 406 is located on a side hill. The east side of the roadway is on an embankment, whereas the west side is in a shallow cut. The St. Catherines Golf Club is situated on the west side of Hwy. 406, whereas the old Welland Canal is on the east side some 300 feet away. It is understood that the drainage system of the golf course consists of series of tile drains which were connected into the Old Welland Canal before construction of Hwy. 406.

The failure of the embankment at the site resulted in the partial removal of the fill material. Wide cracks are visible all over the failure area and it is believed that heavy precipitation may further aggravate the situation.

Visual observations indicate that the failure was caused by seepage forces acting at the contact surface of the fill material and the original subsoil.

A field investigation, consisting of seven test pits were carried out by means of a backhoe in order to determine the subsoil conditions and locate probable seepage zones.

Three of these test pits were located within the failed area and these pits have indicated that a seepage zone exists at the contact surface of the fill material and the parent subsoil at a depth of 9 feet. It is further revealed that the embankment material consists mainly of silty clay to clay, with an organic zone at the contact between the fill and the original subsoil.

This organic layer is about 2 to 3 feet thick, very soft, black coloured deposit containing decayed and undecayed vegetations.

Below the organic zone the natural subsoil appears to be stiff to very stiff silty clay.

In addition, two pits were excavated at the median and one within the drainage ditch located at the west side of Hwy. 406. These excavations failed to show any seepage zones or soft material up to a depth of 12 feet below the existing ground surface.

The subsoil at these locations was found to consist of a surficial layer of topsoil, followed by very stiff to hard silty clay.

Similar conditions were encountered in the test pit located on the top of the cut.

From these observations, it can be concluded that the instability of the embankment was primarily attributed to action of seepage forces through the slope and the presence of a very soft organic deposit between the embankment material and original subsoil.

It is possible that some of the above mentioned tile drains were not disconnected during the highway construction and they are still draining surface water into the slope.

In view of these facts the following remedial measures are recommended to control the seepage forces and to overcome the existing instability of the embankment:

1. All the failed and soft material together with the encountered organic deposit should be removed for the entire depth within the distressed area.
2. A granular blanket of at least 18" in thickness should be placed prior to placing any new fill material in the failed area. The new fill material should be properly compacted in 6 inch layers at about optimum moisture content.

3. Counterfort drains having a minimum base width of 2 feet should be constructed transversely as shown on Drawing No. 73-11070(X). The spacing of these drains should not exceed 30 feet. The material to be used for construction of the counterfort drains should consist of a free draining granular material such as Granular 'A'.

4. All the still active tile drains should be disconnected along the median, and connected to a collector sub-drain which drains into the existing highway drainage system.


In addition, the existing drainage system should be improved at the median as well as at the west side roadway ditch. Free drainage should be provided for the surface run-off water at these locations.

5. Proper grade should be provided for the existing discharge pipe located north of the limits of the failure zone, which drains the nearby median catch basin.

The recommendations contained in this memo were discussed with Mr. C. Mirza and also with District Personnel, in order that remedial measures for the Hwy. 406 embankment failure could be proceeded if necessary.

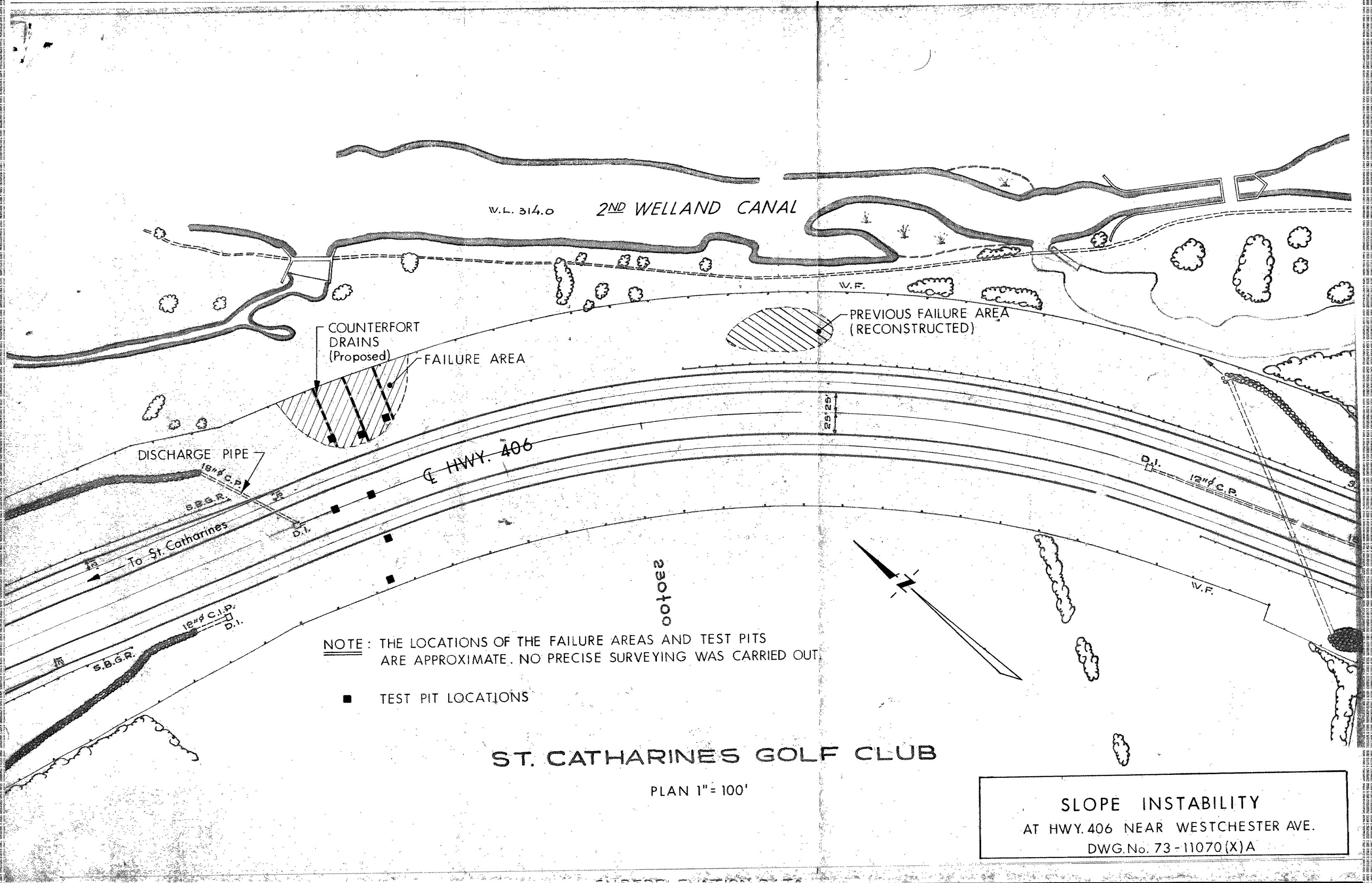
We believe that the above information is sufficient for your requirements. Should you have any further queries with regard to this project, please contact our office.

PP/zh

  
P. Payer,  
SENIOR FOUNDATIONS ENGINEER,  
for M. Devata,  
SUPERVISING FOUNDATIONS ENGINEER.

cc: C.R. Robertson (2)  
J.E. Callaghan  
C. Mirza  
J.W. MacDougall  
B.J. Giroux  
J.M. Crannie

Foundations Files  
Documents





①

EXCAVATE AT CENTER OF  
FAILURE: NAT. FILL (CLAY)  
SEEPAGE AT 9' B.G.L.  
EXCAVATE 2' DEEPER —  
LEAVE HOLE OPEN  
AT 10': BLACK - ORGANIC  
NAT. WET SOFT - ROOTS ETC.

②

TO 7<sup>th</sup> FT. OK. FILL  
WET BELOW THIS DEPTH  
(SLOPES DRAWING IN)  
ORGANICS AT 8' - 10'  
NO SEEPAGE

③

Brown - sil. cl. Fill  
well compacted. O.K.  
DEPTH. 12'

+  
THE ORIGINAL MAT'L.  
PROBABLY FURTHER DOWN.

✓ . . . . .  
+  
④ MEDIAN

TO 3.5' BR. CL.  
WELL COMPACTED  
AT 3.5' SAND - BRIDGING  
FOR DITCH DRAIN, COND. PIPE.  
POOR BACKHOE  
ORIGINAL MAT'L FROM 3'?

EXC. TERMINATED AT 11' -  
NO EVIDENCE OF SEEPAGE



⑤

MOOR APPROX 50' S ON  
MEDIAN TO LOCATE TILE DRAIN  
APPROX 10'-12' LONG STRIP  
5' DEEP - ORIGINAL MAT'L.  
NO SIGN OF DRAIN

⑥

LOCATION: WEST DITCH  
SOFT ON TOP (2' W/ OFF  
WATER) TILL (ORIGINAL  
MATERIAL,  
EXCAVATED TO 8'  
ORIG. MAT'L. - ~~NO EVIDENCE~~  
EVIDENCE OF SOFTENING.

⑦

⑤

MOOR APPROX 50' S ON  
MEDIAN TO LOCATE TILE DRAIN  
APPROX 10'-12' LONG STRIP  
5' DEEP - ORIGINAL NAT'L  
NO SIGN OF DRAIN

⑥

LOCATION: WEST DITCH  
SOFT ON TOP (RUN-OFF  
WATER) TILL (ORIGINAL  
MATERIAL,  
EXCAVATED TO 8'  
ORIG. NAT'L. - ~~NO EVIDENCE~~  
EVIDENCE OF SOFTENING.

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JUN 21 2 39 PM '74

OC 21/74

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DOWN HAMN 3 JUNE 21/74 2.35 PM

MR M DEVATA SUPV FNDN ENG

FOUNDATION OFFICE WEST BLDG

SUBJECT BANK SLIPPAGE 406

406

ADDITIONAL SEVERE SLIPPAGE HAS TAKEN PLACE TO DAY AT WESTCHESTER AND  
AT CNR WOULD YOU PLEASE ADVISE WHEN YOU MAY ATTEND A FIELD MEETING AT  
THE SITE

J L TANSLEY ASST HWY MTCE SUPVR

LAM

Field trip arranged for June 25th 1974.

DN-20

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac,  
Pr. Foundations Engr.,  
Foundations Office.

FROM: Materials & Testing Office,  
Central Region.

ATTENTION: Mr. M. Devata,  
Supvr. Fdns. Engr.

DATE: August 30, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Slope Failure  
Highway 406, St. Catharines  
Hamilton District

At the request of Mr. Mel Scrimshaw, Hamilton District Maintenance, I visited the site of a slope failure on Highway 406 just south of Westchester Avenue in St. Catharines on August 28, 1973.

The failure, which is indicated to be of recent occurrence, is located on the east side of Highway 406 northbound, immediately to the south of the N-EW ramp taper.

A cursory examination of the affected slope and the grounds beyond the toe of the slope does not indicate deep-seated instability. There was no free water or active seepage in evidence.

The failure consists of down slope movement of fairly massive, relatively dry wedges of soil. These wedges are up to two feet  $\pm$  in width and three feet  $\pm$  in depth. By inserting a hand shovel in the opening between the slope and the dislocated soil wedges, I was able to detect fairly soft clay fill material which could easily be in the N = 2 - 4 blows per foot range. I think that there is a potential for further deterioration of this slope should the area be subject to thunder-showers or a prolonged period of steady rainfall.

I indicated to Mr. George Bristol of the Hamilton District Maintenance staff and others who were at the site with him, that I would be contacting you for a subsurface investigation at this site.

Would you please, therefore, consider this memorandum our urgent request to you for an investigation into the probable

continued:-

ESTIMATED: \$ 1000<sup>00</sup>

Mr. A.G. Stermac.

August 30, 1973.

Re: Slope Failure, Highway 406

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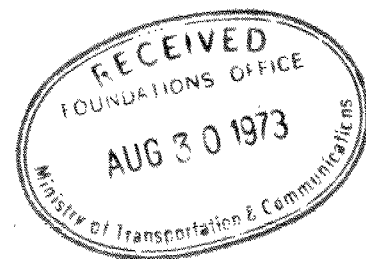
causes of slope movement and remedial measures which will be required to restore stability. Please forward your report to Hamilton District with a copy to us for our information.



C. Mirza,  
Regional Materials Engineer.

CM/js.

cc: H. G. Potts  
(Attn: M. Scrimshaw)  
A. Rutka





Ontario

7540-1037 (2-72)

# ACTION REQUEST

DATE

June 21/74

TO

Murty

FROM

Mr. Tansley, Hamilton District

TELEPHONE NO.



— PLEASE CALL



— WISHES APPOINTMENT



— RETURNED YOUR CALL



— WILL CALL BACK



— NOTE AND FILE



— PROVIDE MORE DETAILS



— PLEASE ANSWER



— NOTE AND FORWARD



— FOR YOUR INFORMATION



— DRAFT REPLY FOR MY SIGNATURE



— NOTE AND RETURN



— FOR YOUR APPROVAL



— INVESTIGATE AND REPORT



— NOTE AND SEE ME



— FOR YOUR SIGNATURE



— TAKE APPROPRIATE ACTION



— RETURN WITH COMMENTS



— PER YOUR REQUEST



COMMENTS:

Regarding 2 bad failures:

① N.W. Corner, Westchester & Hwy 406

② N.W. Corner CNR U'Pass & Hwy 406

(You looked at them last year)

CALL TAKEN BY:

Randa

TIME

10:40 a.m.