



THURBER ENGINEERING LTD.

MEMORANDUM

To: Felix Wong, P.Eng., AMEC
David Sinke, P.Eng., AMEC

Date: March 6, 2013

From: Murray Anderson, P.Eng., Thurber
P.K. Chatterji, P.Eng., Thurber

File: 19-3436-10

MTO 2010-2001 HIGHWAY 404 EXTENSION (GWP 2109-05-00) EXCESS MATERIAL STOCKPILES AT DOANE ROAD INTERCHANGE

This memorandum provides foundation recommendations for construction of temporary stockpiles of excess material within the Highway 404 – Doane Road interchange.

We understand that excess soil from the Highway 404 north contract will be temporarily stockpiled within the northwest and southwest quadrants of the planned Doane Road interchange. The proposed locations of the stockpiles are shown on the attached Sketch 1. The stockpiled material will be reused by York Region in 2017/2018 for reconstruction of Doane Road.

Material Source

The proposed stockpile material will be excavated from deep cuts located from Sta. 34+360 to 34+600, Sta. 34+780 to 34+880, and Sta. 37+400 to 37+760 of the north Highway 404 contract (W.P. 2005-07-00). Review of borehole information from these areas, designated Areas 2, 3 and 7 in the Hydrogeological Report prepared by Golder Associates (Report 08-1111-0022E dated September 2010) indicates that the excavated materials will consist primarily of sand and silt till, varying from clayey silt till to silty sand till, and locally clayey silt. The in situ moisture content of the material typically ranges from 6 to 14%, locally up to 20%.

Foundation Conditions at Doane Road Interchange

A Foundation Investigation was carried out for the Doane Road Underpass located immediately to the east of the proposed stockpile locations (Thurber Engineering Report No. 19-1605-96 dated September 9, 2009). The borehole data from this investigation indicates that the foundation soils at the interchange typically consist of compact to very dense sand and silt till to silt till. The soil profile at the underpass, presented in the Foundation Investigation Report, is appended for reference to illustrate the subsurface conditions.



Stockpile Geometry

To determine a stable slope geometry for the stockpiles, a limit equilibrium stability analysis was carried out using Slope/W software developed by Geo-Slope International Limited and soil strength parameters interpreted from the borehole log data. The following assumptions were made for the analysis:

- The foundation soils at the stockpile locations are similar to those determined at the underpass;
- All topsoil, organics, soft or disturbed materials will be removed from the footprint of the stockpiles;
- The stockpile material will comprise inorganic material from the cut areas as described on the borehole logs, with a moisture content near the measured in situ values. Topsoil, organics, snow/ice, excessively wet or otherwise deleterious material will not be placed in the stockpiles;
- To construct the stockpiles, the material will be spread by a dozer in lifts of about 600 mm, and compaction will be by means of dozer passes only, with attention paid to excluding voids in the placed material; and
- A minimum factor of safety of 1.3 is acceptable to achieve both short-term and long-term stability of the stockpile slopes.

The results of the analyses for slope inclinations of 2H:1V and 2.5H:1V, including the soil model and input parameters, are attached. Based on the analytical results, the following recommendations regarding stockpile slope inclination are provided:

- Sideslopes for stockpiles up to 10 m in height should be inclined no steeper than 2H:1V.
- Sideslopes for stockpiles between 10 and 15 m in height should be inclined no steeper than 2.5H:1V.
- If the toe of the stockpile is within 5 m of the crest of a ditch or stormwater pond excavation, the slope height should be taken from the base of the ditch/pond.
- Mid-height benches are not required to maintain stability from a foundations perspective.

Settlement

Settlement of the foundation soils will occur under the weight of the stockpiles. As the foundation soils are generally cohesionless, the settlement is expected to be elastic and occur essentially as the fill is placed. The maximum settlement under a 10 to 15 m high stockpile is expected to be in the order of 75 to 125 mm. Ground settlement is expected to be negligible.



beyond a distance of approximately 5 m beyond the toe of the stockpile slope and will therefore have no impact on the pavement surface along Doane Road and Highway 404.

Erosion Control

All surfaces of the soil stockpiles must be provided with erosion protection in accordance with OPSS 804. Erosion protection may include seeding with hydraulic or straw mulch if applied during an appropriate growing season or suitable erosion control blankets if placed during the winter. To avoid intermixing of organic material with the underlying fill during subsequent reuse, placement of a topsoil layer over the stockpile is not recommended.

The finished stockpile should include interceptor ditches above the slope crest to direct surface runoff away from the slopes, and properly designed rock-filled channels to convey the water to the slope base. Mid-height benches with interceptor ditches may also be considered to reduce the length of surface flow and the potential for gully development on the slope face. Ditching should be provided around the base of the stockpile to drain water away from the slope toe.

Regards,

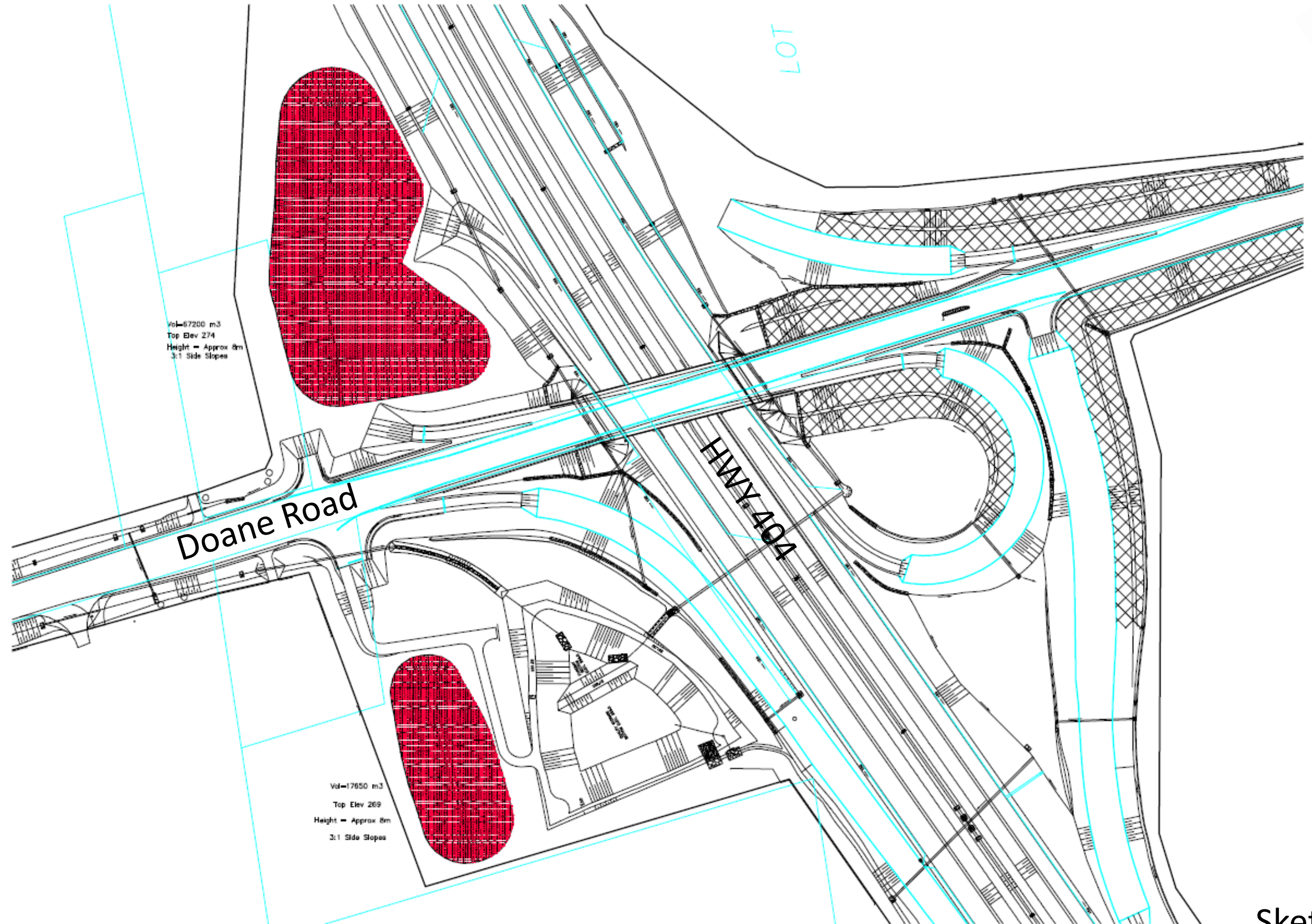
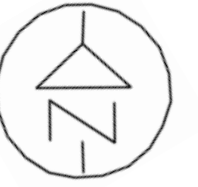
Thurber Engineering Ltd.

P.K. Chatterji, P.Eng.
Principal/Senior Geotechnical Engineer

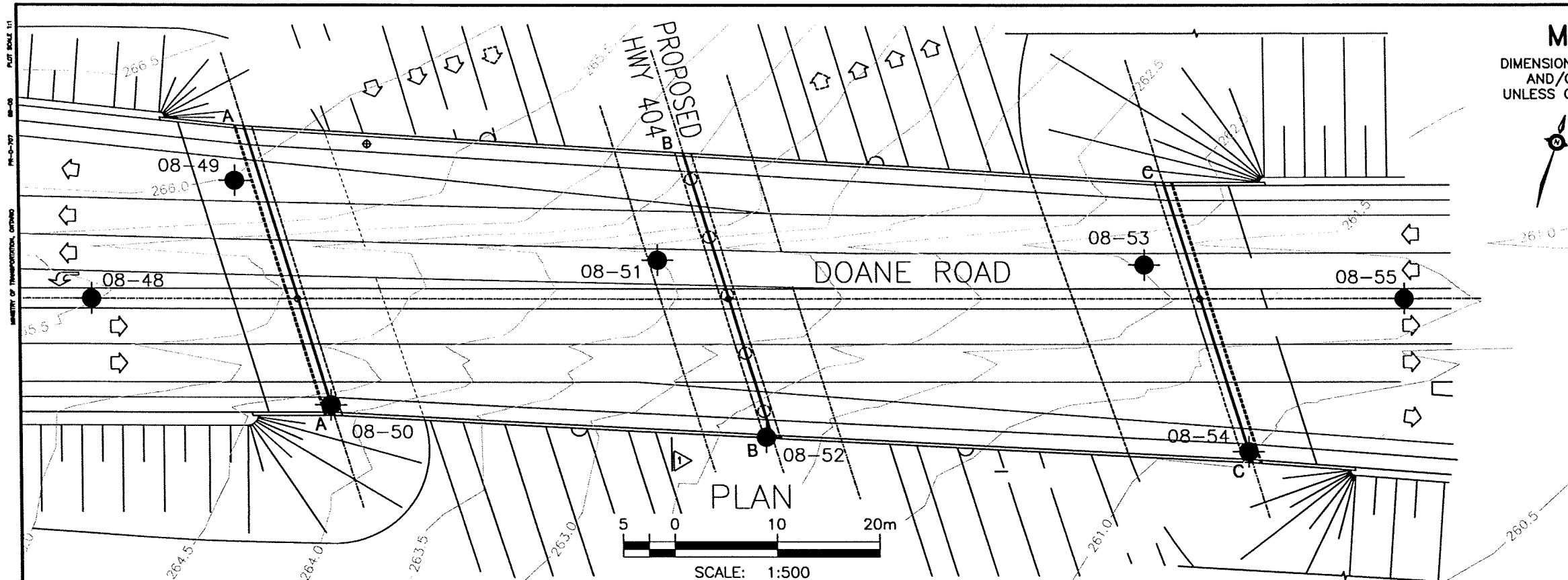


Murray Anderson, P.Eng.
Associate/Senior Geotechnical Engineer





Sketch 1



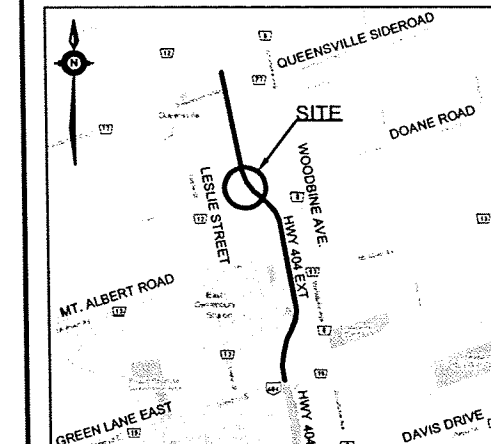
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AND/OR MILLIMETRES
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CONT No
GWP No 2109-05-00

HIGHWAY 404 EXTENSION
BRIDGE FOUNDATIONS
DOANE ROAD UNDERPASS
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET

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GEOTECHNICAL • ENVIRONMENTAL • MATERIALS



KEYPLAN

LEGEND

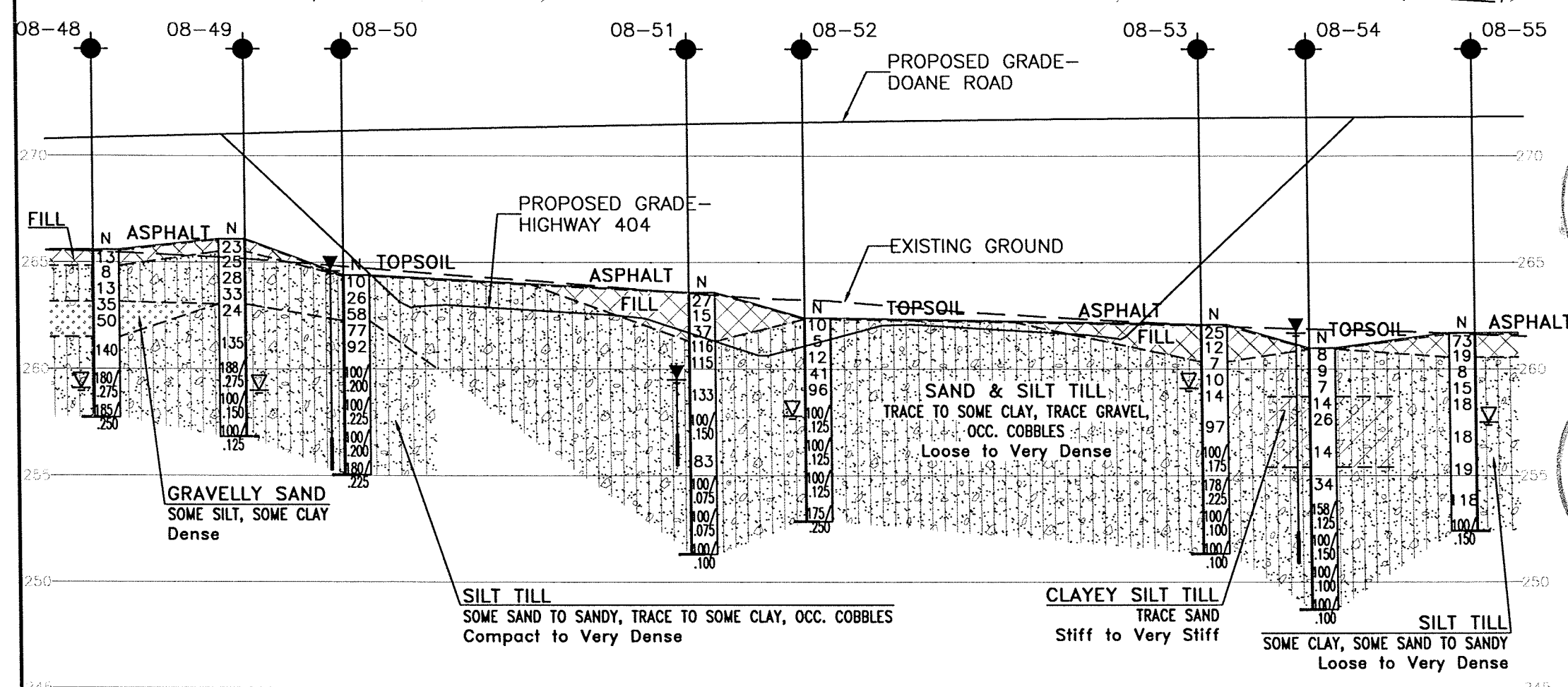
- ◆ Borehole
- ◆ Borehole and Cone
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60' Cone, 475J/blow)
- PH Pressure, Hydraulic
- W Water Level
- HA Head Artesian Water
- PZ Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
08-48	265.6	4 887 093.6	310 301.8
08-49	266.1	4 887 108.9	310 311.7
08-50	264.4	4 887 090.4	310 327.1
08-51	263.6	4 887 113.7	310 353.3
08-52	262.4	4 887 100.1	310 368.4
08-53	262.1	4 887 127.4	310 398.8
08-54	261.0	4 887 112.7	310 413.8
08-55	261.7	4 887 131.7	310 424.0

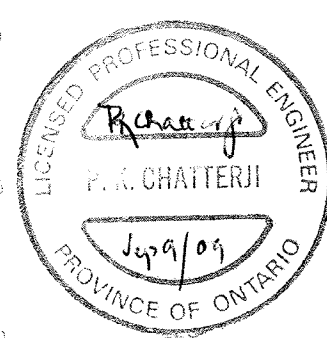
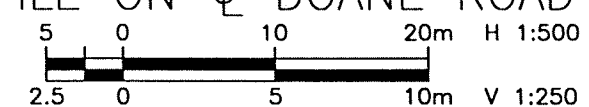
-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

GEOCRES No. 31D - 483



PROFILE ON C DOANE ROAD



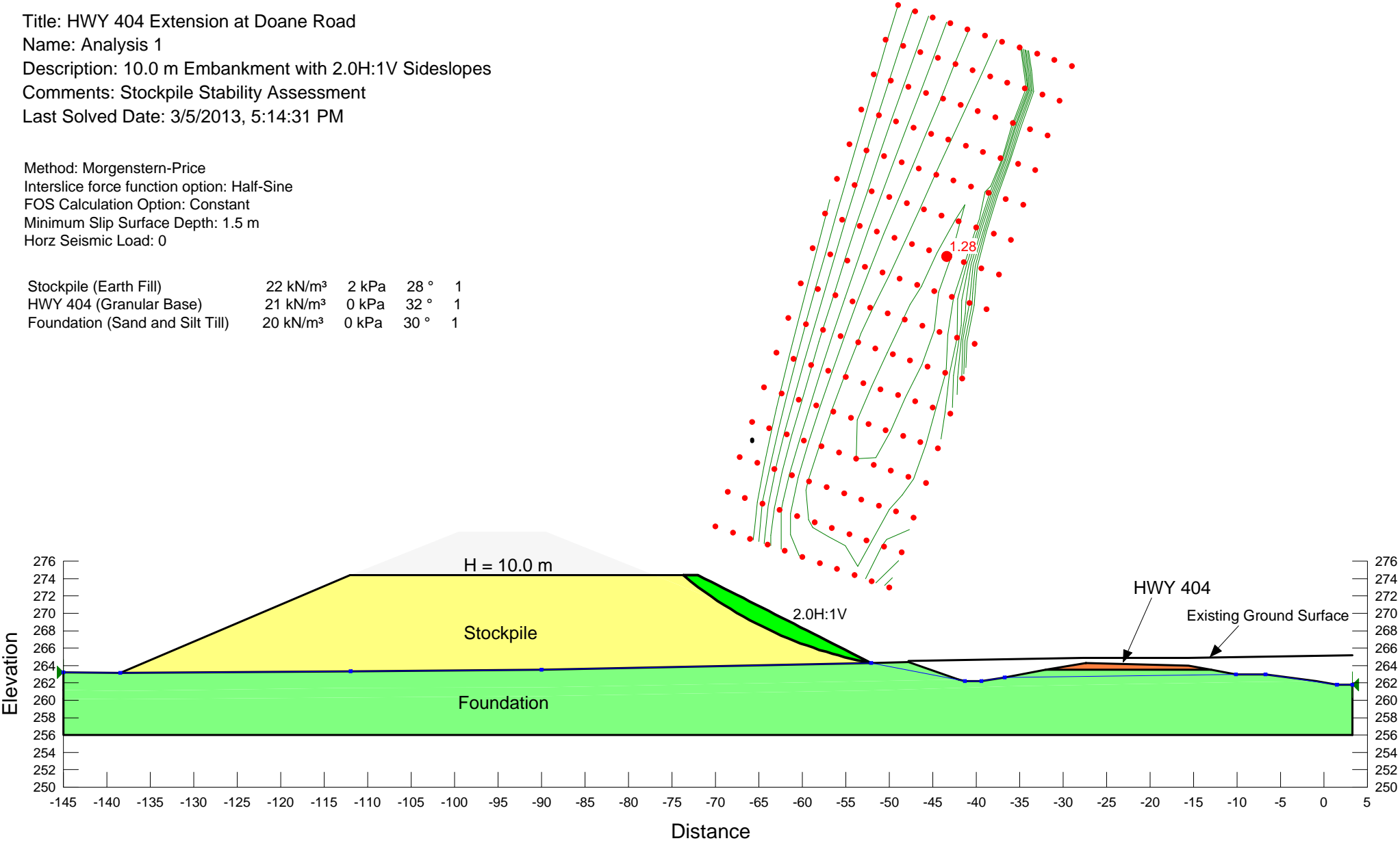
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FILENAME: H:\Drawing\19\1005\483\483-DoaneRoad.dwg
PLOTDATE: Sep 06, 2009 - 3:50pm

Title: HWY 404 Extension at Doane Road
Name: Analysis 1
Description: 10.0 m Embankment with 2.0H:1V Sideslopes
Comments: Stockpile Stability Assessment
Last Solved Date: 3/5/2013, 5:14:31 PM

Method: Morgenstern-Price
Interslice force function option: Half-Sine
FOS Calculation Option: Constant
Minimum Slip Surface Depth: 1.5 m
Horz Seismic Load: 0

Stockpile (Earth Fill)	22 kN/m³	2 kPa	28 °	1
HWY 404 (Granular Base)	21 kN/m³	0 kPa	32 °	1
Foundation (Sand and Silt Till)	20 kN/m³	0 kPa	30 °	1



Title: HWY 404 Extension at Doane Road
Name: Analysis 2
Description: 15.0 m Embankment with 2.5H:1V Sideslopes
Comments: Stockpile Stability Assessment
Last Solved Date: 3/5/2013, 5:14:43 PM

Method: Morgenstern-Price
Interslice force function option: Half-Sine
FOS Calculation Option: Constant
Minimum Slip Surface Depth: 1.5 m
Horz Seismic Load: 0

Stockpile (Earth Fill)	22 kN/m³	2 kPa	28 °	1
HWY 404 (Granular Base)	21 kN/m³	0 kPa	32 °	1
Foundation (Sand and Silt Till)	20 kN/m³	0 kPa	30 °	1

