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GEOCRES No. ______

DIST. 11 ______ REGION ______

W.P. No. ______

CONT. No. 93-02

W. O. No. 93-11026

STR. SITE No. ______

HWY. No. 118

LOCATION Slope Failure, Hwy 118 Near West Guilford

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ______

REMARKS: ______

MEMORANDUM

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To: Stan Wilson
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MTO, Northern Region
447 McKeown Ave
North Bay, Ontario, P1B 8L2

1993 06 30

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Slope Failure, Contract 93-02
Hwy 118 from 8.0 km East of Hwy 35 E'ly 12.7 km
Station 12+550 to 12+600
District 11, Huntsville

At the request of Geotechnical Section, Northern Region (June 24, 93), we visited the above captioned site on June 25, 1992 to inspect the slope failure. Our site inspection was followed by a foundation investigation on June 29, 1993 using a power drilling machine. The details of the project and our findings are as follows:

Under contract 93-02 a rehabilitation program for Hwy 118 was undertaken between 8.0 km E of Hwy 35 E'ly 12.7 km. The slope failure of Hwy 118 took place within the construction zone between station 12+550 and 12+600. It was reported that the slope failure took place within a rockfill which was at 1.25H:1V side slope. It was further reported that there was some indication of slope movement before the construction activity started at the site.

The slope failure took place on the north side of Hwy 118. The south side of Hwy 118, in the vicinity of slope failure, is flat. On the south side of Hwy 118 a ditch runs parallel to the highway. On the north side of Hwy 118 Pine River runs parallel to the highway. At station 12+550 the river extends to the embankment toe and turns towards the north (away from the embankment). The river flows towards the west.

The construction activity in the area started about a week before the failure took place. The construction activity in the area of slope failure was limited, and consisted of installing a silt fence on the embankment slope longitudinally. The silt fence was installed at a distance of 3m above the toe of the embankment and 8.5m below the top of the embankment. In order to install the silt fence a longitudinal pit was dug which was about 0.2m wide and about 0.3m deep.

A silt fence and some straw bails were placed in the south side ditch. It is understood that due to this installation 0.5m to 0.6m high water accumulated in the ditch after a heavy rain. The obstruction in the water flow was removed after the slope failure. The ditch was dry at the time of our inspection.

During the site inspection the soil investigation along the failed slope surface was carried out using a shovel and it was discovered that the soil within 1.5m (maximum depth of probing) consisted of silty sand to fine sand with a trace of gravel.

The drilling program consisted of drilling three boreholes (BH 1,2 and 3). These boreholes were drilled from the road surface at Stations 12+561, 12+575 and 12+593 respectively at about 3.5m offset from the failed slope. The boreholes were advanced 9.6m, 12.6m and 9.6m respectively. All boreholes encountered non-cohesive silty sand to sandy silt material with a few silt zones and occasional cobbles. The 'N' values ranged from 2 to 35 blows. However, 'N' values such as 30 and 35 blows were occasional and probably due to cobbles and were not considered representative. Generally, the 'N' values ranged from 2 to 20 blows with average 'N' value of 6 blows suggesting the material to be very loose to compact but on average loose. Wet sand zones were encountered at depth 6.1m, 3.0m and 2.3m in Boreholes 1,2 and 3 respectively. These water level depth were considered to be perched. Permanent water table was at about 6.1m which was approximately the depth of river water level below the road surface.

Conclusion:

There are several factors which contributed to the slope failure. The details are as follows:

The side slope of the fill (in the failure zone) was quite steep, perhaps 1.5H:1V or steeper (before the slope failure took place). Such permanent slope for sandy material could only be marginally stable and hence is not recommended.

A shallow trench for the silt fence construction along the north side slope about 3m above the toe of the embankment created a weak zone by removing confining forces, after the vegetation was removed the area along the silt fence became susceptible to erosion. After a heavy rain fall prior to the failure the sand became wet and the process of erosion started.

Water from the blocked drainage in the south side ditch of Hwy 118 seeped through the cohesionless material under Hwy 118 and aggravated the wash out process on the north side slope of Hwy 118. As mentioned earlier, the water table within the sand embankment was quite variable ranging from 2.3m to 6.1m below the road surface. Such a great variation within a completely cohesionless soil suggests an un-stabilized hydrostatic head due to a recent flow of water into the material.

As a result of all above, a primary failure (sliding) took place. A longitudinal crack developed within the side slope at a distance of abut 3.5m from the crown of the slope and a wedge of soil slid down pushing soil against the silt fence. After the primary failure below 3.5m from the top of the slope, there was no support for the upper portion of the slope and as a result another crack developed along the shoulder of Hwy 118 near the travelled portion of the highway and the upper portion of the slope also slid down vertically and horizontally. The guide rail post which were supported in the upper wedge of the soil also moved with the soil.

In conclusion, the slope failure is not a deep seated failure. It is surficial and is caused due to lost of material over a steep slope.

Recommendations

The slope with existing material, can be restored by maintaining a 2H:1V slope. In this method the road alignment will have to be shifted towards the south and will require property acquirement.

If the road alignment cannot be changed due to property or any other restriction then the steep slope can be re-constructed using rockfill. To construct the rock fill slope the existing slope will have to be temporarily graded at 1.5H:1V starting from 2m offset from the existing toe of the slope. A 0.5m thick Granular 'A' material should be placed over the sand slope prior to placing the rockfill. Granular 'A' will provide a permanent filter to prevent migration of fine soil into the rockfill and thus prevent piping action. A geosynthetic filter was not recommended due to concerns with punching by the rock fill land a history of poor performance on slopes. Rockfill should be then placed at 1.25H:1V or flatter over the sand slope, bringing the toe of the slope to the present toe location. The placement of rockfill should start from bottom and proceed towards the top. For details refer to the attached sketch.

Caution is required where installation such as silt fences cut into existing slopes.

If you have any questions please advise.

K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

D.H. Dundas, P. Eng.
Senior Foundation Engineer

cc: J. McDougall
Head, Geotechnical Section
Northern Region

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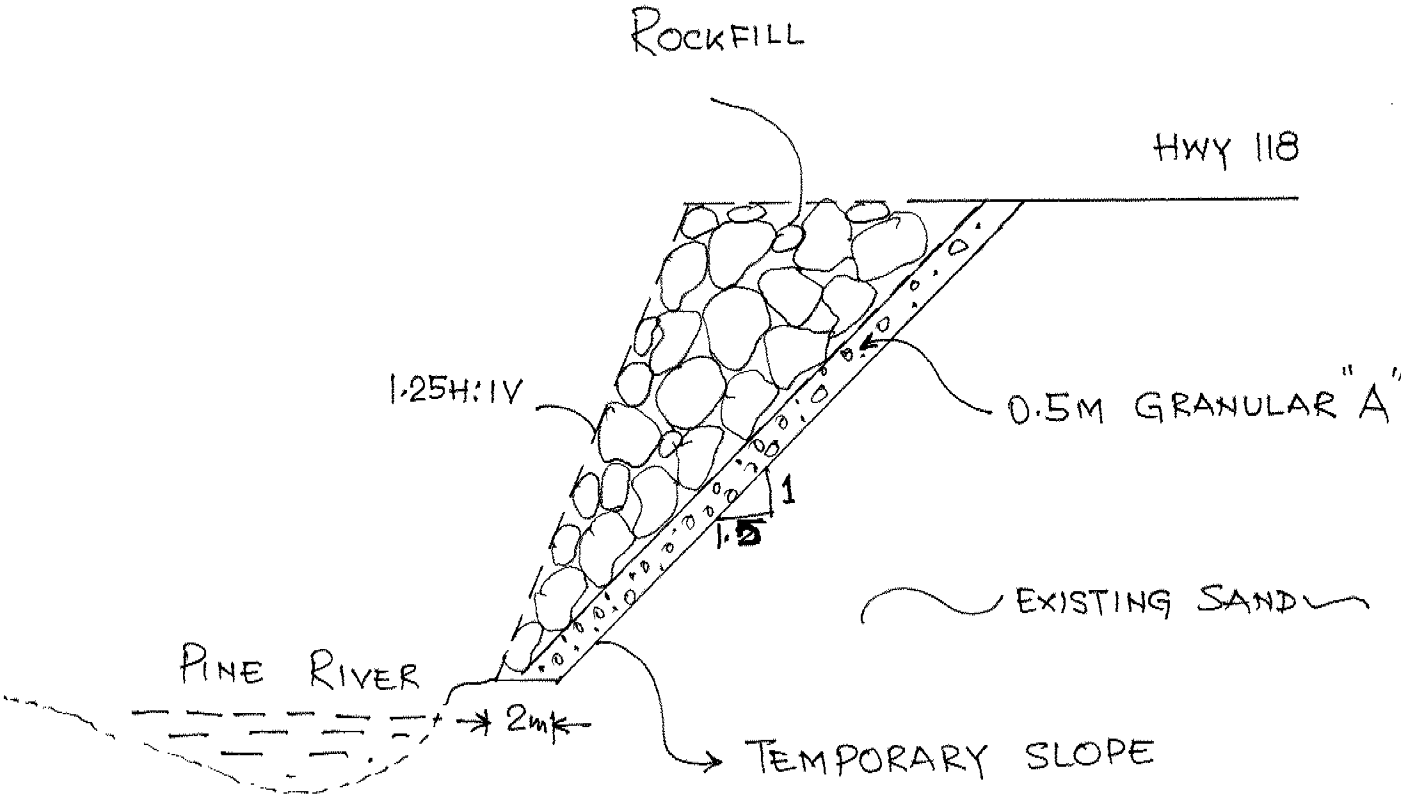

SCHEME OF SLOPE RECONSTRUCTION

FOUNDATION DESIGN SECTION