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G.I.-30 SEPT. 1976

GEOCRES No. 30M5-89

DIST. 4 REGION Central

W.P. No. _____

CONT. No. 72-160

W. O. No. 73-11101

STR. SITE No. _____

HWY. No. 99

LOCATION Cut + Fill Slope Failures

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: _____

RICK MCCANDLESS ROAD INFORMATION

GEOTECHNICAL OFFICE
WEST BUILDING

B
MX TORR 1 JANUARY 18/74 3:45 PM
TORD 1 M DEVATA GEOTECHNICAL OFFICE WEST BUILDING
HAMN 1 D A WALLER DIST CONSTRUCTION ENGINEER HAMILTON DISTRICT
CONTRACT 72-160
HWY 99
DISTRICT 4

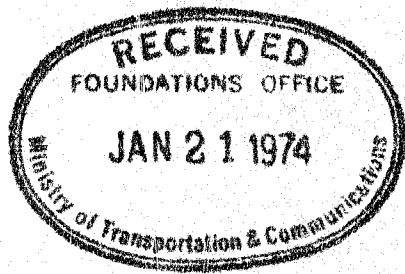
WE HAVE BEEN REQUESTED BY MR. D. A. WALLER TO RUSH HIM RECOMMENDATIONS FOR SLOPE FAILURE TREATMENTS ON ABOVE JOB. PLEASE EXPEDITE YOUR ANALYSES AND FORWARD US THE RESULTS SO THAT WE MAY INCORPORATE THEM IN OUR REPLY TO MR. WALLER.
C MIRZA REGIONAL MATERIALS ENGINEER
DB



Geotechnical Office
West Building

TO: DIRECTOR, CIVIL ENGINEERING
FROM: GEOTECHNICAL OFFICE, WEST BUILDING
SUBJECT: [Illegible]

[Illegible text block]



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. C. Mirza,
Regional Materials Engineer,
Central Region,
3501 Dufferin St., Downsview.

FROM: Geotechnical Office,
Engineering Services Branch,
West Bldg., Downsview.

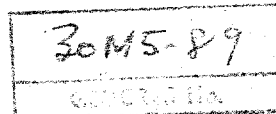
ATTENTION:

DATE: January 23, 1974.

OUR FILE REF.

IN REPLY TO

SUBJECT: Stability of Fills and Cuts
Hwy. 99 Near Copetown
District #4 (Hamilton)
W.O. 73-11101



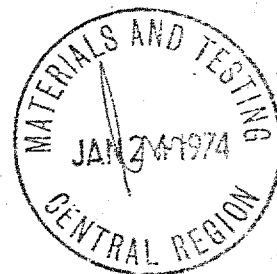
As per your verbal request, we have carried out slope stability analysis for the above-mentioned project, with the following assumptions:

Fill Material (sandy silt or silty sand)

$$\begin{aligned}\gamma &= 120 \text{ p.c.f.} \\ \phi &= 28^\circ\end{aligned}$$

Sandy Silt or Silty Sand

$$\begin{aligned}\gamma &= 120 \text{ p.c.f.} \\ \phi &= 30^\circ\end{aligned}$$



The results of the stability analysis are discussed in the following paragraphs.

i) Fill at Station 99+75

The embankment at Station 99+75 (Hwy. #99) is approximately 23 feet high, with an average slope of 1-3/4:1 to 2:1.

It is understood that the embankment at this location showed some signs of distress; i.e., cracks in the roadway pavement and bulging at mid-slopes. Stability analysis carried out indicated the factor of safety of the existing embankment was very close to unity. To ensure the long-term stability of the embankment at the distressed area, it will be necessary to flatten the side slopes to 3:1. In addition, the slope surface should be protected with sodding.

ii) Cut Sections

Stability analysis were carried out on cuts up to 50 feet high. The results indicated that cuts up to 18 feet high

with 2:1 side slopes are stable against deep-seated rotational type of failure. Cuts up to 36 feet high will require mid-height berm. The berm lengths for various heights of cut are as follows:

<u>Height of Cut-Feet</u>	<u>Length of Mid-Height Berm-Feet</u>
18	0
25	10
31	15
36	20

Note: All slopes 2:1.

For cuts from 36 to 50 feet high, berms at $1/3$ H and $2/3$ H will be required if 2:1 slopes are used. The berm lengths are summarized in the following table.

<u>Height of Cut-Feet</u>	<u>Length of Berm at $1/3$ H and $2/3$ H - Feet</u>
36 - 38	5
39 - 42	10
43 - 46	15
47 - 50	20

In addition, the slope surface should be properly sodded.

Alternatively, the cuts may be constructed with 3:1 slopes which will eliminate the use of berms at two levels for cuts higher than 36 feet. The results of analysis are tabulated as follows:

<u>Height of Cut-Feet</u>	<u>Length of Mid-Height Berm-Feet</u>
35	0
42	
50	

Note: All Slopes 3:1.

We believe that the foregoing is sufficient for your present requirements. Should you have further queries regarding this project, please contact this Office.

CSP/ao

c.c. Foundations Files
Documents

Chris
J. Hoon
C. S. Poon, 3-282
Project Foundations Engineer,
For: M. Devata,
Supervising Foundations Engineer

105120 (12/8)
105120 (13/1)

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

73-11101
file

TO: Mr. D. A. Waller,
Construction Engineer,
Hamilton District.

FROM: Materials and Testing Office,
Central Region.

ATTENTION:

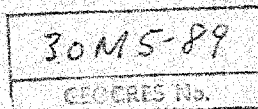
DATE: February 14, 1974.

OUR FILE REF:

IN REPLY TO

SUBJECT:

Contract No. 72-160; Highway 99
Cut and Fill Slope Failures
Hamilton District



In reply to your memorandum of February 6, 1974, the following are our comments and recommendations regarding the remedial treatments for the cut slope failures that occurred on the above-noted highway.

A field review of these cut slopes made during December, 1973 and again on February 6, 1974 indicated that the distress throughout can be classified as shallow failures consisting mainly of soil sloughs and surface erosion.

After completion of the grading, for the most part these slopes had been topsoiled and seeded, but the vegetation cover has not had time to develop and tie down the material on the slopes.

The soil has a high silt content and it is quite susceptible to surface erosion.

This office requested the Foundation Office to carry out stability analyses of the cut and embankment slopes. The analyses have been completed on the basis of assumed soils properties.

The results of the analyses were made available in a memorandum dated January 23, 1974, a copy of which is attached. Please note that the recommendations contained therein are of theoretical interest only and we have used them to obtain a "feel" for the problem.

After studying the property restrictions and the cross-sections of the cut and fill slopes, and discussing this with the Project Supervisor, Mr. John Cleaver, it is considered that the following corrective treatments will be most practical and economical:



1. Cut Slopes:

Station 84+00± (north and south sides)

Station 96+00± (north and south sides)

Remove the sloughed and loose soil from the slope and replace with Granular 'A' which should be extended to the ditch line. The slope then should be topsoiled and reseeded.

2. Cut Slope:

Station 105+88± (north side)

Remove the sloughed soil, reshape the slope using native material and then reseed.

3. Cut Slope:

Station 159+25± to Station 162+00± (south side)

At this location the cut slope has been covered with a series of soil sloughs and erosions due mainly to internal water seeping to the slope surface.

The intensive seepage zones visually observed at present are at Station 160+00± (elev. 555') and Station 161+00± (elev. 560'). The surface area here has funnel-shaped washouts (15' to 25' wide) with considerable gullies and sloughs extending down the slope.

In order to control the seepage erosion, the following treatment is recommended:

Remove the sloughed soil and excavate the trench to a minimum depth of 2 feet to provide for counterfort drain consisting of Granular 'A'. The trench should be extended from an elevation of 2 feet above the observed seepage zone down to the ditch line.

The width and exact location of the counterfort drain will be determined in the field after the sloughed soil has been removed from the slope and the seepage zones are exposed.

After this treatment has been completed, the entire slope can then be topsoiled and seeded.

4. Cut Slopes:

Station 162+50± (north side)

Station 175+60± (south side)

Station 188+00± (south side)

Stations 224+50± to 227+50± (north and south sides)

Reshape the slope with native material and then reseed.

5. Fill Slopes:

Station 101+00± (north side)

Station 135+00± (south side)

Station 213+00± (north side)

Station 232+00± (north side)

The shallow soil sloughs and bulgings that occurred on the above embankment slopes at this time will require reshaping and reseeding only.

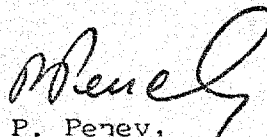
The material on the cut and fill slopes is still frozen and, undoubtedly, more sloughing will occur after the spring thaw. In spite of this possibility, the above remedial treatments should be carried out at the earliest practical date.

We believe that the above recommendations will be of assistance to you in arranging and starting the negotiations for this work.

Should you require additional information or wish to discuss any alternate type of treatments for each area affected, please contact this office. We will be available to assist your construction personnel in preparing the design or to delineate the areas of the distressed slopes that require corrective treatments.

PP/nt
Attachment.

cc: G. A. Metcalfe
M. Devata
S. A. Cant
H. Spence



P. Penev,
Project Soils Engineer.