McCORMICK RANKIN

GEOTECHNICAL INVESTIGATION PROPOSED OTTAWA PALLADIUM INTERCHANGE AT HIGHWAY 417

WEST CARLETON, ONTARIO

JACQUES WHITFORD LIMITED

July 29, 1992

PROJECT NO. 10285

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Report

to

McCormick Rankin

on

Geotechnical Investigation

Proposed Ottawa Palladium
Interchange at Highway 417

West Carleton, Ontario

Jacques Whitford Limited

July 29, 1992

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Ottawa Palladium Interchange at Highway 417 in West Carleton, Ontario. The investigation was carried out in accordance with our original proposal submitted to McCormick Rankin on September 17, 1991 and amended April 22, 1992. Authorization to carry out this work was received from Mr. M. Goetz, P. Eng. of McCormick Rankin.

This report has been prepared specifically and solely for the proposed construction described herein. It contains all of our findings and includes geotechnical recommendations for the design and construction of the project. The Foundation Investigation for the underpass structure of the Interchange has been reported previously, and is not included in this report.

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2.0 PROPOSED DEVELOPMENT

The proposed Ottawa Palladium is to be located south of Highway 417 and east of Huntmar Road (see Key Plan on Drawing No. 10285-1 in Appendix 2). One principal access will be through the proposed Palladium Interchange at Highway 417. The Palladium Interchange Project includes the following components:

- 2.8 km of on/off ramps
- 3.0 km of speed change lanes (widening of existing Highway 417).
- 2.4 km of roadways connecting Huntmar Road to the Interchange through Palladium Drive North and South.
- Construction of four (4) culverts for creek crossings located on the north side of Highway 417.
- Construction of two (2) retaining walls at the forward slopes of the approach fills of the existing Huntmar Road Underpass to permit widening of Highway 417.
- Construction of the Palladium Drive Underpass, consisting of a two span structure and associated approach fills (Foundation Investigation was previously carried out and the report was submitted February 27, 1992).

It is our understanding that all of the proposed roads, and ramps are to be fill sections (no cut sections). Related to the approach fills of the underpass structure, fill heights will be in the order of 8 m, and up to a maximum of about 11 m in localized areas. For Palladium Drive away from the approach fill areas, the fill heights are to be less than 2.0 m. McCormick Rankin and Associates have provided the design traffic volumes utilized in pavement designs as discussed herein.

It is also understood that the creek north of Highway 417 may be diverted. Therefore the requirement/locations of related culverts may be changed in the future.

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3.0 SCOPE OF WORK

The scope of work for this investigation is as follows:

- To carry out a field drilling investigation for the proposed Ottawa Palladium Interchange.

- To assess the compatibility and characteristics of the on site materials. To perform the necessary laboratory tests including visual identification and moisture contents.

- To provide an engineering report with recommendations including the following:

  a) Subgrade preparation prior to fill placement.

  b) Pavement structure and drainage recommendations.

  c) Foundation and slope stability information for the proposed culverts.

  d) Foundation and stability information for the retaining walls at the Huntmar Road Underpass.

Environmental considerations for this project were not a part of the scope of work.

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4.0 PROCEDURE

4.1 Field Investigation

The field work for this investigation was carried out in two (2) phases. Phase 1 **boreholes** (I-1 to I-12 and P-1 to P-6) were put down on May 6, 1992 using a track mounted CME 55 power drill. The Phase 2 **auger holes** (I-13 to I-23) were put down in series of five auger holes using a truck-mounted post hole auger on June 2, 1992.

Prior to the onset of the field investigation, the borehole and auger hole locations were established in the field by McCormick Rankin personnel and cleared of any existing underground services by our site personnel.

The first phase of field work involved drilling eighteen boreholes, numbered I-1 to I-12 (Interchange), and P-1 to P-6 (Palladium Drive). The second phase, auger holes numbered I-13 to I-23, was carried out for the Highway 417 widening investigation and the connection of the Palladium Drive North to Huntmar Road. The holes put down for each component of the project are summarized below, and are located as shown in Drawing 10285-1 in Appendix 2.

Hole	Component	Remarks
I-1 to I-12	Interchange-Ramps	
P-1 to P-6	Palladium Drive North & South	
I-13, I-14, I-20, I-21	Widening at Huntmar Road Underpass	for proposed retaining walls
I-12, I-22 I-15 to I-19	Highway 417 widening	a series of 5 auger holes at each location to determine soil/granular profile
I-23	Palladium Drive North Huntmar Road connection	

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Boreholes I-1 to I-12 and P-1 to P-6 were advanced to depths ranging from 1.5 m to 7.3 m using a track-mounted CME 55 power auger drill. Solid stem augers, 100 mm in diameter were used to advance these holes except in Boreholes I-7, I-9 and I-11 (proposed culvert locations) where hollow-stem augers, 200 mm in outside diameter, were used. The soils were sampled at regular intervals by conducting Standard Penetration Tests. In cohesive deposits, field vane tests were carried out in order to assess in situ shear strengths. The auger holes were advanced using a truck-mounted post hole auger at the locations I-12 to I-23 to determine the soil/granular profile.

All recovered soil samples were stored in moisture-proof bags and subsequently returned to our laboratory for detailed classification and testing.

The ground water levels presented herein are based on readings taken at the time of drilling.

All boreholes were backfilled with augered cuttings.

4.2 Survey

Borehole and auger hole locations and elevations were surveyed by McCormick Rankin upon completion of the drilling. The information obtained is provided in the Borehole and Auger Hole Records in Appendix 1 and is shown in Drawing 10285-1 in Appendix 2. Elevations have been referenced to the Geodetic datum.

4.3 Laboratory Testing

All samples returned to the laboratory were subjected to a detailed visual classification by a geotechnical engineer. Selected samples were tested for moisture content.

Remaining samples will be stored for a period of six months after issuance of this report. Following this period they will be discarded unless we are directed otherwise.

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5.0 RESULTS OF THE INVESTIGATION

5.1 Surface Conditions

At the time of the site investigation the ground surface over the proposed project area consisted of a series of predominantly flat, grass covered, open fields. These fields were separated by rows of bushes and small trees. The exception is a tree-lined ravine/creek, approximately 3 m deep on the north side of, and parallel to, Highway 417.

5.2 Subsurface Profile

The subsurface profiles, observed at the specified borehole locations, are presented in the Borehole Records and Auger Hole Records in Appendix 1. An explanation of the symbols and terms used to describe the Records is also provided.

In general, in the proposed new roadway areas the observed stratigraphy east of the interchange consists of the existing surficial topsoil overlying silty clay. All boreholes located west of the interchange, with the exception of Borehole I-4, were found to consist of the existing surficial topsoil overlying silty sand. In the proposed Highway 417 widening areas, asphalt pavement structure over compact sand fill was encountered. A summary of the observed subsurface conditions is provided below.

Topsoil

A layer of surficial topsoil was encountered in all boreholes. The layer thickness ranged between 75 mm and 300 mm, with an average thickness of 200 mm when considering all boreholes. The topsoil material observed in the boreholes consists of a dark brown, organic, sandy, silty clay.

Silty Clay

Silty clay was encountered underlying the topsoil in Boreholes I-4 through I-6, I-8, I-9, I-10, I-12 and P-1 through P-6. Borehole I-11 contains silty clay beneath a thin layer of silty sand. The silty clay layer thickness, based on Borehole I-9, is approximately 4.0 m and has a consistency ranging from firm to stiff. Moisture content tests revealed that moisture contents range between 30% and 57% with an average of 42%.

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Silty Sand

A loose to compact silty sand was encountered underlying the topsoil in Boreholes I-1 through I-3, I-7 and I-11. A dense silty sand layer was also evident below the silty clay in Borehole I-9. The layer thickness ranged between 0.3 m and 1.6 m in the near surface deposits and 2.5 m in the deeper deposit of Borehole I-9. Moisture content tests revealed that moisture contents range between 17% to 24% with an average of 20%.

Till

A till deposit consisting of silt, sand, some gravel and trace clay was encountered beneath the silty sand in Boreholes I-1, I-2 and I-7 and beneath the silty clay in Boreholes I-9 and I-11. Moisture content tests carried out on representative samples of the till indicate that the moisture content ranges between 8% and 21% with an average of 16%.

Bedrock

Bedrock was inferred, from auger refusal, at Boreholes I-7 and I-9. According to geologic subsurface maps of this area, the bedrock consists of limestone of the Ottawa Formation.

Pavement Structures

The auger holes taken on the shoulder of the existing Highway 417 typically encountered 25 to 50 mm of asphalt (edge of paved shoulder) over 380 to 525 mm of very dense brown sand and gravel with a trace of silt (base granular). Underlying the granular material is a fill consisting of compact brown sand with a trace of silt and gravel. The fill encountered in all shoulder auger holes extends to depths greater than 1.2 m.

Auger hole I-23 is located near the connection between Palladium Drive North and Huntmar Road. Asphalt, 40 mm in thickness, over sand and gravel fill was encountered at this location. Silty clay was encountered below a depth of 480 mm.

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Peat

Swamp material in the form of peat was encountered in the I-18 series of holes. It was measured to be 1.0 m in thickness at a point 5.7 m south of the edge of pavement of the east bound lanes.

Approach Fills of the Highway 417 Underpass at Huntmar Road

In general, there is between 0 and 150 mm of topsoil overlying fill. The fill is composed of sand and gravel with a trace of silt and occasional cobbles and boulders. The frequency of boulder occurrence increases with depth. Only one of the auger holes was able to penetrate through the boulders. Auger Hole I-21 reached a silty clay at a depth of 2.8 m which corresponds to an elevation of 99.1 m. It is estimated that the toe of the slope is at elevation 101.1 m. The silty clay is intermixed with roots and topsoil indicating that prestripping was not adequately performed beneath the approach fills. Groundwater was not encountered.

5.3 Groundwater

Water level readings were taken while drilling the boreholes and are shown on the Borehole Records. The ground water levels range between 0.9 m and 3.05 m below the existing ground surface. Groundwater was not encountered in any of the Auger Holes (I-13 to I-23).

Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

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6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 General

The new construction of Palladium Drive will generally involve shallow fill of less than 2.0 m height. For the approach fills of the underpass structure and the associated on/off ramps, fill height of up to about 11 m will be reached in localized areas, and in general less than 8 m. It is anticipated that the fill material to be used as subgrade fill will consist of imported fill as the limited amount of cut material from the roadwork of this project may be too wet to pass as Earth Borrow. Excessive settlement is not expected from the proposed embankments. Swamp excavation will be required at the western limit of the proposed Highway 417 widening. Two different pavement structures are recommended for the various roadways for this project based on differing traffic loads. Transitions between the differing pavement structures will be required.

The proposed Interchange includes the placement of four (4) culverts north of Highway 417. Subexcavation of the culvert foundations will not be required. One of the culverts will be under as much as 11 m of fill. Section 6.3 provides general recommendations for the foundations and backfill of culverts.

Highway 417 widening will include two retaining walls at the approach fills of the Huntmar Road Underpass. The presence of boulders at the recommended footing elevation necessitates subexcavation and backfilling beneath the proposed footing depth. Shoring will be required to prevent undermining of the underpass abutments.

6.2 New Roadways - Interchange Ramps, Palladium Drive and Speed Change Lanes

6.2.1 Fill Sections

As part of the roadway construction, it is anticipated that fill placement of less than 2.0 m will be carried out along the proposed Palladium Drive. For the approach fills of the underpass structure and the associated ramps, fill placement of up to 11 m will be required in localized areas, and generally less than 8 m in other areas. Stability and settlement associated with the high fills have been addressed in the previous Foundation Investigation Report dated February 27, 1992. Excessive settlement of the underlying soil due to road and ramp embankment placement is not anticipated.

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In fill areas where the fill heights are less than 1.2 m, all topsoil, organic and other deleterious materials should be stripped and removed prior to fill placement. Grubbing will be required in forested areas. In areas where fill heights are in excess of 1.2 m, only close cut clearing is required. The stripped area should be proofrolled as directed by the Engineer. Any soft areas noted during proofrolling should be removed and replaced with Earth Borrow or OPSS Select Subgrade Material prior to fill placement. For design purposes, assume a topsoil stripping depth of 200 mm for all existing side slopes, ditches and subgrade under proposed fills.

Structural fill used to build up the subgrade should consist of approved material such as Earth Borrow or OPSS Select Subgrade Material. Structural fill used to build up the subgrade should be placed and compacted in accordance with OPSS 501.

The permanent side slopes of the fills should be sloped no steeper than 2 horizontal to 1 vertical. The fill side slopes should be protected from erosion by hydroseeding, placing sod, placing an appropriate filter blanket, or other acceptable methods.

6.2.2 Transitions

It is understood that in an effort to minimize the elevation difference between the proposed Palladium Drive and adjacent lands, the maximum fill height may be limited. In areas where superelevation is required, consideration may be given to excavation on the lower side to allow for the placement of the granular base and subbase. Transition in the transverse and longitudinal directions may be required in this case. Transition treatment should be carried out in accordance with the OPSD-205 series, using a minimum depth of transition point treatment, t, of 1.2 m.

6.2.3 Assessment of Excavated Material

The excavated granular materials from within the existing roadway will be suitable for reuse as Earth Borrow or Select Subgrade Material.

The overburden materials encountered throughout the investigation do not meet the OPSS requirements for Select Subgrade Material due to the high fine content. Depending on the depth of excavation, weather conditions, and construction methodology, portions of the silty sand and silty clay will likely not meet Earth Borrow specifications as the water contents of these materials may be too high to achieve adequate compaction. These materials may need to be wasted.

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6.2.4 Pavement Structure

Pavement structure has been based on traffic information supplied by McCormick Rankin. The AADT values have been calculated based on the traffic volume estimated for a design event (a sold out hockey game), with 180 to 200 events per year. The estimated traffic volume for a design event is included in Appendix 3. The AADT used for the pavement structure recommendations are as follows:

Road	AADT
N-W Ramp	260
S-W Ramp	360
W-N/S Ramp	500
N-E Ramp	1030
Palladium Drive North (Sta. 20+182 to 21+240)	1270
E-N/S Ramp	1710
S-E Ramp	1900
Palladium Drive South (Sta. 18+900 to 20+182)	2230

It is understood that all design traffic is Palladium related. Traffic associated with future developments have not been included.

Using the procedure from the American Association of State Highway and Transportation Officials (AASHTO) "Guide for the Design of Pavement Structures" in conjunction with MTO procedures, the following minimum pavement structures are recommended:

At the **Palladium Drive South (Sta. 18+900 to 20+182), S-E Ramp and E-N/S Ramp** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
50 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
450 mm OPSS Granular B Type II.

At the **Palladium Drive North (Sta. 20+182 to 21+240), W-N/S Ramp, N-E Ramp, S-W Ramp and N-W Ramp** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
40 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
300 mm OPSS Granular B Type II.

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MTO Soils Design Report W.P. 433-64-02 has been reviewed in establishing the recommended minimum pavement structure for the Speed Change Lanes. At all the **Highway 417 widening / Speed Change Lane** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
40 mm OPSS HL8 Binder Course
50 mm OPSS HL8 Binder Course
50 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
450 mm OPSS Granular B Type II
over OPSS SSM.

At **Huntmar Road North**, the recommended minimum pavement structure is:

50 mm OPSS HL1 Surface Course
150 mm OPSS Granular A
150 mm OPSS Granular B Type II.

For the **Structure Deck of the Palladium Drive Underpass**, the recommended pavement structure is:

40 mm OPSS HL1 Surface Course
40* mm OPSS HL8 Binder Course
* Plus 10 mm waterproofing, for a total of 50 mm

At the Speed Change Lane locations a substitution of Granular B for the OPSS SSM listed above would also provide adequate support.

Full-time inspection of the placement of the subbase must be carried out to confirm that construction traffic has not contaminated the pavement structure. Both the OPSS Granular A and Granular B materials should be compacted to 100 percent of Standard Proctor maximum dry density as specified in OPSS-501.

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6.2.5 Bituminous Pavement Transitions

A 10 horizontal to 1 vertical wedge should be provided at the bullnose locations for the full pavement width to provide a uniform load transfer between the differing pavement structures at the following locations:

Palladium Drive North	-	E-N Ramp
Palladium Drive North	-	S-W Ramp
Palladium Drive North	-	Existing Huntmar Road
Palladium Drive South	-	W-N/S Ramp
Palladium Drive South	-	N-E Ramp
All Speed Change Lanes	-	All Ramps

A butt joint is required between the pavement structures of the existing Huntmar Road and the new Palladium Drive North.

The following procedures apply to all Highway 417 Widenings for the construction of Speed Change Lanes:

- Remove existing paved shoulder and blade off existing granulars to provide for the recommended bituminous pavement thickness.

- Provide an 80 mm 2 lift step joint 300 mm in width into existing pavement as shown in Drawing 10285-2 in Appendix 2.

- Excavate from 0.5 m outside the edge of existing pavement to inside limit of shoulder rounding to allow for 150 mm Granular A and the recommended bituminous pavement thickness.

- Excavate from 0.9 m outside the edge of existing pavement outward to intersect the existing embankment slope to allow for the recommended Granular B thickness under the Granular A and bituminous pavement.

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6.2.6 Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between subgrade material and the subbase material in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loadings can result in the reduction of the load carrying capacity of the pavement structure. If the surrounding grades are lower than the proposed roadway, proper grading of the subgrade and provision of surface ditches in accordance with OPSD-200 series is sufficient.

6.2.7 Swamp Treatment

Swamp excavation and replacement will be necessary at the western end of the N-W ramp and the W-N/S ramp. It is estimated that up to 1.5 m of material will have to be removed between approximate Sta 8+200 and Sta 8+710 (N-W Ramp) and between approximate Sta 8+230 to 8+715 (W-N/S Ramp). The excavation should be replaced with OPSS SSM or other acceptable granular fill in accordance with OPSD-203.02.

6.2.8 Adjustment Factors

The compensating factors outlined in Appendix A (Contingencies and Allowances), Chapter B of the Contract Design Estimating and Documentations Manual are suitable for use on this project.

In areas where the subgrade consists of sand material, a 20% loss factor for Granular B, Type II should be allowed in the design.

The following conversion factors (in t/m^3) are recommended for this project:

Granular B, Type I	2.0
Granular B, Type II	2.2
Sand within R.O.W.	1.7
Silty Clay within R.O.W.	1.7
SSM	1.8

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6.2.9 Boulder Treatment

Boulders are observed on ground surface at the western portion of the Highway 417 widening. Boulders encountered at subgrade elevation are to be treated as per OPSD 204.01. Existing boulders not exceeding 450 mm in size may be reused, provided that there are no boulder clusters creating voids, and that OPSD 204.01 is followed.

6.3 Culverts

The culvert types and locations proposed for this project have not been finalized at this time. The following are general recommendations which may be modified if necessary once the details are known.

6.3.1 Culvert Foundations

All four (4) new culverts should be founded on competent inorganic materials. It is anticipated that flexible pipe or box culverts will be used in the project. Subexcavation of the subsoils is not anticipated at any of the four culvert locations.

The proposed invert elevations of the culverts are not available at this time. The culvert structures may be founded on spread footings located within either silty clay or silty sand. The following design values are recommended:

Soil Type	Factored Bearing Capacity at U.L.S.	Bearing Capacity at S.L.S. Type II
silty clay	250 kPa	75 kPa
silty sand	275 kPa	100 kPa

An open box type culvert has been assumed with 2 m wide footings located 1.8 m below the invert elevation in the calculations of capacities. The S.L.S. Type II bearing pressure has been calculated based on 25 mm of allowable settlement.

The depth of frost penetration at the site is anticipated to be 1.8 m.

The above recommendations should be reviewed once the culvert types, locations and invert elevations are finalized.

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6.3.2 Culvert Backfill

To prevent hydrostatic pressure buildup, backfill to culvert walls and retaining structures should consist of free draining materials such as OPSS Granular A or Granular B. Backfill for box culverts should be in accordance with OPSD-803 series. For the design of the culvert backfill configurations, the frost line in OPSD-803.01 to 803.06 should be taken as 1.8 m below road surface.

Lateral earth pressures should be calculated in accordance with the O.H.B.D.C. Section 6.1.2 using the following design parameters:

	Granular A	Granular B
Unit Weight (kN/m^3),	22.8	21.2
Unfactored Angle of Internal Friction, ϕ	35°	30°
Coefficient of Active Earth Pressure, (K_a)	.27	.33
Coefficient of Earth Pressure at Rest, (K_o)	.43	.50

Sliding resistance between concrete and the existing native silty sand and silty clay can be calculated in accordance to O.H.B.D.C. Section 6.7.3.3.2 using an unfactored friction coefficient of 0.55 and 0.50 respectively, assuming unfactored angles of friction of 29 and 27 degrees respectively.

6.4 Retaining Walls

In order to accommodate the widening of Highway 417 for the E-N/S and the S-E Ramps, the foreword slopes of the Huntmar Road Underpass will have to be provided with retaining structures. It is our understanding that the two structures will be limited to about 2 m in height.

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Lateral earth pressures should be calculated in accordance with the O.H.B.D.C. Section 6.1.2 using the following design parameters:

Unit Weight (kN/m^3),	21.2
Unfactored Angle of Internal Friction, ϕ	30°
Coefficient of Active Earth Pressure, (K_a)	.53
Coefficient of Earth Pressure at Rest, (K_o)	.80

The above parameters are recommended based on the nature of the existing fill material and that the backfill behind the retaining walls is sloped at 2H:1V.

It is recommended that a minimum thickness of 0.5 m of Granular A be placed immediately behind the wall. The existing granular fill removed to construct the wall may be reused behind the Granular A material.

Only one of the four auger holes at this location penetrated through the fill due to the presence of a layer of boulders and cobbles. It is our understanding from the tender drawings for the Huntmar Road Underpass (W.P. 436-64-00) that the toe of the existing foreword slope is at elevation approximately 101.1 m. Borehole I-21 indicates that the base of the fill is at approximately 99.1 m elevation.

It is recommended that a subexcavation be taken below the footing to remove the boulder layer and create a good footing pad. This subexcavation should be advanced into the silty clay deep enough to remove the organic roots and topsoil noted in Auger Hole I-21. The subexcavation should be inspected and approved by a geotechnical engineer prior to backfilling. For design purposes, assume subexcavation to elevation 98.5 m. Granular A should be placed in the excavation and compacted in 300 mm layers up to the base of footing elevation.

A shoring system may be required to protect the integrity of the truncated approach fills and prevent undermining of the foundations of the underpass structure during construction.

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Boreholes put down through the approach fills were for assessment of the fill material only, and not for foundation design purposes. We have reviewed the Foundation Investigation Report for the Huntmar Road Underpass prepared by the MTO Foundation Design Section (Report W.P. 436-64-00). The following bearing capacities are recommended based on information presented in this report.

Foundation Elev. (m)	Factored Bearing Capacity at U.L.S.	Bearing Capacity at S.L.S. Type II
99.3	250 kPa	150 kPa

Bearing capacities of the foundation soils have been calculated assuming a 2 m wide footing. Further reduction to the U.L.S. value will be necessary once the inclination and eccentricity of the loads has been established.

An earth cover of 1.8 m minimum is recommended for frost protection.

Sliding resistance between concrete and the Granular A fill beneath the proposed retaining wall foundation can be calculated in accordance to O.H.B.D.C. Section 6.7.3.3.2 using an unfactored friction coefficient of 0.7, assuming an unfactored angle of friction of 35 degrees.

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7.0 CLOSURE

The recommendations made in this report are in accordance with our present understanding of the project. A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

We trust the above information meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

We thank you for the opportunity to be of service to you.

Yours very truly,

JACQUES, WHITFORD LIMITED

Fred J. Griffiths, Ph.D., P.Eng.

LICENSED PROFESSIONAL ENGINEER
C. C. K. KWOK
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SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional	less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength kips/sq.ft.	kPa	'N' Value
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

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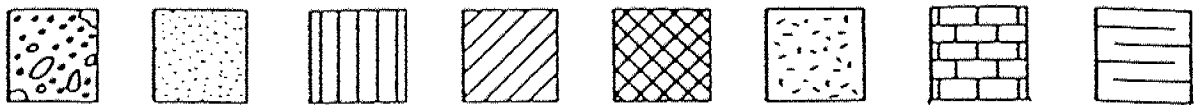
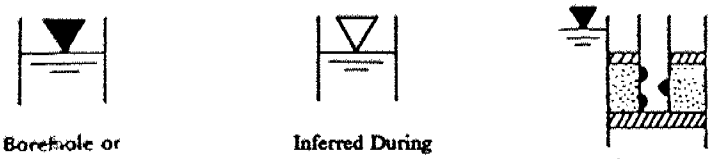
SYMBOLS AND TERMS CONTINUED

STRATA PLOT



Gravel & Boulders | Sand | Silt | Clay | Fill | Igneous Bedrock | Sedimentary Bedrock | Metamorphic Bedrock

WATER LEVEL MEASUREMENT



Borehole or Standpipe | Inferred During Drilling | Piezometer

SAMPLES

SS.... Split spoon sample (obtained by performing the standard penetration test)
ST.... Shelby tube or thin wall tube
PS.... Piston sample

BS.... Bulk sample
WS.... Wash sample
RC.... Rock core
AXT, BXL, etc....
Rock core samples obtained with the use of standard diamond drilling bits.

OTHER TESTS

G..... Specific gravity
H..... Hydrometer analysis
S..... Sieve analysis
γ.... Unit weight
C..... Consolidation
CD.... Consolidated drained triaxial

CU.... Consolidated undrained triaxial with pore pressure measurements
UU.... Unconsolidated undrained triaxial
DS.... Direct shear
P..... Field permeability

ROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal insitu fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured.

Recycled Paper

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-1

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

PROJECT No. 10285

BOREHOLE No. I-1

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	104.37	Grass covered ground surface						
	104.1	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Compact, light brown, SILTY SAND, some clay						
	103.5							
1		Compact, brown and grey, silt, sand, clay and gravel, occasional cobbles: TILL			SS	1	600	7
	102.8							
2		End of Borehole						
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

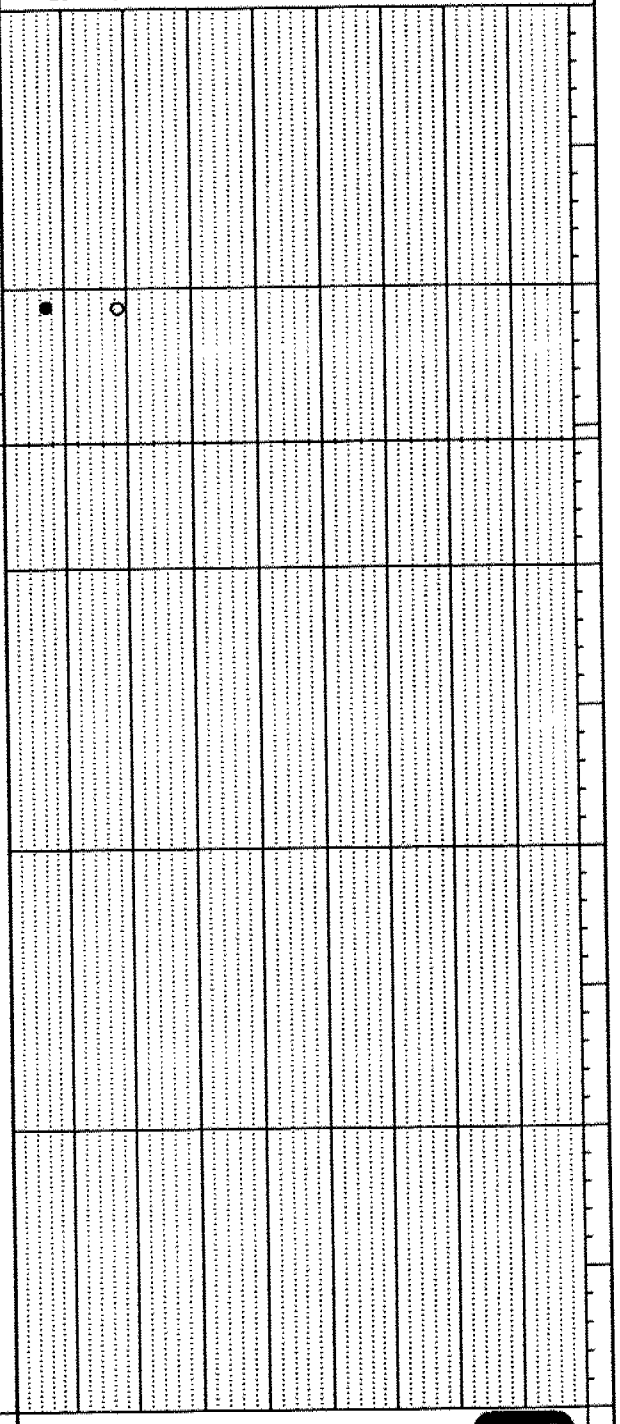
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-2

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. I-2

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	103.28	Grass covered ground surface						
	103.0	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Loose to compact, light brown, SILTY SAND, some clay, trace organics						
	102.3							
1		Compact, brown, silty sand and gravel, occasional cobbles: TILL			SS	1	250	3
	101.7							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

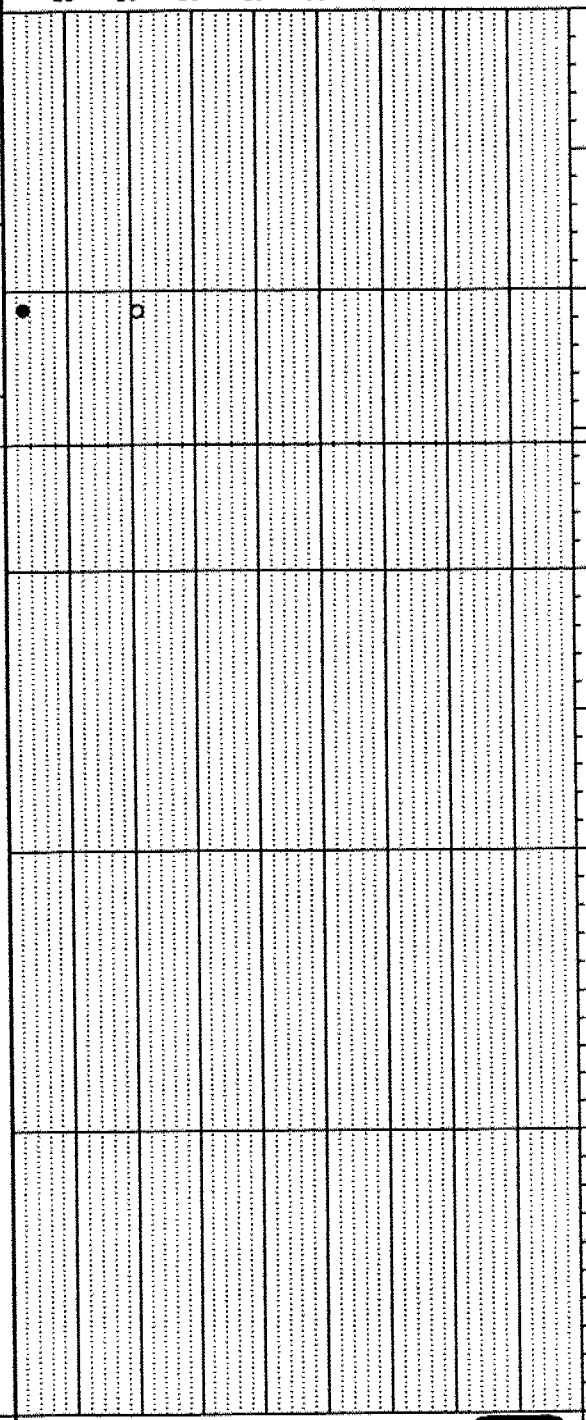
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-3

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-3

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	104.06	Grass covered ground surface						
	103.8	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Loose, light brown, SILTY SAND, trace to some clay, trace gravel Boulder encountered at 600 mm			SS	1	500	1
1	102.5							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

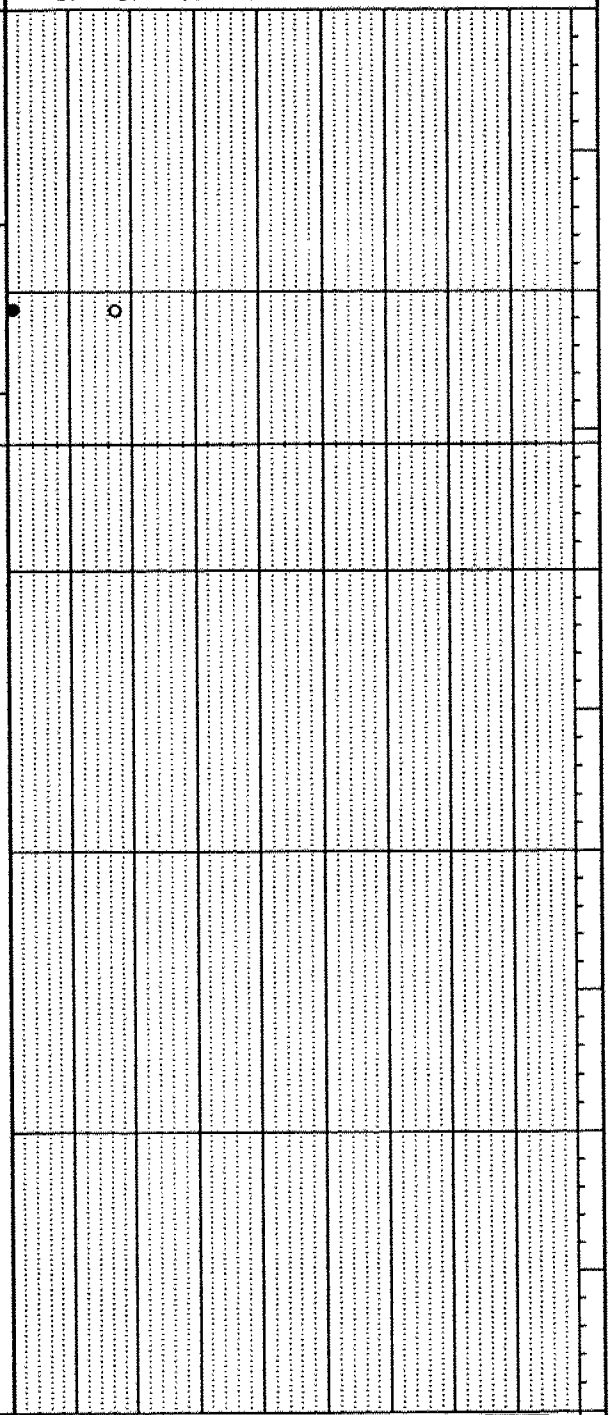
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-4

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. I-4

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	103.57	Grass covered ground surface						
	103.4	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, greyish brown, SILTY CLAY, trace sand						
1					SS	1	250	7
	102.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

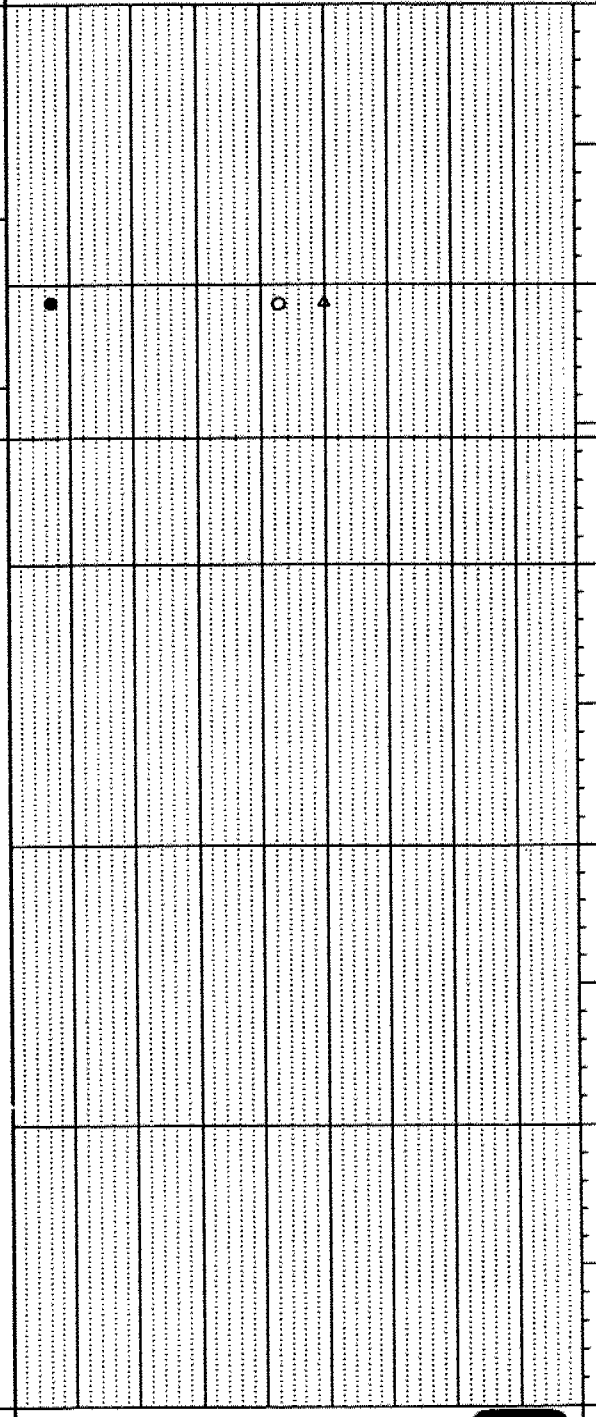
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-5

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-5

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	103.21	Grass covered ground surface						
	103.0	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brownish grey, SILTY CLAY, trace sand			SS	1	200	7
1	101.7							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-6

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-6

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	102.78	Grass covered ground surface						
	102.6	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm to stiff, grey, SILTY CLAY, trace sand			SS	1	600	4
1	101.2							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-7

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-7

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	103.00	Grass covered ground surface						
	102.9	75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Compact, brown, SILTY SAND, trace to some clay, trace organics			SS	1	400	7
1								
	101.3				BS	2	--	--
		Firm, brown, SILTY SAND, trace to some clay		▼				
2	100.9							
	100.6	Compact, grey matrix of silt, sand and gravel, frequent cobbles: TILL						
		Auger refusal on inferred bedrock End of Borehole						
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

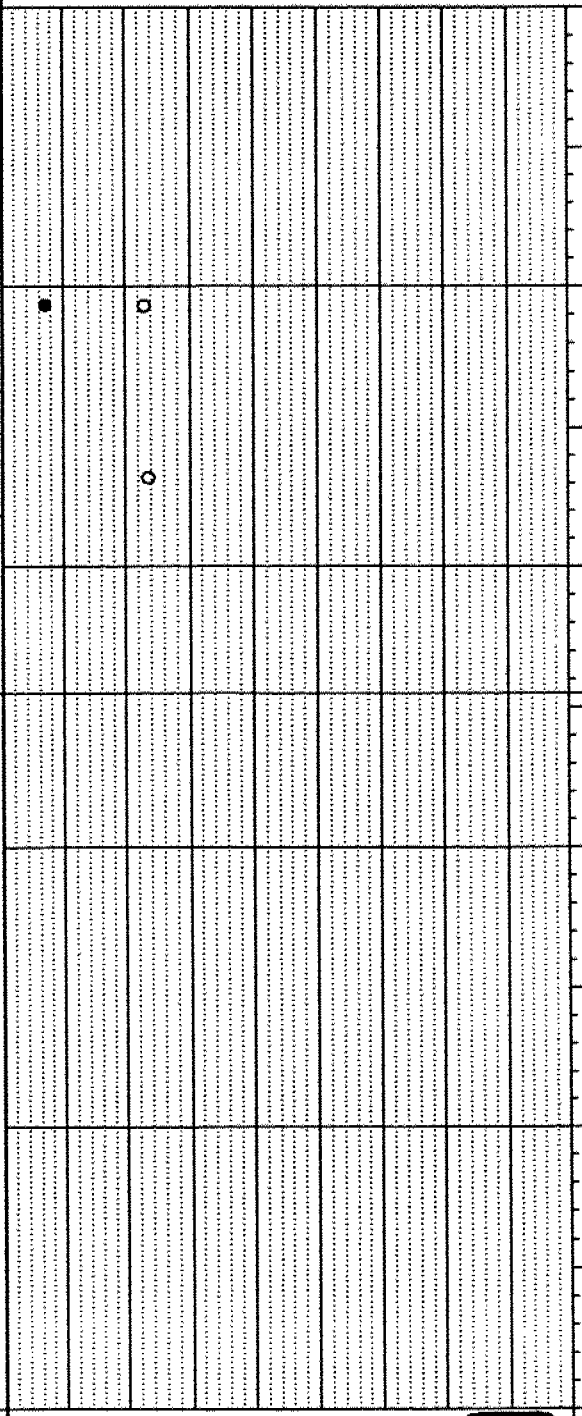
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-8

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-8

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	103.00	Grass covered surface						
	102.9	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Stiff, brownish grey, SILTY CLAY, trace sand						
1					SS	1	400	4
	101.5							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

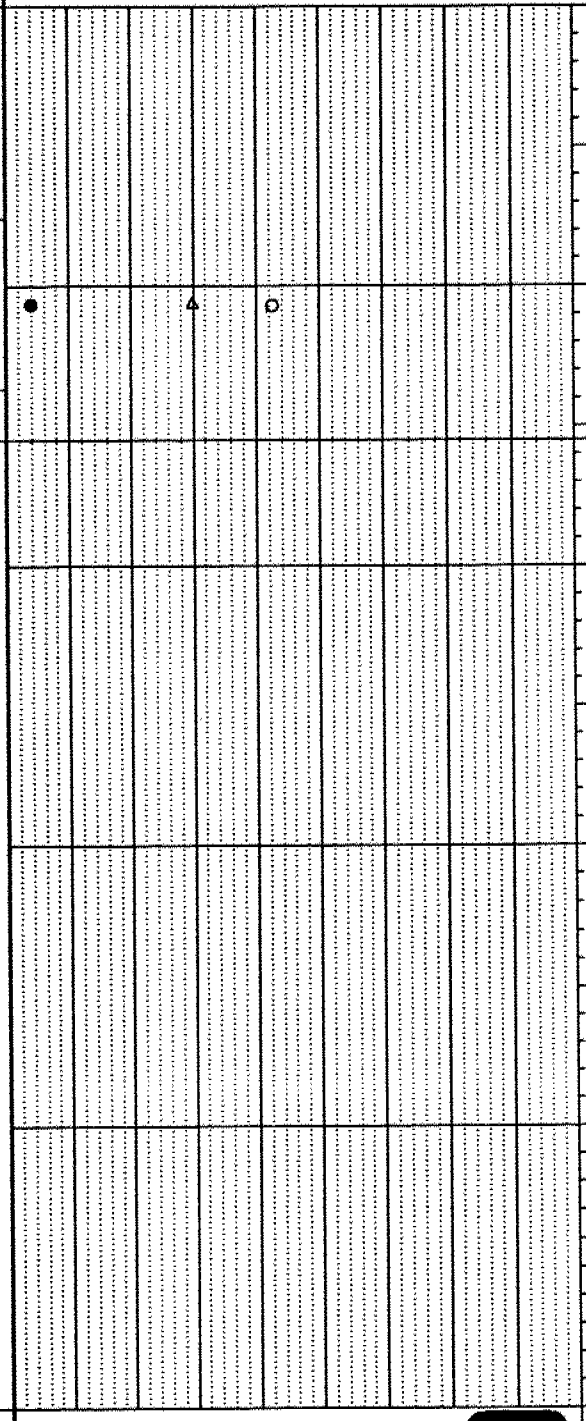
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-9

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

PROJECT No. 10285

BOREHOLE No. I-9

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	102.31	Grass covered surface						
	102.2	100 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Stiff, brown, SILTY CLAY, trace sand						
1					SS	1	600	9
2								
3								
4	98.1							
		Loose to dense, grey SILTY SAND, trace clay			SS	2	600	5
5								

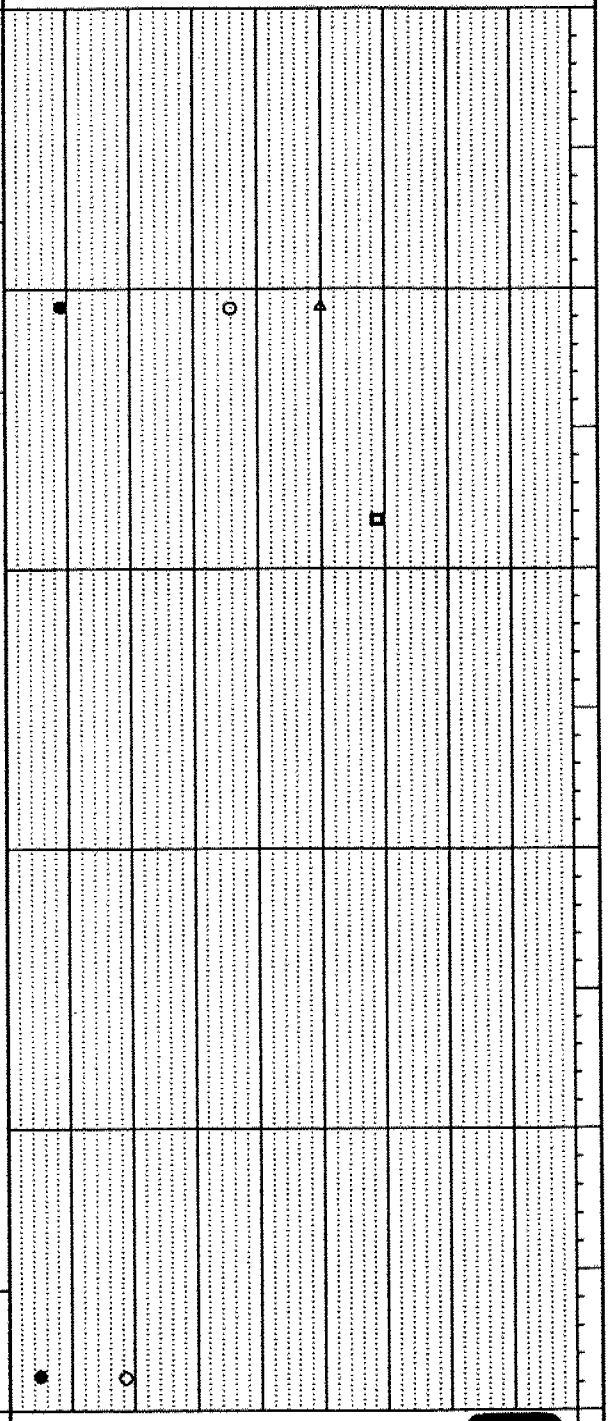
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Continued Next Page

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-9

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-9

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
5		Loose to dense, grey SILTY SAND, trace clay						
6					BS	3	--	--
	95.6							
7		Dense, grey matrix of silt, sand, gravel, frequent boulders						
	95.0	Auger refusal on inferred bedrock End of Borehole						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

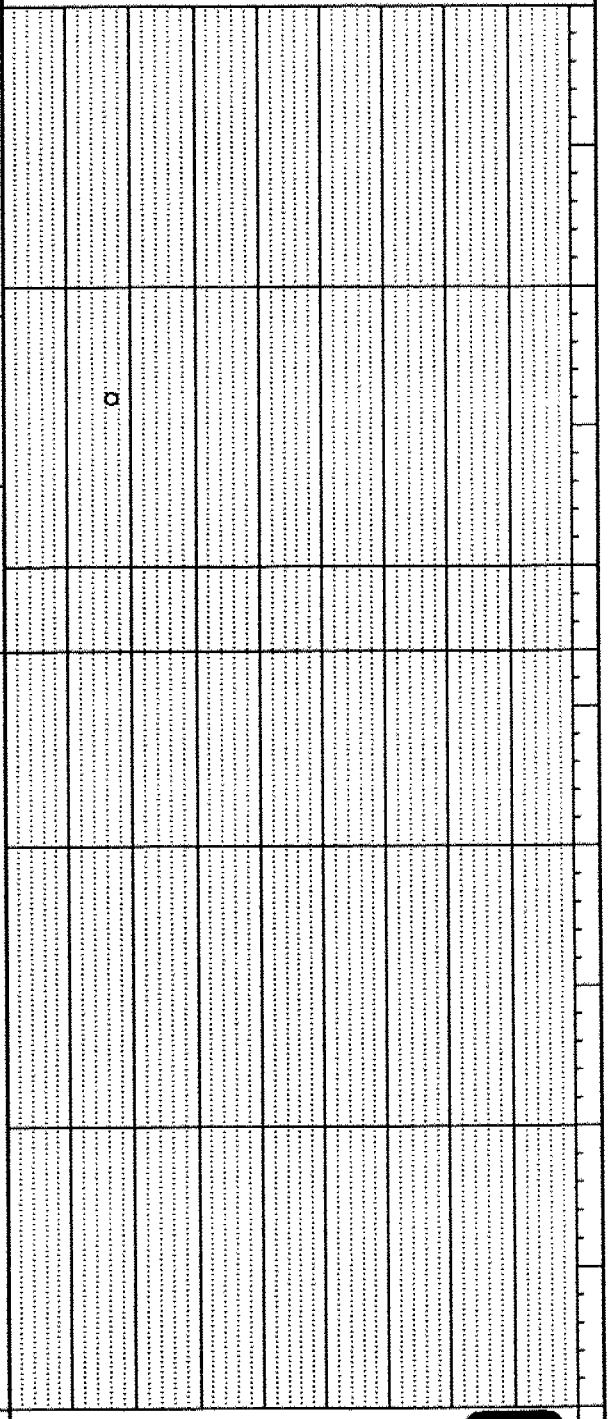
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-10

CLIENT McCormick Rankin

PROJECT No. 10285

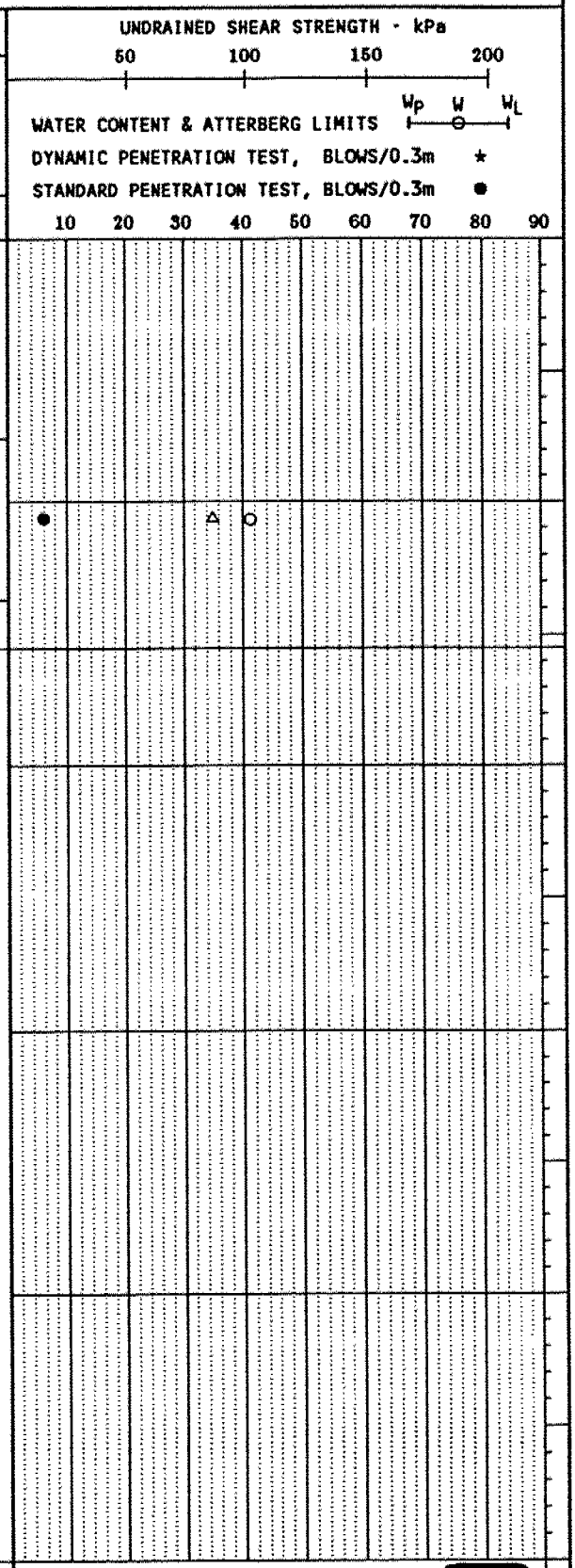
LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-10

DATES: BORING 92-05-06 WATER LEVEL -----

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	102.58	Grass covered ground surface						
	102.4	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brown, SILTY CLAY, trace sand			SS	1	600	6
	101.0	End of Borehole Groundwater not encountered						
1								
2								
3								
4								
5								



- ■ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-11

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-11

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
	99.35	Grass covered ground surface						
0	99.3	75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
	99.0	Compact, brown SILTY SAND, trace clay						
		Stiff to firm, mottled grey and brown, SILTY CLAY, trace sand						
1					SS	1	400	7
2								
3					SS	2	600	1
4	95.1							
		Loose to dense, grey matrix of sand, silt, clay and gravel, occasional cobbles and boulders: TILL			SS	3	600	3
5								

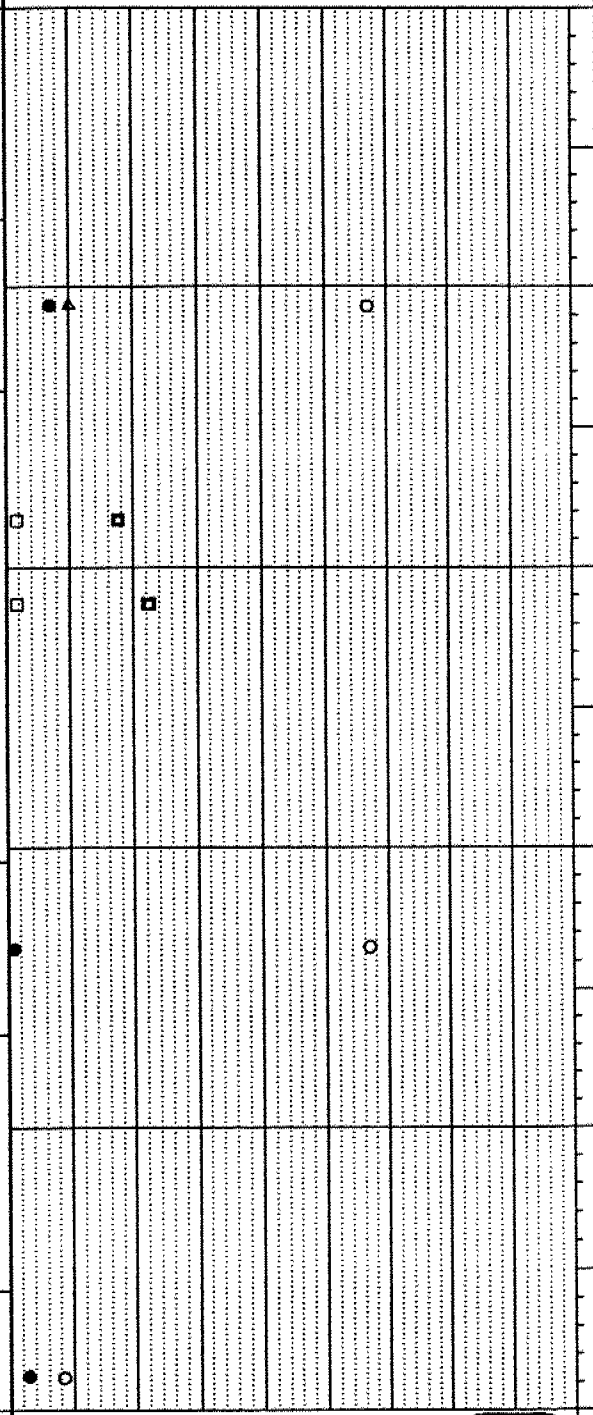
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Continued Next Page

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-11

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-11

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
5		Loose to dense, grey matrix of sand, silt, clay and gravel, occasional cobbles and boulders: TILL						
6	93.3	End of Borehole						
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-12

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

PROJECT No. 10285

BOREHOLE No. I-12

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	102.01	Grass covered ground surface						
	101.7	300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Soft, brown, SILTY CLAY, trace sand			SS	1	600	2
1	100.5	End of Borehole						
2								
3								
4								
5								

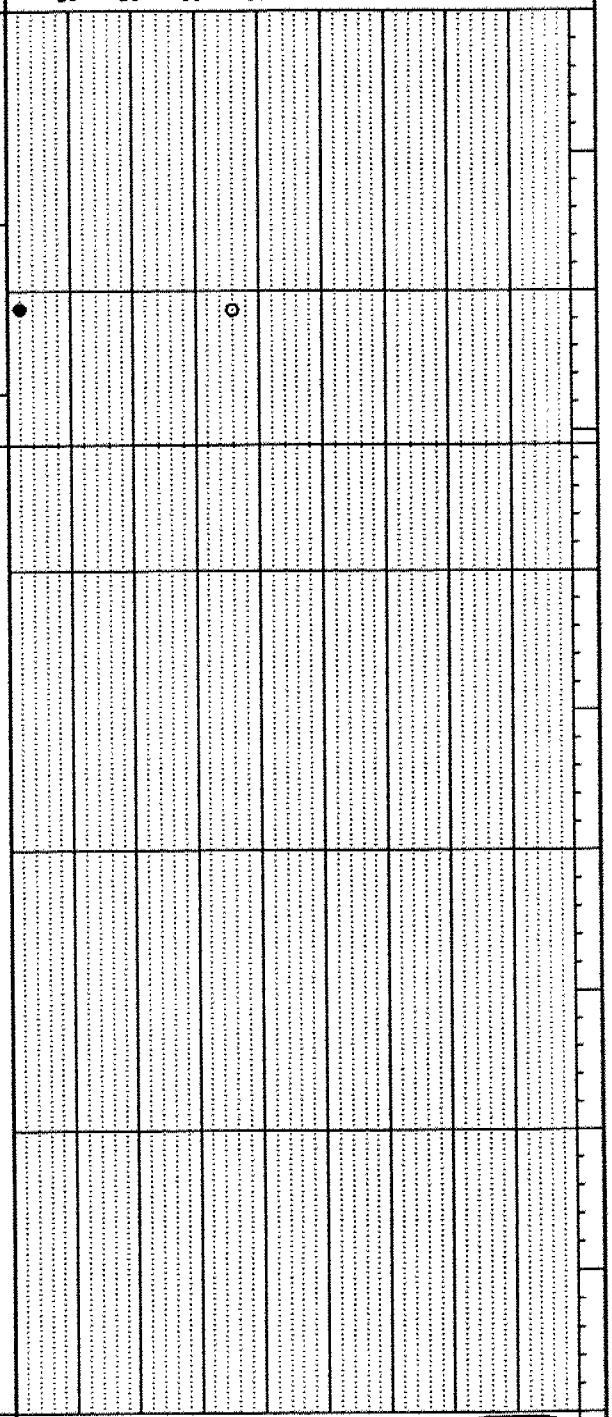
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-1

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. P-1

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	101.56	Grass covered ground surface						
	101.3	300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, mottled, brown and grey, SILTY CLAY, trace sand			SS	1	600	2
	100.0	End of Borehole Groundwater not encountered						

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

Depth scale: 0, 1, 2, 3, 4, 5

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-2

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-2

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	102.58	Grass covered ground surface						
	102.4	175 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, mottled brown and grey, SILTY CLAY, trace sand						
1					SS	1	600	5
	101.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

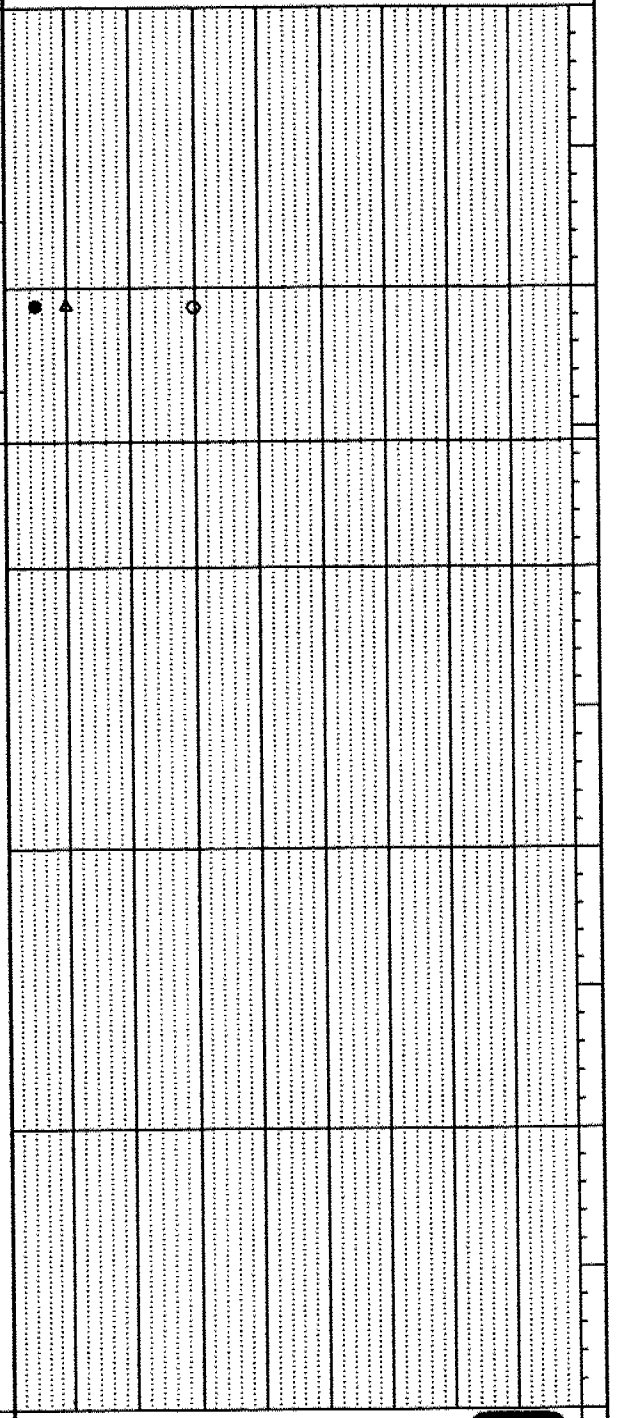
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-3

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. P-3

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	103.50	Grass covered ground surface						
	103.2	300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brownish grey, SILTY CLAY, trace sand, trace organics			SS	1	600	5
1	102.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

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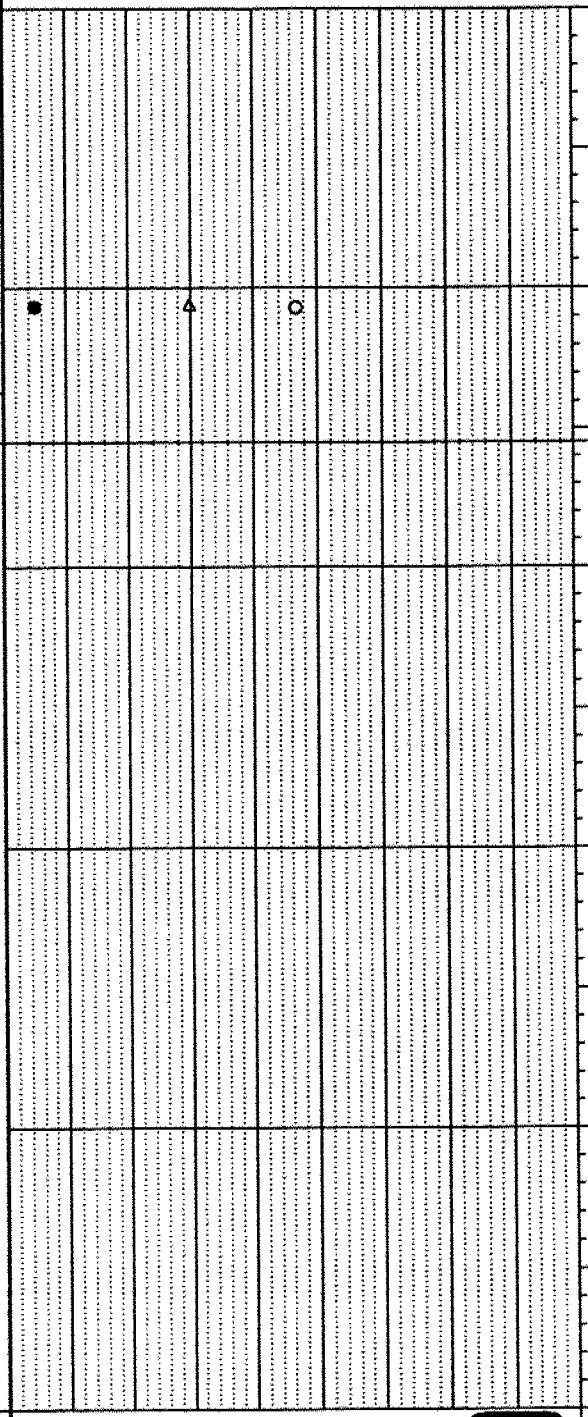


■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-4

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-4

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	102.27	Grass covered ground surface						
		275 mm dark brown, organic, sandy, silty clay: ROOTMAT						
	102.0	Firm to stiff, grey, SILTY CLAY, trace sand						
1					SS	1	600	5
	100.7							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

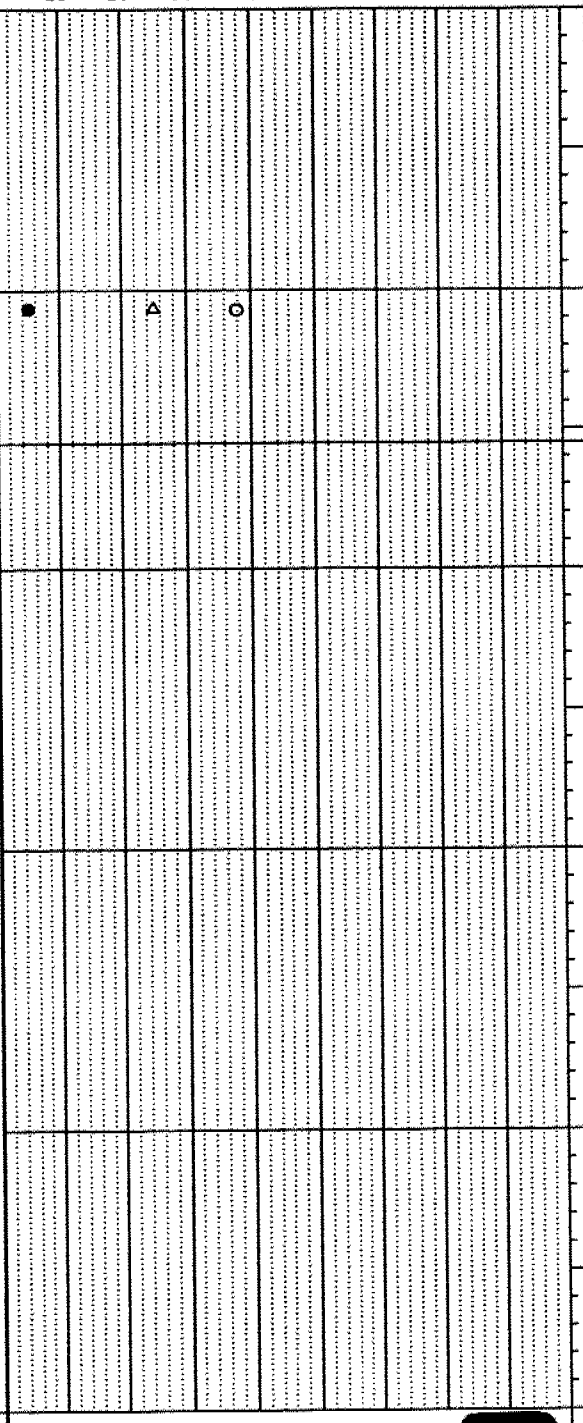
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ■ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-5

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-5

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	100.85	Grass covered ground surface						
	100.6	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, grey, SILTY CLAY, trace sand			SS	1	600	4
	99.3							
		End of Borehole Groundwater not encountered						

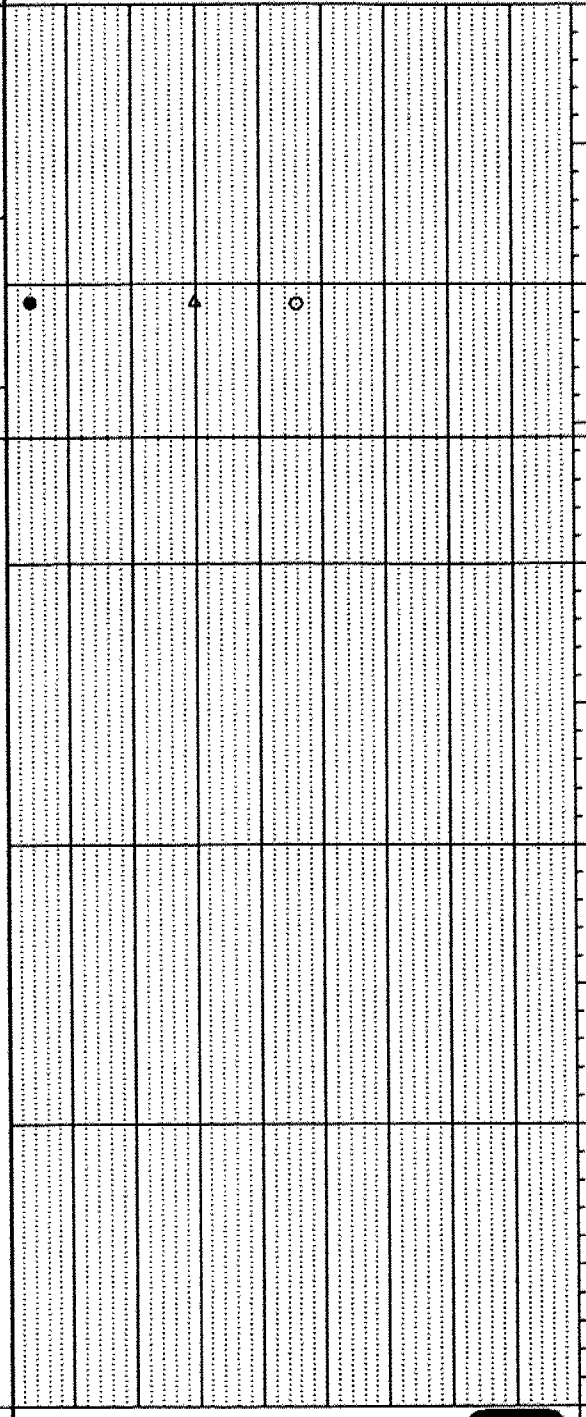
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-6

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. P-6

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0		Grass covered ground surface						
		75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm to stiff, brownish grey, SILTY CLAY, trace sand						
1					SS	1	600	6
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

AUGER HOLE RECORDS

Notes

1. Auger hole locations are provided on the Drawing No. 10285-1 in Appendix 2.

2. The auger holes were put down using a post hole auger on June 2, 1992.

3. The auger holes were located relative to existing site features. The ground surface elevations were surveyed by McCormick Rankin. It is our understanding that the elevations are referenced to geodetic datum.

4. All measurements are in millimetres and metres (ie. 800 mm, 1.0 m) , measured from ground surface at the auger hole locations.

5. Refer to attached sheets for symbols and terms used to describe the observed conditions.

AUGER HOLE RECORDS (CONTINUED)

I-13 - Elevation of ground surface 102.27 m Geodetic.
- Huntmar Road north abutment, east of concrete slope treatment.

0 -	100	Brown TOPSOIL/ROOTMAT
100 -	2.9	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
2.9 -	3.2	Compact, brown, sand, trace to some gravel: FILL

Groundwater was not encountered.

Borehole stopped at 2.9 m below ground surface because hole caving in as borehole is advanced.

I-14A - Elevation of ground surface 102.34 m Geodetic.
- Huntmar Road north abutment, west of concrete slope treatment.

0 -	125	Brown TOPSOIL/ROOTMAT
125 -	2.6	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
2.6 -	3.7	Compact, brown sand and gravel, trace silt, frequent cobbles and boulders: FILL

Groundwater was not encountered.

Borehole caving.

I-14B - Elevation of ground surface 101.46 m Geodetic.
- Huntmar Road north abutment, west of concrete slope treatment.

0 -	1.8	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
1.8 -	3.7	Compact, brown sand and gravel, trace silt, frequent cobbles and boulders: FILL

Groundwater was not encountered.

Borehole caving.

AUGER HOLE RECORDS (CONTINUED)

I-15 Section - North of the WBL at Station 9+963.5

I-15A - Elevation of ground surface 101.84 m Geodetic.
- 0.0 m from edge of pavement.

0 - 25	25 mm ASPHALT
25 - 430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 - 900	Compact, brown, sand, trace silt: FILL

I-15B - Elevation of ground surface 101.76 m Geodetic.
- 1.8 m from edge of pavement.

0 - 380	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
380 - 3.1	Compact, brown sand, trace silt: FILL
3.1 - 3.7	Stiff, grey, SILT and CLAY

I-15C - Elevation of ground surface 101.09 m Geodetic.
- 5.6 m from edge of pavement.

0 - 50	TOPSOIL
50 - 250	Compact, brown sand, trace silt: ROOTMAT
250 - 900	Compact, brown sand, trace silt: FILL

I-15D - Elevation of ground surface 100.69 m Geodetic.
- 7.2 m from edge of pavement.

0 - 250	TOPSOIL/ROOTMAT
250 - 750	Firm, brown/grey, mottled, silt and clay, some organics: FILL
750 - 900	Compact, brown sand, trace silt: FILL

I-15E - Elevation of ground surface 99.95 m Geodetic.
- 9.3 m from edge of pavement.

0 - 300	TOPSOIL/ROOTMAT
300 - 1.2	Firm, brown/grey, mottled, silt and clay, some organics: FILL
1.2 - 2.1	Firm, grey, SILT and CLAY

NOTE: - Groundwater was not observed in any of the I-15 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-16 Section - North of the WBL at Station 9+322.3

I-16A - Elevation of ground surface 104.93 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown, sand, some gravel, trace silt: FILL

I-16B - Elevation of ground surface 104.78 m Geodetic.
- 2.4 m from edge of pavement.

0 -	300	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
300 -	1.2	Compact, brown sand, some gravel, trace silt: FILL

I-16C - Elevation of ground surface 104.38 m Geodetic.
- 5.4 m from edge of pavement.

0 -	150	TOPSOIL
150 -	900	Compact, brown sand, some gravel, trace silt: FILL

I-16D - Elevation of ground surface 103.95 m Geodetic.
- 8.2 m from edge of pavement.

0 -	125	TOPSOIL/ROOTMAT
125 -	600	Firm, brown SILTY CLAY

I-16E - Elevation of ground surface 103.83 m Geodetic.
- 10.4 m from edge of pavement.

0 -	150	TOPSOIL/ROOTMAT
150 -	1.5	Firm, brown, SILTY and CLAY
1.5 -	2.1	Compact, brown, SILTY SAND (moist)
2.1 -	2.5	Compact, brown, silty sand, trace to some gravel: TILL
2.5 -	3.1	Compact, grey, silty sand, some gravel, occasional cobbles and boulders: TILL

NOTE: - Groundwater was not observed in any of the I-16 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-17 Section - North of the WBL at Station 8+826.7

I-17A - Elevation of ground surface 106.81 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown, sand, some gravel, trace silt: FILL

I-17B - Elevation of ground surface 106.60 m Geodetic.
- 2.7 m from edge of pavement.

0 -	300	Dense, brown sand and gravel: BASE and SUBBASE
300 -	1.2	Compact, brown sand, some gravel, trace silt: FILL

I-17C - Elevation of ground surface 106.19 m Geodetic.
- 5.5 m from edge of pavement.

0 -	430	Silty clay: TOPSOIL/ROOTMAT
430 -	1.5	Compact, brown sand, some gravel, trace silt: FILL

I-17D - Elevation of ground surface 105.79 m Geodetic.
- 8.5 m from edge of pavement.

0 -	600	TOPSOIL/ROOTMAT
600 -	900	Compact, brown SILTY SAND

I-17E - Elevation of ground surface 105.49 m Geodetic.
- 10.3 m from edge of pavement.

0 -	480	TOPSOIL/ROOTMAT
150 -	1.1	Compact, brown, SILTY SAND
1.1 -	1.7	Compact, grey, gravelly silty sand: TILL (saturated)
1.7 -	3.1	Compact, grey, gravelly silty sand, frequent cobbles and boulders: TILL (saturated)

NOTE: - Groundwater was not observed in any of the I-17 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-18 Section - South of the EBL at Station 8+730.0

I-18A - Elevation of ground surface 107.49 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	520	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
520 -	1.2	Compact, brown, sand, trace silt and gravel: FILL

I-18B - Elevation of ground surface 107.29 m Geodetic.
- 2.9 m from edge of pavement.

0 -	75	Dense, grey sand and gravel, trace silt: BASE and SUBBASE
75 -	430	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown sand, trace silt and gravel: FILL

I-18C - Elevation of ground surface 106.79 m Geodetic.
- 5.7 m from edge of pavement.

0 -	200	Brown sand, trace silt: ROOTMAT
200 -	1.2	PEAT
1.2 -	1.5	Compact, brown, sand, trace silt: FILL (saturated)

I-18D - Elevation of ground surface 106.52 m Geodetic.
- 8.4 m from edge of pavement.

0 -	230	TOPSOIL/ROOTMAT
230 -	600	Loose, brown/black silty sand, some peat layers: FILL
600 -	1.2	Compact, brown, SILTY SAND

I-18E - Elevation of ground surface 106.24 m Geodetic.
- 10.2 m from edge of pavement.

0 -	900	PEAT
900 -	2.0	Compact, brown SILTY SAND
2.0 -	3.1	Compact, grey, silty sand, some gravel, occcasional cobbles and boulders: TILL (saturated)

NOTE: - Groundwater was not observed in any of the I-18 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-19 Section - South of the EBL at Station 9+435.1

I-19A - Elevation of ground surface 104.58 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	550	Very dense, grey to brown, sand and gravel, trace silt: BASE and SUBBASE
550 -	1.2	Compact, brown, sand, trace silt: FILL

I-19B - Elevation of ground surface 104.48 m Geodetic.
- 2.4 m from edge of pavement.

0 -	430	Dense, brown to grey sand and gravel, trace silt: BASE and SUBBASE
430 -	1.5	Compact, brown sand, some gravel, trace silt: FILL

I-19C - Elevation of ground surface 104.10 m Geodetic.
- 5.4 m from edge of pavement.

0 -	225	TOPSOIL/ROOTMAT
225 -	900	Compact, brown sand, some gravel, trace silt: FILL

I-19D - Elevation of ground surface 103.58 m Geodetic.
- 7.6 m from edge of pavement.

0 -	75	TOPSOIL
75 -	600	Loose, brown sand, trace silt: FILL
600 -	1.2	Grey, silt and clay, trace sand: FILL

I-19E - Elevation of ground surface 103.25 m Geodetic.
- 9.4 m from edge of pavement.

0 -	150	TOPSOIL
150 -	2.8	Firm to Stiff, brown, SILTY CLAY

NOTE: - Groundwater was not observed in any of the I-19 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-20 - Elevation of ground surface 101.90 m Geodetic.
- Huntmar Road south abutment, 1.2 m west of concrete slope treatment.

0 -	600	Compact, brown sand and gravel, trace silt: FILL
600 -	1.4	Compact, brown sand, some gravel, trace silt: FILL
1.4 -	2.5	Compact, brown, sand, trace silt and gravel, frequent boulders: FILL

Groundwater was not encountered.

Borehole stopped at 2.5 m below ground surface because difficulty to obtain sample when going through boulders.

I-21 - Elevation of ground surface 101.92 m Geodetic.
- Huntmar Road south abutment, 1.0 m east of concrete slope treatment.

0 -	150	Brown TOPSOIL
150 -	1.2	Compact, brown sand and gravel, trace silt: FILL
1.2 -	1.8	Compact, brown sand and gravel, trace silt, occasional cobbles and boulders: FILL
1.8 -	2.8	Compact, brown sand, trace silt and gravel: FILL
2.8 -	3.7	Firm, SILTY CLAY intermixed with roots and topsoil

Groundwater was not encountered.

AUGER HOLE RECORDS (CONTINUED)

I-22 Section - South of the EBL at Station 10+125

I-22A - Elevation of ground surface 100.81 m Geodetic.
- 0.0 m from edge of pavement.

0 -	50	50 mm ASPHALT
50 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.5	Compact, brown, sand, trace silt: FILL

I-22B - Elevation of ground surface 100.57 m Geodetic.
- 2.8 m from edge of pavement.

0 -	280	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
280 -	1.2	Compact, brown sand, trace silt: FILL

I-22C - Elevation of ground surface 100.10 m Geodetic.
- 5.7 m from edge of pavement.

0 -	300	TOPSOIL
300 -	1.2	Compact, brown sand, trace silt: FILL

I-22D - Elevation of ground surface 99.62 m Geodetic.
- 8.6 m from edge of pavement.

0 -	460	TOPSOIL/ROOTMAT
460 -	900	Firm, brown/grey, mottled, SILT and CLAY

I-22E - Elevation of ground surface 99.38 m Geodetic.
- 10.5 m from edge of pavement.

0 -	150	TOPSOIL/ROOTMAT
150 -	2.5	Firm, brown/grey, mottled, SILT and CLAY

NOTE: - Groundwater was not observed in any of the I-15 Boreholes.

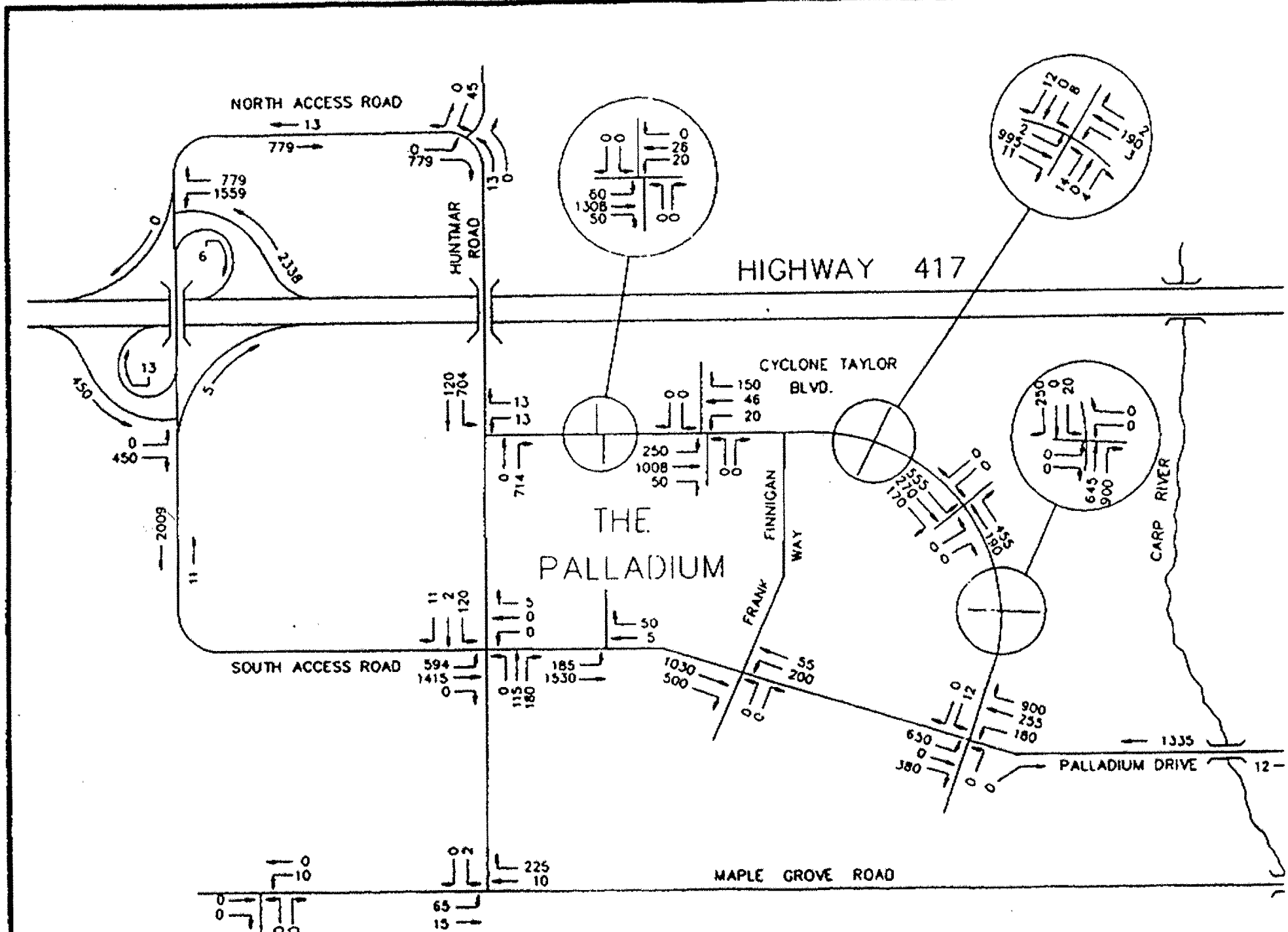
AUGER HOLE RECORDS (CONTINUED)

I-23 -Near Borehole P-6, at about Station 21+212.
-0.0 m west from west edge of pavement.

0 - 40	40 mm ASPHALT
40 - 480	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
480 - 500	Stiff, brown, SILTY CLAY

NOTE: - No groundwater observed.

1996 18:30 - 19:30 SATURDAY COMPOSITE TRAFFIC VOLUMES



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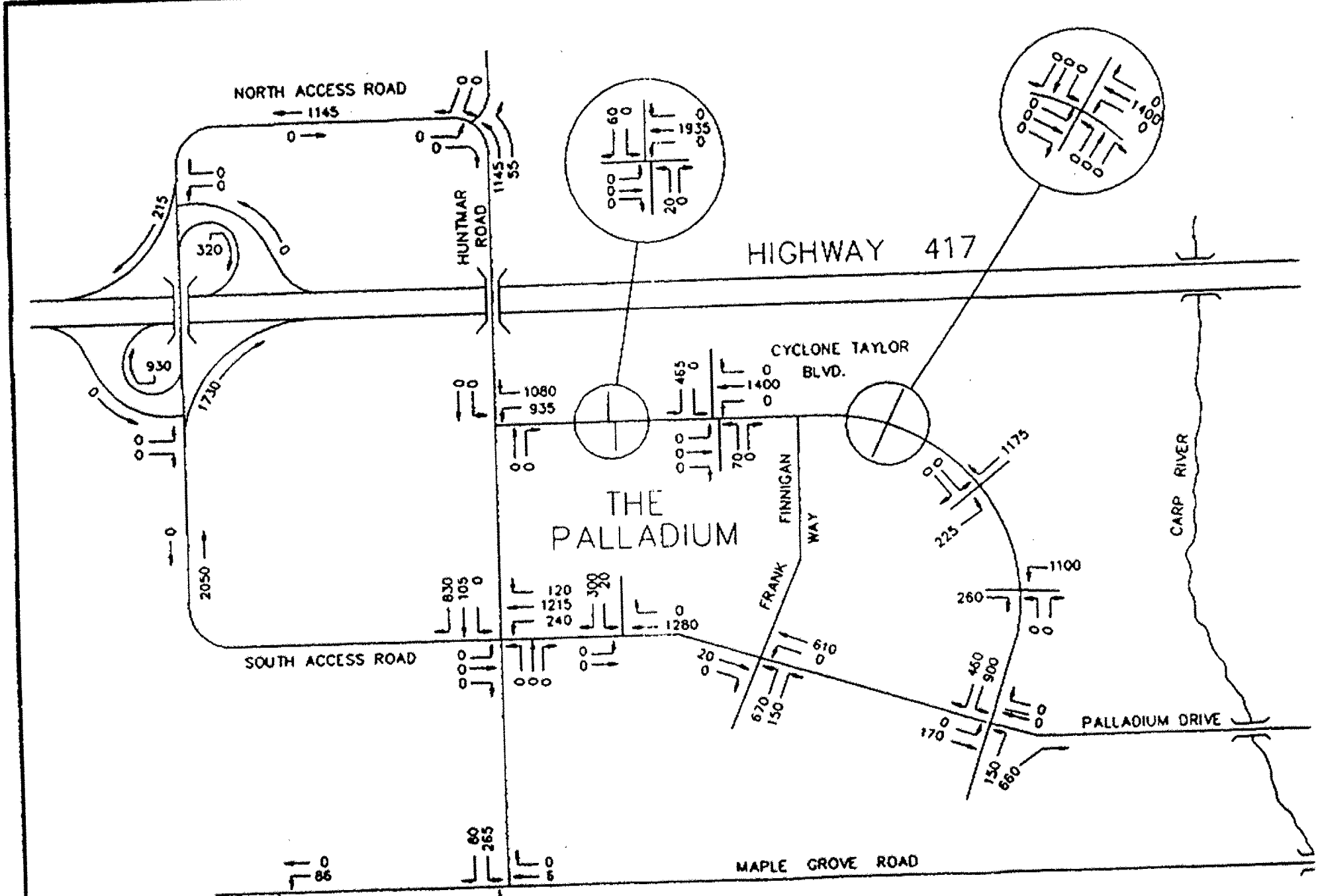

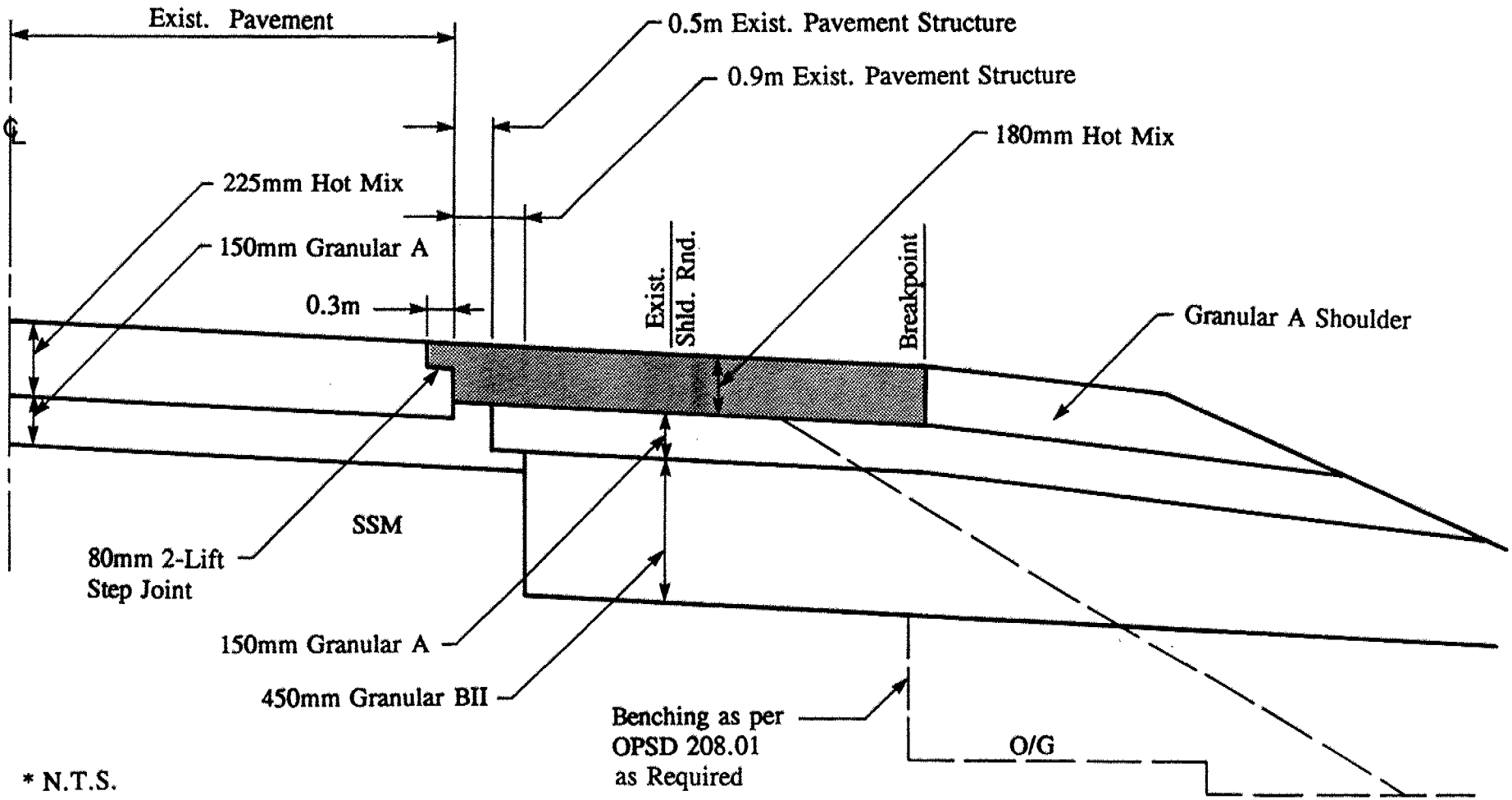

HIGHWAY 417 WIDENING

DRAWING No. 10285-2

OVERSIZE DRAWING(S)

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 3165-193

DIST. 9 REGION

W.P. No.

CONT. No.

W. O. No. 94-11003

STR. SITE No.

HWY. No. 417

LOCATION Hwy 417 - Palladium Dr. Underpass

No OF PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

GEOCRES #31G5-193

McCORMICK RANKIN

GEOTECHNICAL INVESTIGATION PROPOSED OTTAWA PALLADIUM INTERCHANGE AT HIGHWAY 417

WEST CARLETON, ONTARIO

JACQUES WHITFORD LIMITED

July 29, 1992

PROJECT NO. 10285

Recycled Paper

Report

to

McCormick Rankin

on

Geotechnical Investigation

Proposed Ottawa Palladium
Interchange at Highway 417

West Carleton, Ontario

Jacques Whitford Limited

July 29, 1992

Project No. 10285

Recycled Paper

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Appendix 1

- Symbols and Terms used on the Borehole and Auger Hole Records
- Borehole Records
- Auger Hole Records

Appendix 2

- Drawing No. 10285-1: Borehole Location Plan
- Drawing No. 10285-2: Highway 417 Widening

Appendix 3

- Traffic Volume per Design Event

Recycled Paper

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for the proposed Ottawa Palladium Interchange at Highway 417 in West Carleton, Ontario. The investigation was carried out in accordance with our original proposal submitted to McCormick Rankin on September 17, 1991 and amended April 22, 1992. Authorization to carry out this work was received from Mr. M. Goetz, P. Eng. of McCormick Rankin.

This report has been prepared specifically and solely for the proposed construction described herein. It contains all of our findings and includes geotechnical recommendations for the design and construction of the project. The Foundation Investigation for the underpass structure of the Interchange has been reported previously, and is not included in this report.

Recycled Paper

2.0 PROPOSED DEVELOPMENT

The proposed Ottawa Palladium is to be located south of Highway 417 and east of Huntmar Road (see Key Plan on Drawing No. 10285-1 in Appendix 2). One principal access will be through the proposed Palladium Interchange at Highway 417. The Palladium Interchange Project includes the following components:

- 2.8 km of on/off ramps
- 3.0 km of speed change lanes (widening of existing Highway 417).
- 2.4 km of roadways connecting Huntmar Road to the Interchange through Palladium Drive North and South.
- Construction of four (4) culverts for creek crossings located on the north side of Highway 417.
- Construction of two (2) retaining walls at the forward slopes of the approach fills of the existing Huntmar Road Underpass to permit widening of Highway 417.
- Construction of the Palladium Drive Underpass, consisting of a two span structure and associated approach fills (Foundation Investigation was previously carried out and the report was submitted February 27, 1992).

It is our understanding that all of the proposed roads, and ramps are to be fill sections (no cut sections). Related to the approach fills of the underpass structure, fill heights will be in the order of 8 m, and up to a maximum of about 11 m in localized areas. For Palladium Drive away from the approach fill areas, the fill heights are to be less than 2.0 m. McCormick Rankin and Associates have provided the design traffic volumes utilized in pavement designs as discussed herein.

It is also understood that the creek north of Highway 417 may be diverted. Therefore the requirement/locations of related culverts may be changed in the future.

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4.0 PROCEDURE

4.1 Field Investigation

The field work for this investigation was carried out in two (2) phases. Phase 1 **boreholes** (I-1 to I-12 and P-1 to P-6) were put down on May 6, 1992 using a track mounted CME 55 power drill. The Phase 2 **auger holes** (I-13 to I-23) were put down in series of five auger holes using a truck-mounted post hole auger on June 2, 1992.

Prior to the onset of the field investigation, the borehole and auger hole locations were established in the field by McCormick Rankin personnel and cleared of any existing underground services by our site personnel.

The first phase of field work involved drilling eighteen boreholes, numbered I-1 to I-12 (Interchange), and P-1 to P-6 (Palladium Drive). The second phase, auger holes numbered I-13 to I-23, was carried out for the Highway 417 widening investigation and the connection of the Palladium Drive North to Huntmar Road. The holes put down for each component of the project are summarized below, and are located as shown in Drawing 10285-1 in Appendix 2.

Hole	Component	Remarks
I-1 to I-12	Interchange-Ramps	
P-1 to P-6	Palladium Drive North & South	
I-13, I-14, I-20, I-21	Widening at Huntmar Road Underpass	for proposed retaining walls
I-12, I-22 I-15 to I-19	Highway 417 widening	a series of 5 auger holes at each location to determine soil/granular profile
I-23	Palladium Drive North Huntmar Road connection	

Recycled Paper

Boreholes I-1 to I-12 and P-1 to P-6 were advanced to depths ranging from 1.5 m to 7.3 m using a track-mounted CME 55 power auger drill. Solid stem augers, 100 mm in diameter were used to advance these holes except in Boreholes I-7, I-9 and I-11 (proposed culvert locations) where hollow-stem augers, 200 mm in outside diameter, were used. The soils were sampled at regular intervals by conducting Standard Penetration Tests. In cohesive deposits, field vane tests were carried out in order to assess in situ shear strengths. The auger holes were advanced using a truck-mounted post hole auger at the locations I-12 to I-23 to determine the soil/granular profile.

All recovered soil samples were stored in moisture-proof bags and subsequently returned to our laboratory for detailed classification and testing.

The ground water levels presented herein are based on readings taken at the time of drilling.

All boreholes were backfilled with augered cuttings.

4.2 Survey

Borehole and auger hole locations and elevations were surveyed by McCormick Rankin upon completion of the drilling. The information obtained is provided in the Borehole and Auger Hole Records in Appendix 1 and is shown in Drawing 10285-1 in Appendix 2. Elevations have been referenced to the Geodetic datum.

4.3 Laboratory Testing

All samples returned to the laboratory were subjected to a detailed visual classification by a geotechnical engineer. Selected samples were tested for moisture content.

Remaining samples will be stored for a period of six months after issuance of this report. Following this period they will be discarded unless we are directed otherwise.

Recycled Paper

5.0 RESULTS OF THE INVESTIGATION

5.1 Surface Conditions

At the time of the site investigation the ground surface over the proposed project area consisted of a series of predominantly flat, grass covered, open fields. These fields were separated by rows of bushes and small trees. The exception is a tree-lined ravine/creek, approximately 3 m deep on the north side of, and parallel to, Highway 417.

5.2 Subsurface Profile

The subsurface profiles, observed at the specified borehole locations, are presented in the Borehole Records and Auger Hole Records in Appendix 1. An explanation of the symbols and terms used to describe the Records is also provided.

In general, in the proposed new roadway areas the observed stratigraphy east of the interchange consists of the existing surficial topsoil overlying silty clay. All boreholes located west of the interchange, with the exception of Borehole I-4, were found to consist of the existing surficial topsoil overlying silty sand. In the proposed Highway 417 widening areas, asphalt pavement structure over compact sand fill was encountered. A summary of the observed subsurface conditions is provided below.

Topsoil

A layer of surficial topsoil was encountered in all boreholes. The layer thickness ranged between 75 mm and 300 mm, with an average thickness of 200 mm when considering all boreholes. The topsoil material observed in the boreholes consists of a dark brown, organic, sandy, silty clay.

Silty Clay

Silty clay was encountered underlying the topsoil in Boreholes I-4 through I-6, I-8, I-9, I-10, I-12 and P-1 through P-6. Borehole I-11 contains silty clay beneath a thin layer of silty sand. The silty clay layer thickness, based on Borehole I-9, is approximately 4.0 m and has a consistency ranging from firm to stiff. Moisture content tests revealed that moisture contents range between 30% and 57% with an average of 42%.

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Silty Sand

A loose to compact silty sand was encountered underlying the topsoil in Boreholes I-1 through I-3, I-7 and I-11. A dense silty sand layer was also evident below the silty clay in Borehole I-9. The layer thickness ranged between 0.3 m and 1.6 m in the near surface deposits and 2.5 m in the deeper deposit of Borehole I-9. Moisture content tests revealed that moisture contents range between 17% to 24% with an average of 20%.

Till

A till deposit consisting of silt, sand, some gravel and trace clay was encountered beneath the silty sand in Boreholes I-1, I-2 and I-7 and beneath the silty clay in Boreholes I-9 and I-11. Moisture content tests carried out on representative samples of the till indicate that the moisture content ranges between 8% and 21% with an average of 16%.

Bedrock

Bedrock was inferred, from auger refusal, at Boreholes I-7 and I-9. According to geologic subsurface maps of this area, the bedrock consists of limestone of the Ottawa Formation.

Pavement Structures

The auger holes taken on the shoulder of the existing Highway 417 typically encountered 25 to 50 mm of asphalt (edge of paved shoulder) over 380 to 525 mm of very dense brown sand and gravel with a trace of silt (base granular). Underlying the granular material is a fill consisting of compact brown sand with a trace of silt and gravel. The fill encountered in all shoulder auger holes extends to depths greater than 1.2 m.

Auger hole I-23 is located near the connection between Palladium Drive North and Huntmar Road. Asphalt, 40 mm in thickness, over sand and gravel fill was encountered at this location. Silty clay was encountered below a depth of 480 mm.

Recycled Paper

Peat

Swamp material in the form of peat was encountered in the I-18 series of holes. It was measured to be 1.0 m in thickness at a point 5.7 m south of the edge of pavement of the east bound lanes.

Approach Fills of the Highway 417 Underpass at Huntmar Road

In general, there is between 0 and 150 mm of topsoil overlying fill. The fill is composed of sand and gravel with a trace of silt and occasional cobbles and boulders. The frequency of boulder occurrence increases with depth. Only one of the auger holes was able to penetrate through the boulders. Auger Hole I-21 reached a silty clay at a depth of 2.8 m which corresponds to an elevation of 99.1 m. It is estimated that the toe of the slope is at elevation 101.1 m. The silty clay is intermixed with roots and topsoil indicating that prestripping was not adequately performed beneath the approach fills. Groundwater was not encountered.

5.3 Groundwater

Water level readings were taken while drilling the boreholes and are shown on the Borehole Records. The ground water levels range between 0.9 m and 3.05 m below the existing ground surface. Groundwater was not encountered in any of the Auger Holes (I-13 to I-23).

Fluctuations in the groundwater level due to seasonal variations or in response to a particular precipitation event should be anticipated.

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6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 General

The new construction of Palladium Drive will generally involve shallow fill of less than 2.0 m height. For the approach fills of the underpass structure and the associated on/off ramps, fill height of up to about 11 m will be reached in localized areas, and in general less than 8 m. It is anticipated that the fill material to be used as subgrade fill will consist of imported fill as the limited amount of cut material from the roadwork of this project may be too wet to pass as Earth Borrow. Excessive settlement is not expected from the proposed embankments. Swamp excavation will be required at the western limit of the proposed Highway 417 widening. Two different pavement structures are recommended for the various roadways for this project based on differing traffic loads. Transitions between the differing pavement structures will be required.

The proposed Interchange includes the placement of four (4) culverts north of Highway 417. Subexcavation of the culvert foundations will not be required. One of the culverts will be under as much as 11 m of fill. Section 6.3 provides general recommendations for the foundations and backfill of culverts.

Highway 417 widening will include two retaining walls at the approach fills of the Huntmar Road Underpass. The presence of boulders at the recommended footing elevation necessitates subexcavation and backfilling beneath the proposed footing depth. Shoring will be required to prevent undermining of the underpass abutments.

6.2 New Roadways - Interchange Ramps, Palladium Drive and Speed Change Lanes

6.2.1 Fill Sections

As part of the roadway construction, it is anticipated that fill placement of less than 2.0 m will be carried out along the proposed Palladium Drive. For the approach fills of the underpass structure and the associated ramps, fill placement of up to 11 m will be required in localized areas, and generally less than 8 m in other areas. Stability and settlement associated with the high fills have been addressed in the previous Foundation Investigation Report dated February 27, 1992. Excessive settlement of the underlying soil due to road and ramp embankment placement is not anticipated.

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In fill areas where the fill heights are less than 1.2 m, all topsoil, organic and other deleterious materials should be stripped and removed prior to fill placement. Grubbing will be required in forested areas. In areas where fill heights are in excess of 1.2 m, only close cut clearing is required. The stripped area should be proofrolled as directed by the Engineer. Any soft areas noted during proofrolling should be removed and replaced with Earth Borrow or OPSS Select Subgrade Material prior to fill placement. For design purposes, assume a topsoil stripping depth of 200 mm for all existing side slopes, ditches and subgrade under proposed fills.

Structural fill used to build up the subgrade should consist of approved material such as Earth Borrow or OPSS Select Subgrade Material. Structural fill used to build up the subgrade should be placed and compacted in accordance with OPSS 501.

The permanent side slopes of the fills should be sloped no steeper than 2 horizontal to 1 vertical. The fill side slopes should be protected from erosion by hydroseeding, placing sod, placing an appropriate filter blanket, or other acceptable methods.

6.2.2 Transitions

It is understood that in an effort to minimize the elevation difference between the proposed Palladium Drive and adjacent lands, the maximum fill height may be limited. In areas where superelevation is required, consideration may be given to excavation on the lower side to allow for the placement of the granular base and subbase. Transition in the transverse and longitudinal directions may be required in this case. Transition treatment should be carried out in accordance with the OPSD-205 series, using a minimum depth of transition point treatment, t, of 1.2 m.

6.2.3 Assessment of Excavated Material

The excavated granular materials from within the existing roadway will be suitable for reuse as Earth Borrow or Select Subgrade Material.

The overburden materials encountered throughout the investigation do not meet the OPSS requirements for Select Subgrade Material due to the high fine content. Depending on the depth of excavation, weather conditions, and construction methodology, portions of the silty sand and silty clay will likely not meet Earth Borrow specifications as the water contents of these materials may be too high to achieve adequate compaction. These materials may need to be wasted.

Recycled Paper

6.2.4 Pavement Structure

Pavement structure has been based on traffic information supplied by McCormick Rankin. The AADT values have been calculated based on the traffic volume estimated for a design event (a sold out hockey game), with 180 to 200 events per year. The estimated traffic volume for a design event is included in Appendix 3. The AADT used for the pavement structure recommendations are as follows:

Road	AADT
N-W Ramp	260
S-W Ramp	360
W-N/S Ramp	500
N-E Ramp	1030
Palladium Drive North (Sta. 20+182 to 21+240)	1270
E-N/S Ramp	1710
S-E Ramp	1900
Palladium Drive South (Sta. 18+900 to 20+182)	2230

It is understood that all design traffic is Palladium related. Traffic associated with future developments have not been included.

Using the procedure from the American Association of State Highway and Transportation Officials (AASHTO) "Guide for the Design of Pavement Structures" in conjunction with MTO procedures, the following minimum pavement structures are recommended:

At the **Palladium Drive South (Sta. 18+900 to 20+182), S-E Ramp and E-N/S Ramp** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
50 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
450 mm OPSS Granular B Type II.

At the **Palladium Drive North (Sta. 20+182 to 21+240), W-N/S Ramp, N-E Ramp, S-W Ramp and N-W Ramp** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
40 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
300 mm OPSS Granular B Type II.

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MTO Soils Design Report W.P. 433-64-02 has been reviewed in establishing the recommended minimum pavement structure for the Speed Change Lanes. At all the **Highway 417 widening / Speed Change Lane** locations the recommended minimum pavement structure is:

40 mm OPSS HL1 Surface Course
40 mm OPSS HL8 Binder Course
50 mm OPSS HL8 Binder Course
50 mm OPSS HL8 Binder Course
150 mm OPSS Granular A
450 mm OPSS Granular B Type II
over OPSS SSM.

At **Huntmar Road North**, the recommended minimum pavement structure is:

50 mm OPSS HL1 Surface Course
150 mm OPSS Granular A
150 mm OPSS Granular B Type II

For the **Structure Deck of the Palladium Drive Underpass**, the recommended pavement structure is:

40 mm OPSS HL1 Surface Course
40* mm OPSS HL8 Binder Course
* Plus 10 mm waterproofing, for a total of 50 mm

At the Speed Change Lane locations a substitution of Granular B for the OPSS SSM listed above would also provide adequate support.

Full-time inspection of the placement of the subbase must be carried out to confirm that construction traffic has not contaminated the pavement structure. Both the OPSS Granular A and Granular B materials should be compacted to 100 percent of Standard Proctor maximum dry density as specified in OPSS-501.

Recycled Paper

6.2.5 Bituminous Pavement Transitions

A 10 horizontal to 1 vertical wedge should be provided at the bullnose locations for the full pavement width to provide a uniform load transfer between the differing pavement structures at the following locations:

Palladium Drive North	-	E-N Ramp
Palladium Drive North	-	S-W Ramp
Palladium Drive North	-	Existing Huntmar Road
Palladium Drive South	-	W-N/S Ramp
Palladium Drive South	-	N-E Ramp
All Speed Change Lanes	-	All Ramps

A butt joint is required between the pavement structures of the existing Huntmar Road and the new Palladium Drive North.

The following procedures apply to all Highway 417 Widenings for the construction of Speed Change Lanes:

- Remove existing paved shoulder and blade off existing granulars to provide for the recommended bituminous pavement thickness.

- Provide an 80 mm 2 lift step joint 300 mm in width into existing pavement as shown in Drawing 10285-2 in Appendix 2.

- Excavate from 0.5 m outside the edge of existing pavement to inside limit of shoulder rounding to allow for 150 mm Granular A and the recommended bituminous pavement thickness.

- Excavate from 0.9 m outside the edge of existing pavement outward to intersect the existing embankment slope to allow for the recommended Granular B thickness under the Granular A and bituminous pavement.

Recycled Paper

6.2.6 Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between subgrade material and the subbase material in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loadings can result in the reduction of the load carrying capacity of the pavement structure. If the surrounding grades are lower than the proposed roadway, proper grading of the subgrade and provision of surface ditches in accordance with OPSD-200 series is sufficient.

6.2.7 Swamp Treatment

Swamp excavation and replacement will be necessary at the western end of the N-W ramp and the W-N/S ramp. It is estimated that up to 1.5 m of material will have to be removed between approximate Sta 8+200 and Sta 8+710 (N-W Ramp) and between approximate Sta 8+230 to 8+715 (W-N/S Ramp). The excavation should be replaced with OPSS SSM or other acceptable granular fill in accordance with OPSD-203.02.

6.2.8 Adjustment Factors

The compensating factors outlined in Appendix A (Contingencies and Allowances), Chapter B of the Contract Design Estimating and Documentations Manual are suitable for use on this project.

In areas where the subgrade consists of sand material, a 20% loss factor for Granular B, Type II should be allowed in the design.

The following conversion factors (in t/m^3) are recommended for this project:

Granular B, Type I	2.0
Granular B, Type II	2.2
Sand within R.O.W.	1.7
Silty Clay within R.O.W.	1.7
SSM	1.8

Recycled Paper

6.2.9 Boulder Treatment

Boulders are observed on ground surface at the western portion of the Highway 417 widening. Boulders encountered at subgrade elevation are to be treated as per OPSD 204.01. Existing boulders not exceeding 450 mm in size may be reused, provided that there are no boulder clusters creating voids, and that OPSD 204.01 is followed.

6.3 Culverts

The culvert types and locations proposed for this project have not been finalized at this time. The following are general recommendations which may be modified if necessary once the details are known.

6.3.1 Culvert Foundations

All four (4) new culverts should be founded on competent inorganic materials. It is anticipated that flexible pipe or box culverts will be used in the project. Subexcavation of the subsoils is not anticipated at any of the four culvert locations.

The proposed invert elevations of the culverts are not available at this time. The culvert structures may be founded on spread footings located within either silty clay or silty sand. The following design values are recommended:

Soil Type	Factored Bearing Capacity at U.L.S.	Bearing Capacity at S.L.S. Type II
silty clay	250 kPa	75 kPa
silty sand	275 kPa	100 kPa

An open box type culvert has been assumed with 2 m wide footings located 1.8 m below the invert elevation in the calculations of capacities. The S.L.S. Type II bearing pressure has been calculated based on 25 mm of allowable settlement.

The depth of frost penetration at the site is anticipated to be 1.8 m.

The above recommendations should be reviewed once the culvert types, locations and invert elevations are finalized.

Recycled Paper

6.3.2 Culvert Backfill

To prevent hydrostatic pressure buildup, backfill to culvert walls and retaining structures should consist of free draining materials such as OPSS Granular A or Granular B. Backfill for box culverts should be in accordance with OPSD-803 series. For the design of the culvert backfill configurations, the frost line in OPSD-803.01 to 803.06 should be taken as 1.8 m below road surface.

Lateral earth pressures should be calculated in accordance with the O.H.B.D.C. Section 6.1.2 using the following design parameters:

	Granular A	Granular B
Unit Weight (kN/m^3),	22.8	21.2
Unfactored Angle of Internal Friction, ϕ	35°	30°
Coefficient of Active Earth Pressure, (K_a)	.27	.33
Coefficient of Earth Pressure at Rest, (K_o)	.43	.50

Sliding resistance between concrete and the existing native silty sand and silty clay can be calculated in accordance to O.H.B.D.C. Section 6.7.3.3.2 using an unfactored friction coefficient of 0.55 and 0.50 respectively, assuming unfactored angles of friction of 29 and 27 degrees respectively.

6.4 Retaining Walls

In order to accommodate the widening of Highway 417 for the E-N/S and the S-E Ramps, the foreword slopes of the Huntmar Road Underpass will have to be provided with retaining structures. It is our understanding that the two structures will be limited to about 2 m in height.

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Lateral earth pressures should be calculated in accordance with the O.H.B.D.C. Section 6.1.2 using the following design parameters:

Unit Weight (kN/m^3),	21.2
Unfactored Angle of Internal Friction, ϕ	30°
Coefficient of Active Earth Pressure, (K_a)	.53
Coefficient of Earth Pressure at Rest, (K_o)	.80

The above parameters are recommended based on the nature of the existing fill material and that the backfill behind the retaining walls is sloped at 2H:1V.

It is recommended that a minimum thickness of 0.5 m of Granular A be placed immediately behind the wall. The existing granular fill removed to construct the wall may be reused behind the Granular A material.

Only one of the four auger holes at this location penetrated through the fill due to the presence of a layer of boulders and cobbles. It is our understanding from the tender drawings for the Huntmar Road Underpass (W.P. 436-64-00) that the toe of the existing foreword slope is at elevation approximately 101.1 m. Borehole I-21 indicates that the base of the fill is at approximately 99.1 m elevation.

It is recommended that a subexcavation be taken below the footing to remove the boulder layer and create a good footing pad. This subexcavation should be advanced into the silty clay deep enough to remove the organic roots and topsoil noted in Auger Hole I-21. The subexcavation should be inspected and approved by a geotechnical engineer prior to backfilling. For design purposes, assume subexcavation to elevation 98.5 m. Granular A should be placed in the excavation and compacted in 300 mm layers up to the base of footing elevation.

A shoring system may be required to protect the integrity of the truncated approach fills and prevent undermining of the foundations of the underpass structure during construction.

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Boreholes put down through the approach fills were for assessment of the fill material only, and not for foundation design purposes. We have reviewed the Foundation Investigation Report for the Huntmar Road Underpass prepared by the MTO Foundation Design Section (Report W.P. 436-64-00). The following bearing capacities are recommended based on information presented in this report.

Foundation Elev. (m)	Factored Bearing Capacity at U.L.S.	Bearing Capacity at S.L.S. Type II
99.3	250 kPa	150 kPa

Bearing capacities of the foundation soils have been calculated assuming a 2 m wide footing. Further reduction to the U.L.S. value will be necessary once the inclination and eccentricity of the loads has been established.

An earth cover of 1.8 m minimum is recommended for frost protection.

Sliding resistance between concrete and the Granular A fill beneath the proposed retaining wall foundation can be calculated in accordance to O.H.B.D.C. Section 6.7.3.3.2 using an unfactored friction coefficient of 0.7, assuming an unfactored angle of friction of 35 degrees.

Recycled Paper

7.0 CLOSURE

The recommendations made in this report are in accordance with our present understanding of the project. A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

We trust the above information meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

We thank you for the opportunity to be of service to you.

Yours very truly,

JACQUES, WHITFORD LIMITED

Fred J. Griffiths, Ph.D., P.Eng.

LICENSED PROFESSIONAL ENGINEER
C. C. K. KWOK
PROVINCE OF ONTARIO

Charles C. K. Kwok, M.Sc., P.Eng.

Recycled Paper

SYMBOLS AND TERMS USED ON THE BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded	-	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded	-	predominantly of one grain size.

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional	less than 10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. silt and sand)	35-50%

The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

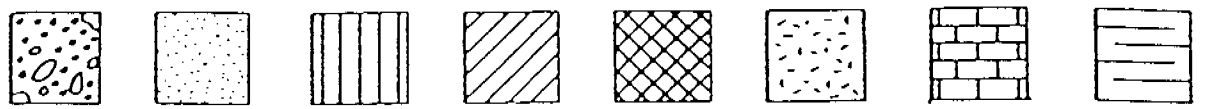
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength kips/sq.ft.	kPa	'N' Value
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

Recycled Paper

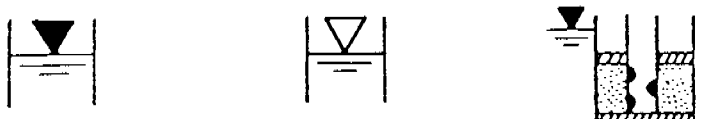
SYMBOLS AND TERMS CONTINUED

STRATA PLOT



Gravel & Boulders | Sand | Silt | Clay | Fill | Igneous Bedrock | Sedimentary Bedrock | Metamorphic Bedrock

WATER LEVEL MEASUREMENT



Borehole or Standpipe | Inferred During Drilling | Piezometer

SAMPLES

SS.... Split spoon sample (obtained by performing the standard penetration test)
ST.... Shelby tube or thin wall tube
PS.... Piston sample
BS.... Bulk sample
WS.... Wash sample
RC.... Rock core
AXT, BXL, etc....
Rock core samples obtained with the use of standard diamond drilling bits.

OTHER TESTS

G..... Specific gravity
H..... Hydrometer analysis
S..... Sieve analysis
γ.... Unit weight
C..... Consolidation
CD.... Consolidated drained triaxial
CU.... Consolidated undrained triaxial with pore pressure measurements
UU.... Unconsolidated undrained triaxial
DS.... Direct shear
P..... Field permeability

ROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are counted as recowery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal insitu fractures.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured.

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BOREHOLE RECORD

I-1

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

PROJECT No. 10285

BOREHOLE No. I-1

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	104.37	Grass covered ground surface						
	104.1	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Compact, light brown, SILTY SAND, some clay						
	103.5							
1		Compact, brown and grey, silt, sand, clay and gravel, occasional cobbles: TILL			SS	1	600	7
	102.8							
2		End of Borehole						
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

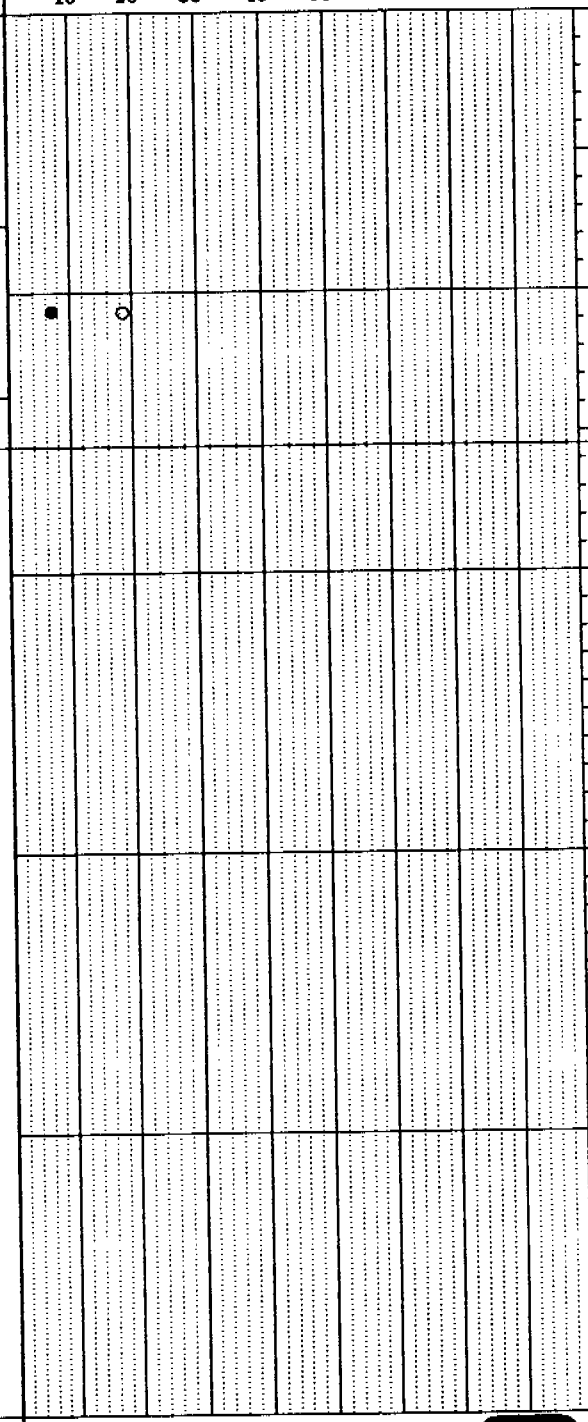
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-2

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. I-2

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	103.28	Grass covered ground surface						
	103.0	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
	102.3	Loose to compact, light brown, SILTY SAND, some clay, trace organics						
1	101.7	Compact, brown, silty sand and gravel, occasional cobbles: TILL			SS	1	250	3
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-3

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-3

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	104.06	Grass covered ground surface						
	103.8	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Loose, light brown, SILTY SAND, trace to some clay, trace gravel Boulder encountered at 600 mm			SS	1	500	1
1	102.5							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

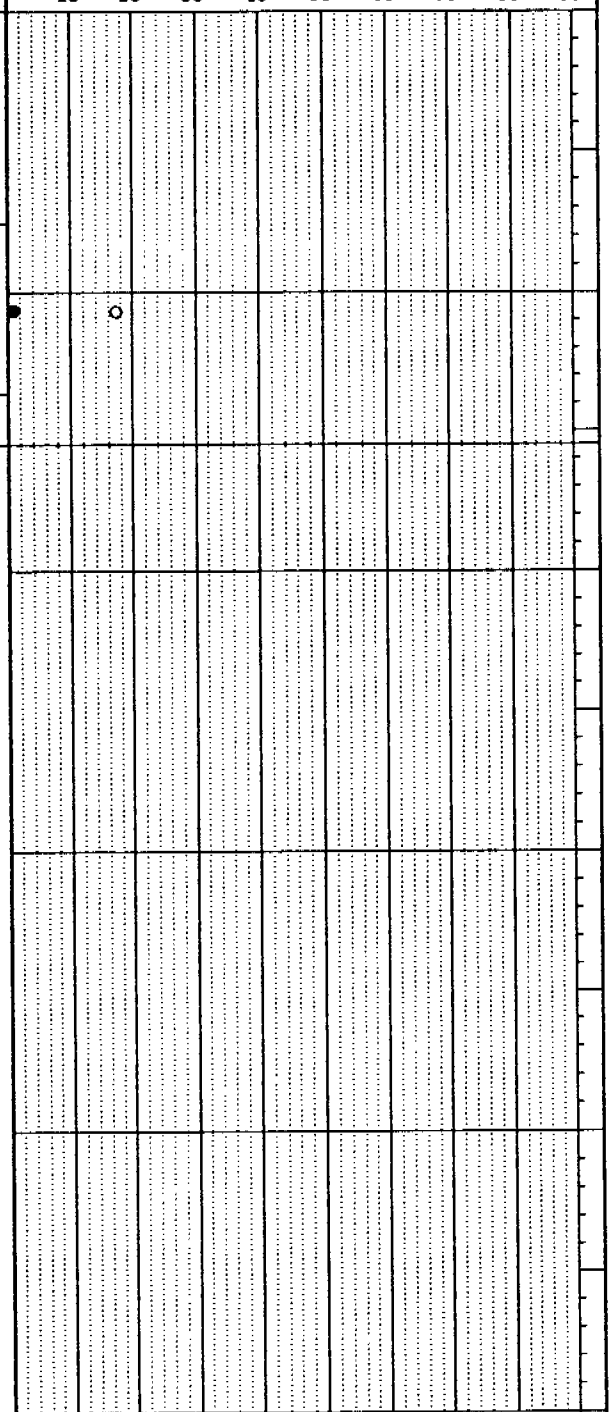
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-4

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. I-4

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	103.57	Grass covered ground surface						
	103.4	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, greyish brown, SILTY CLAY, trace sand						
1					SS	1	250	7
	102.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

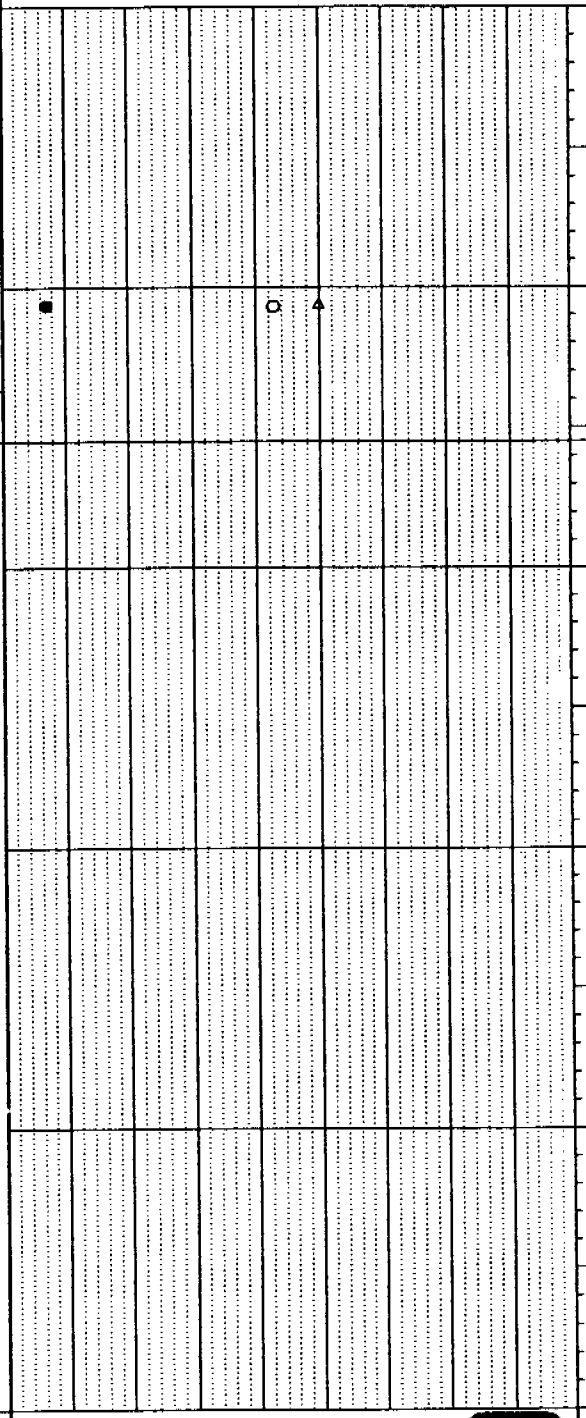
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-5

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-5

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	103.21	Grass covered ground surface						
	103.0	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brownish grey, SILTY CLAY, trace sand			SS	1	200	7
1	101.7							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

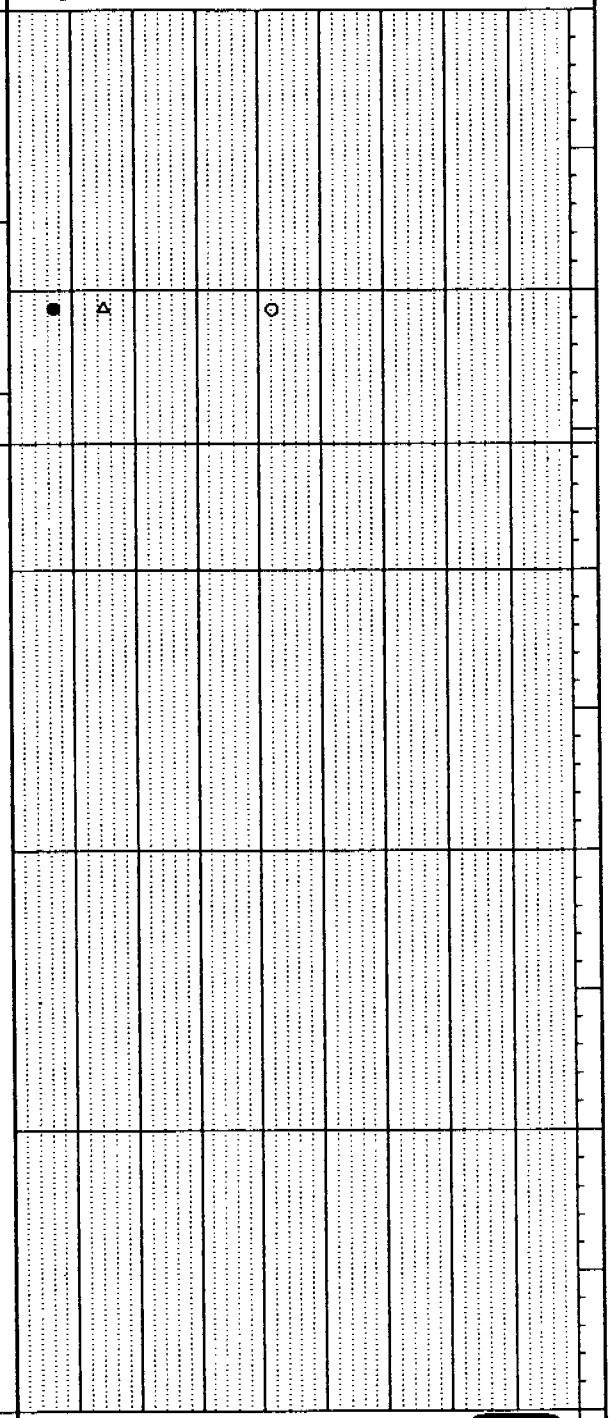
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-6

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-6

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	102.78	Grass covered ground surface						
	102.6	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm to stiff, grey, SILTY CLAY, trace sand						
1					SS	1	600	4
	101.2							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

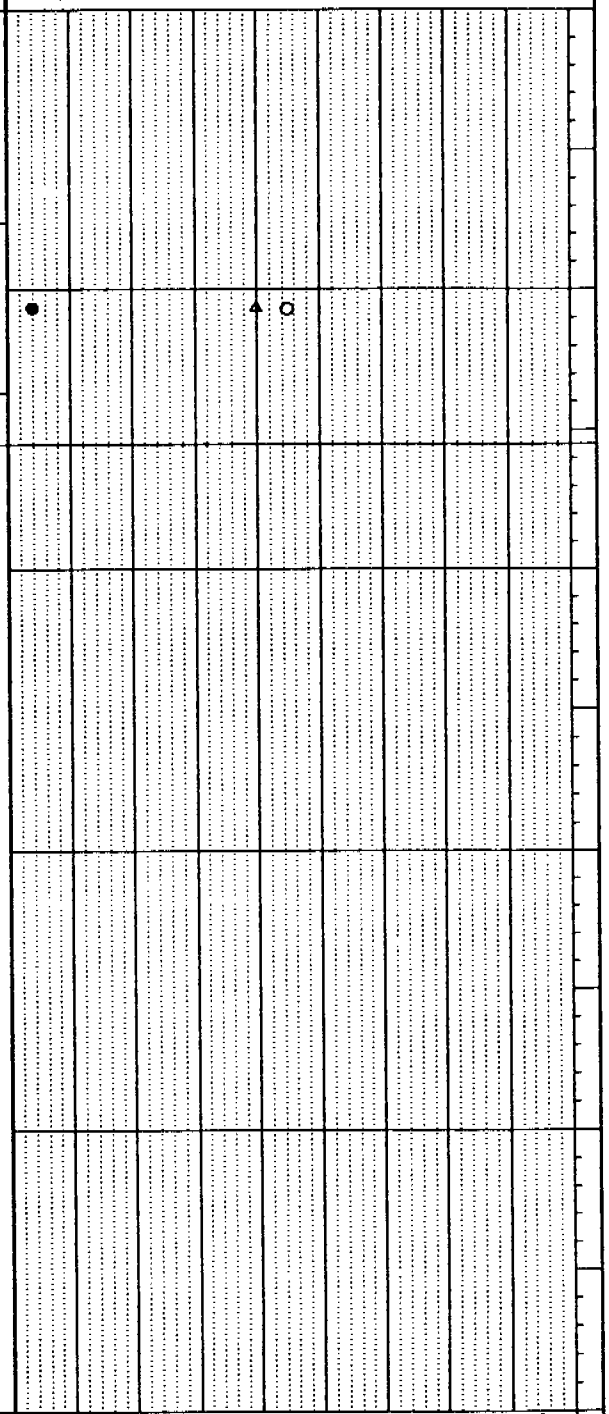
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-7

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-7

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	103.00	Grass covered ground surface						
	102.9	75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Compact, brown, SILTY SAND, trace to some clay, trace organics						
1					SS	1	400	7
	101.3				BS	2	--	--
		Firm, brown, SILTY SAND, trace to some clay		▼				
2	100.9							
	100.6	Compact, grey matrix of silt, sand and gravel, frequent cobbles: TILL						
		Auger refusal on inferred bedrock End of Borehole						
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

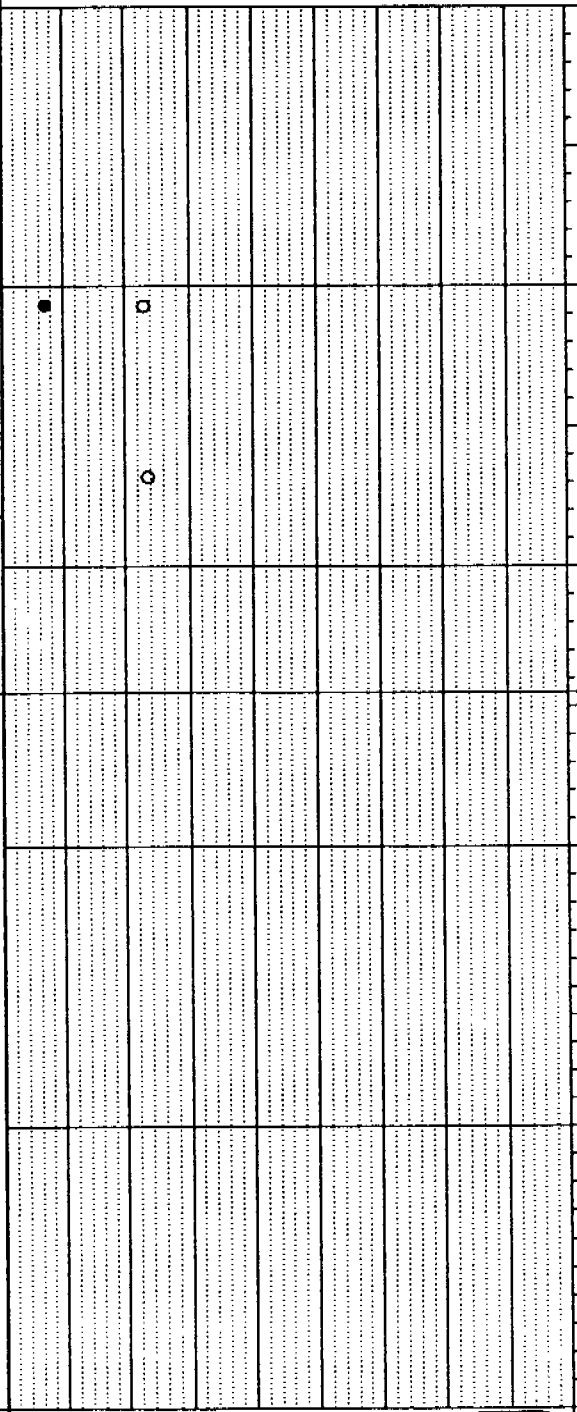
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-8

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-8

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	103.00	Grass covered surface						
	102.9	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Stiff, brownish grey, SILTY CLAY, trace sand			SS	1	400	4
1								
	101.5	End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

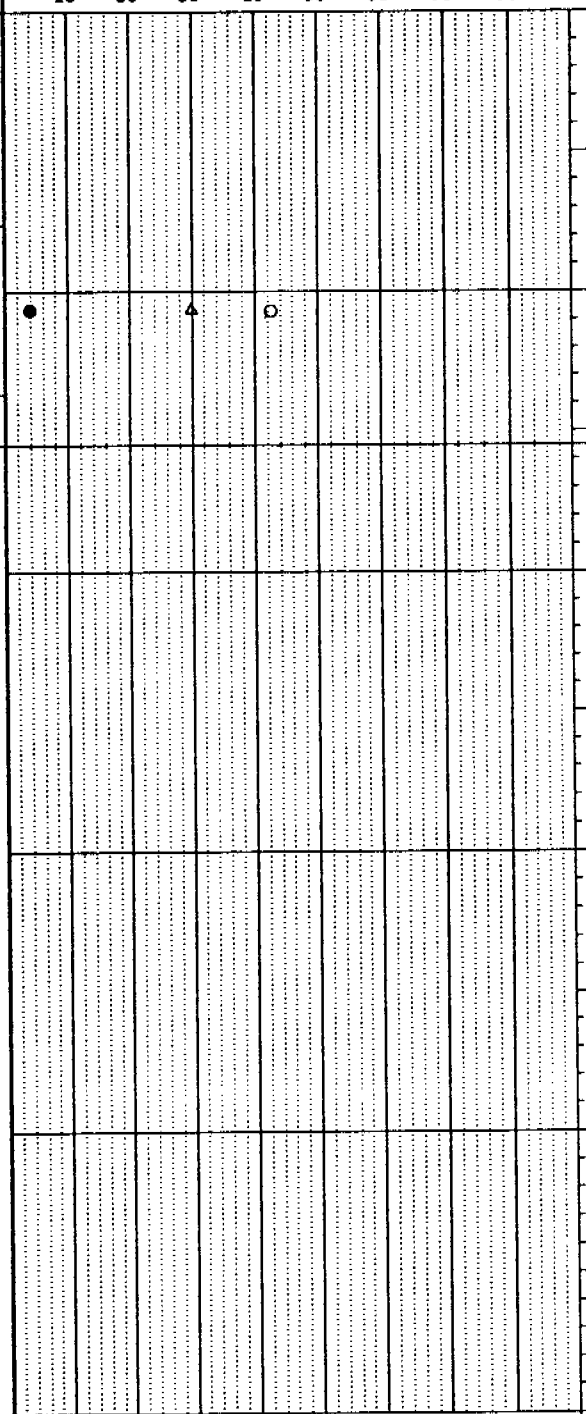
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-9

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-9

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	102.31	Grass covered surface						
	102.2	100 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Stiff, brown, SILTY CLAY, trace sand						
1					SS	1	600	9
2								
3								
4	98.1							
		Loose to dense, grey SILTY SAND, trace clay			SS	2	600	5
5								

UNDRAINED SHEAR STRENGTH - kPa

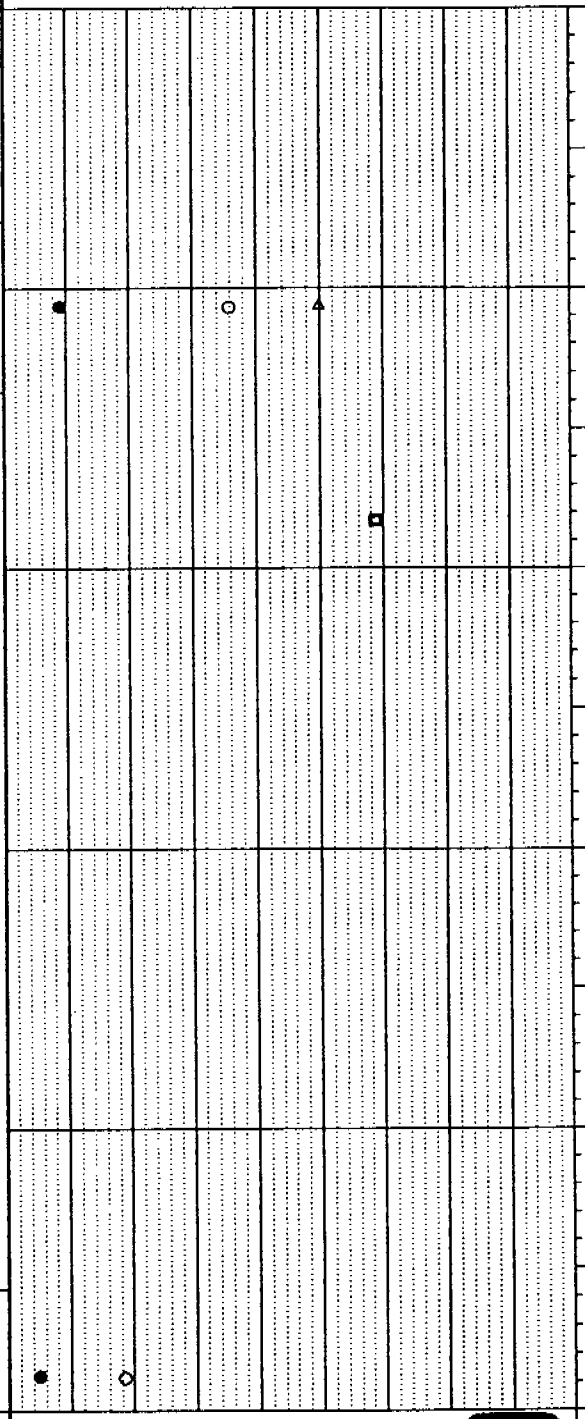
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

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JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-9

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-9

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
5		Loose to dense, grey SILTY SAND, trace clay						
6					BS	3	--	--
	95.6							
7		Dense, grey matrix of silt, sand, gravel, frequent boulders						
	95.0							
		Auger refusal on inferred bedrock End of Borehole						
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa

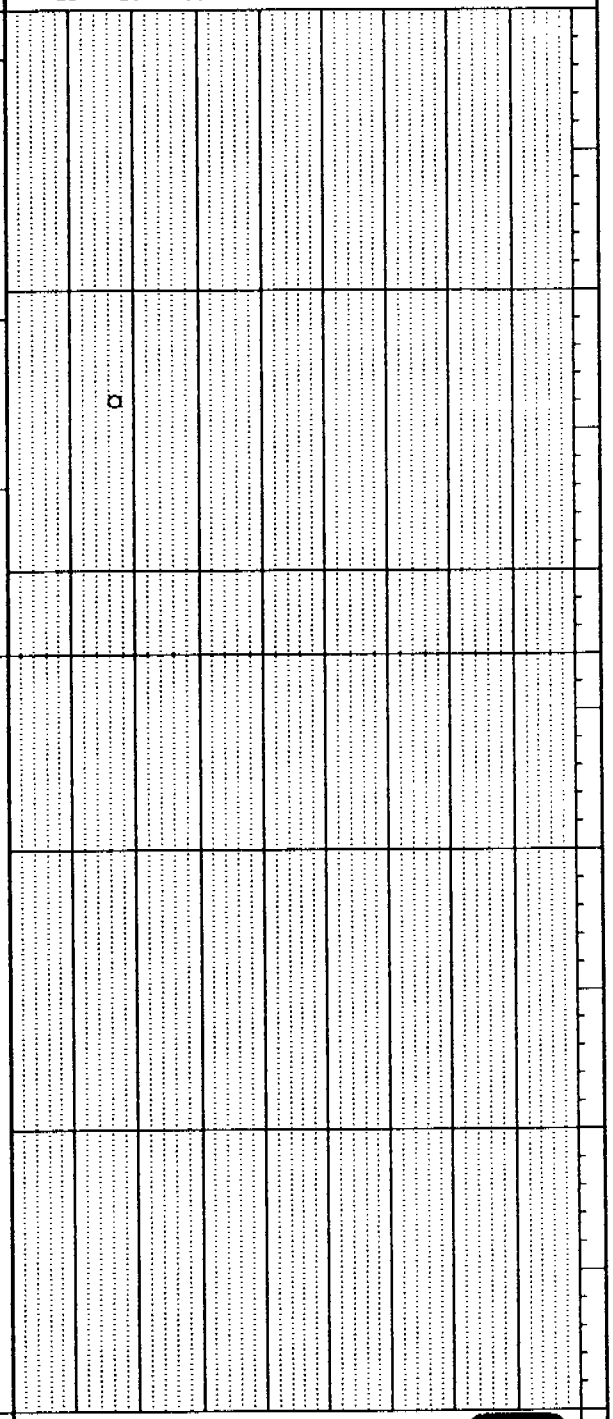
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-10

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-10

DATES: BORING 92-05-06 WATER LEVEL -----

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	102.58	Grass covered ground surface						
	102.4	150 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brown, SILTY CLAY, trace sand						
1					SS	1	600	6
	101.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

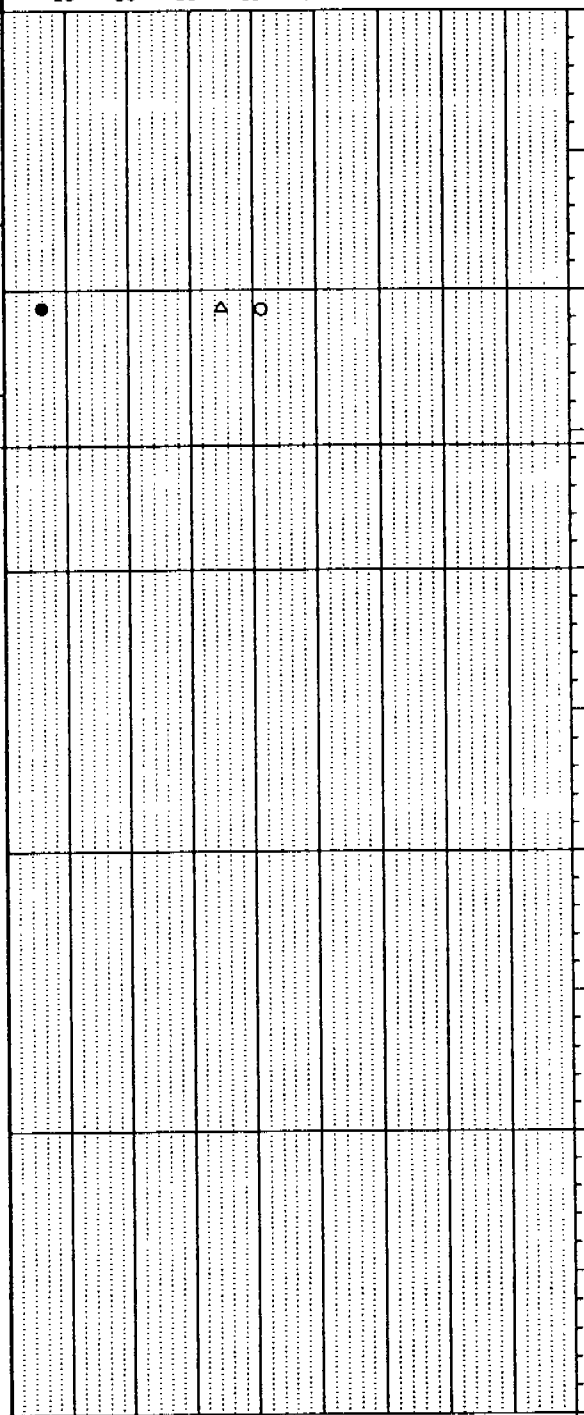
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-11

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

PROJECT No. 10285

BOREHOLE No. I-11

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
	99.35	Grass covered ground surface						
0	99.3	75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
	99.0	Compact, brown SILTY SAND, trace clay						
		Stiff to firm, mottled grey and brown, SILTY CLAY, trace sand						
1					SS	1	400	7
2								
3					SS	2	600	1
4	95.1							
		Loose to dense, grey matrix of sand, silt, clay and gravel, occasional cobbles and boulders: TILL			SS	3	600	3
5								

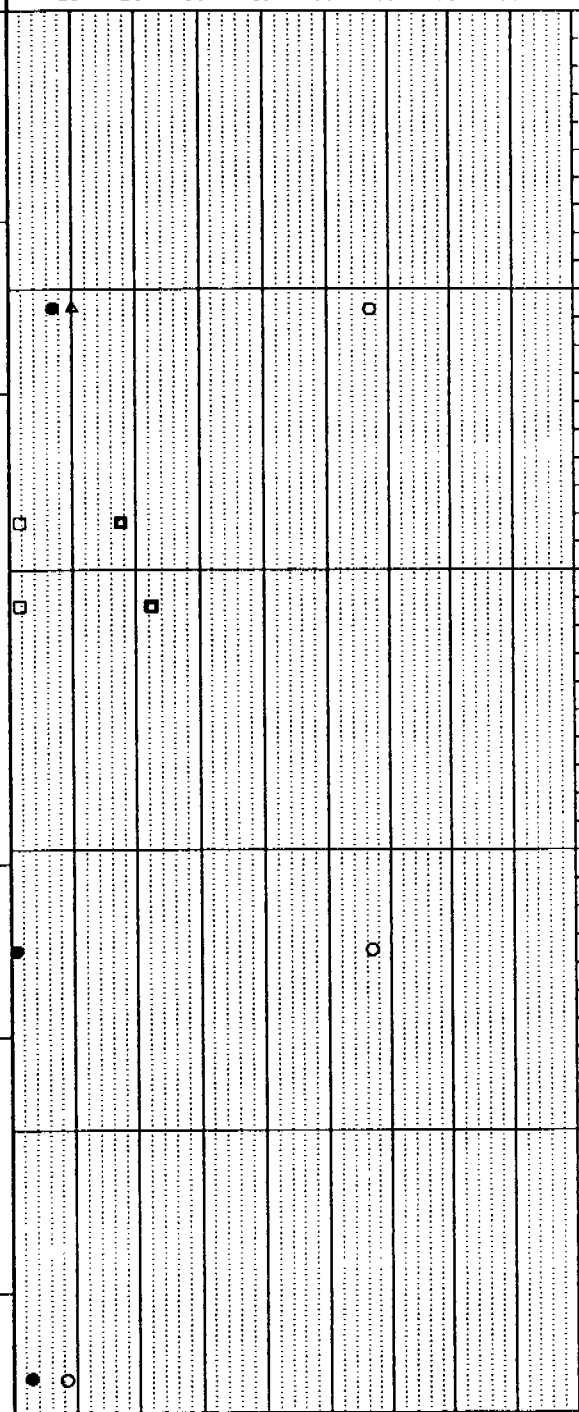
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

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JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-11

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-11

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
5		Loose to dense, grey matrix of sand, silt, clay and gravel, occasional cobbles and boulders: TILL						
6	93.3	End of Borehole						
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

◘ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

I-12

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. I-12

DATES: BORING 92-05-06 WATER LEVEL 92-05-06

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD
0	102.01	Grass covered ground surface						
	101.7	300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Soft, brown, SILTY CLAY, trace sand		▼	SS	1	600	2
1	100.5	End of Borehole						
2								
3								
4								
5								

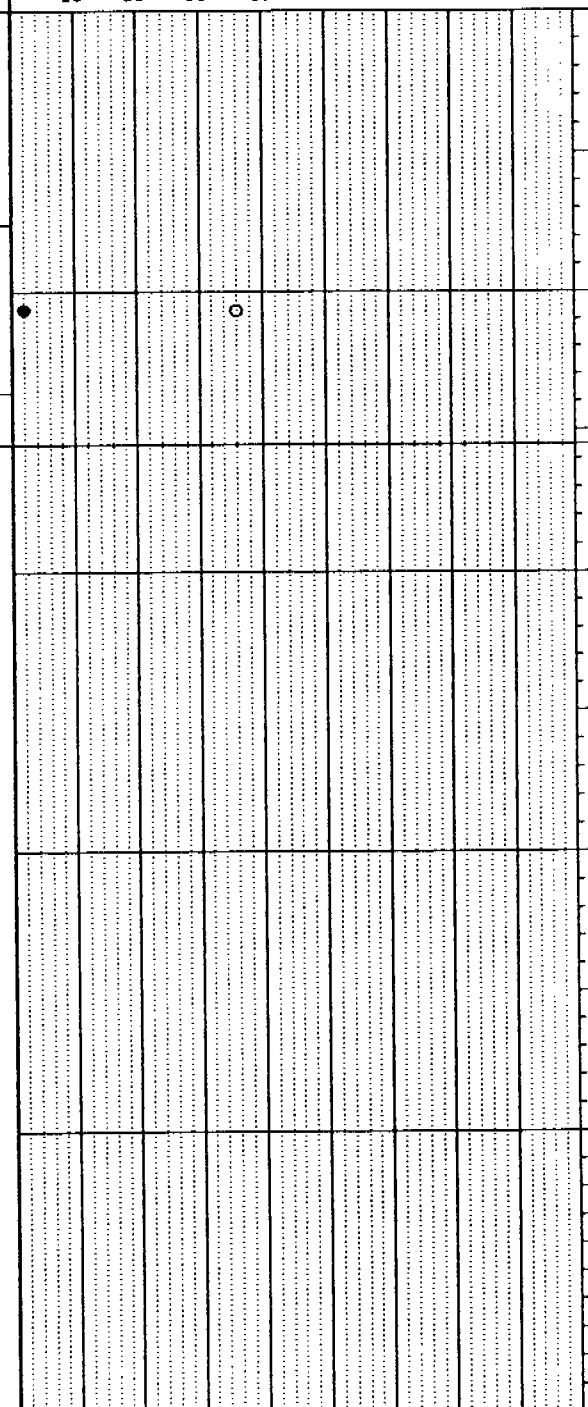
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-1

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-1

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	101.56	Grass covered ground surface						
		300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
	101.3	Firm, mottled, brown and grey, SILTY CLAY, trace sand						
1					SS	1	600	2
	100.0	End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

◘ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-2

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-2

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	102.58	Grass covered ground surface						
	102.4	175 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, mottled brown and grey, SILTY CLAY, trace sand						
1					SS	1	600	5
	101.0	End of Borehole Groundwater not encountered						
2								
3								
4								
5								

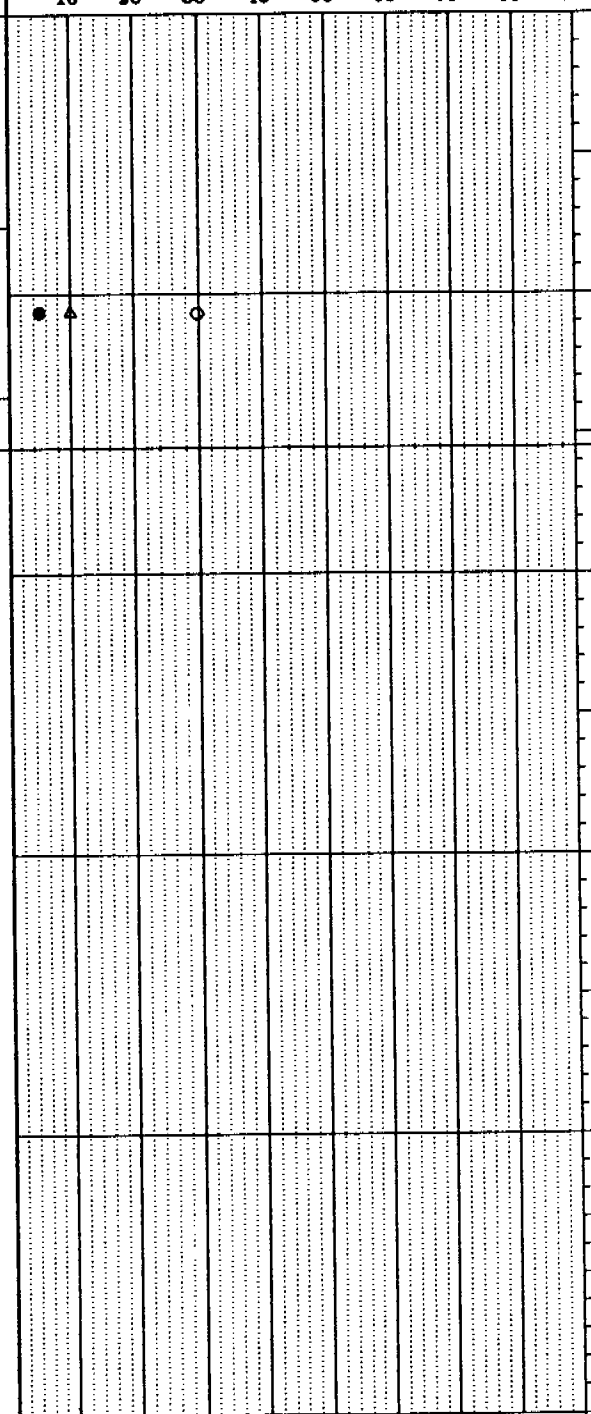
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-3

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. P-3

DATES: BORING 92-05-06

WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	103.50	Grass covered ground surface						
	103.2	300 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, brownish grey, SILTY CLAY, trace sand, trace organics			SS	1	600	5
1	102.0							
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

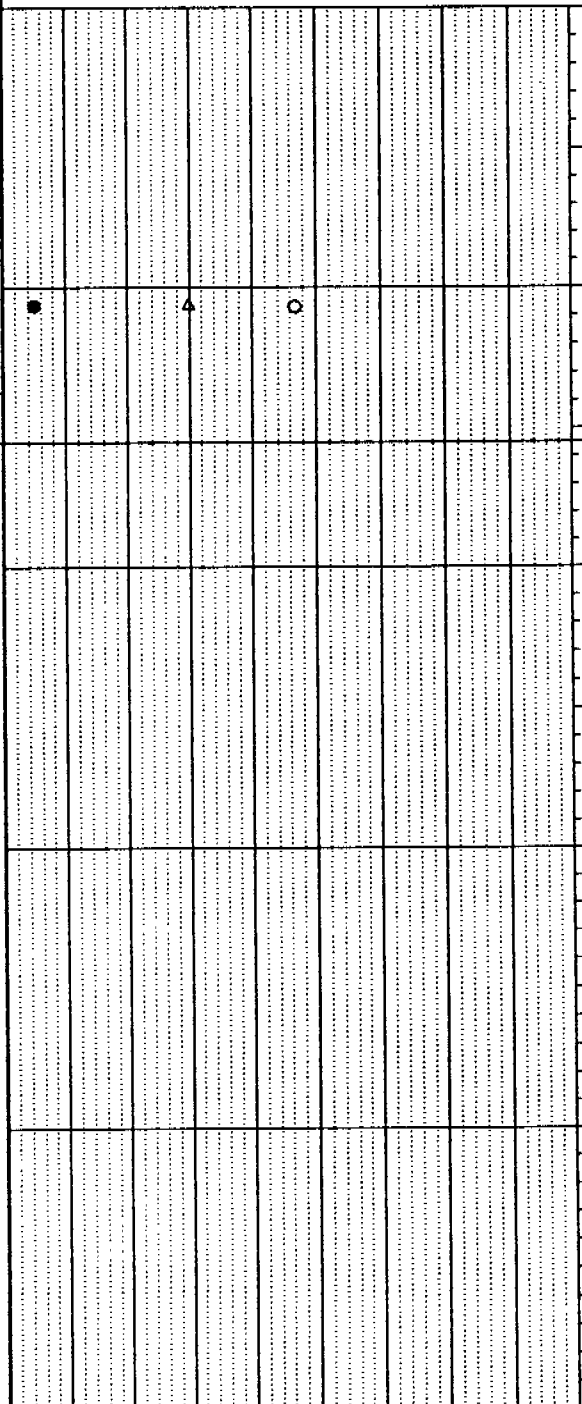
50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-4

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-4

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD
0	102.27	Grass covered ground surface						
	102.0	275 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm to stiff, grey, SILTY CLAY, trace sand			SS	1	600	5
1	100.7	End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

■ Field Vane Test, kPa

□ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-5

CLIENT McCormick Rankin

PROJECT No. 10285

LOCATION Palladium Interchange, Kanata, Ontario

BOREHOLE No. P-5

DATES: BORING 92-05-06 WATER LEVEL ------

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0	100.85	Grass covered ground surface						
	100.6	250 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm, grey, SILTY CLAY, trace sand			SS	1	600	4
	99.3							
		End of Borehole Groundwater not encountered						

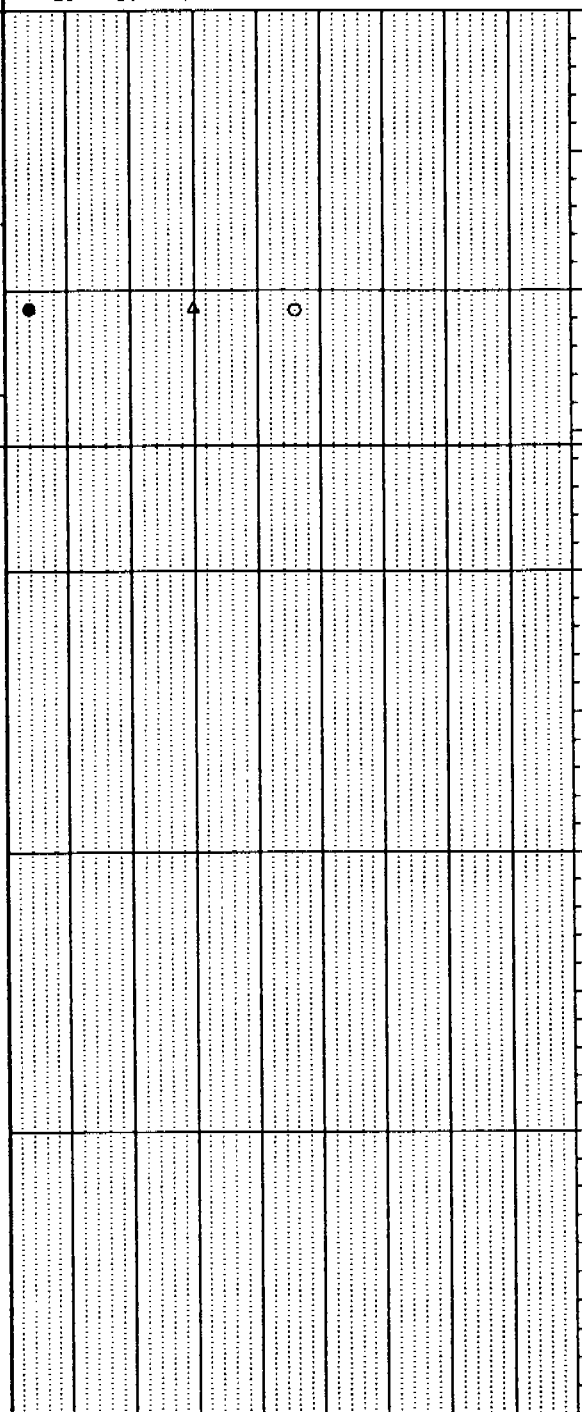
UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90



- ■ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

JACQUES, WHITFORD LIMITED

BOREHOLE RECORD

P-6

CLIENT McCormick Rankin

LOCATION Palladium Interchange, Kanata, Ontario

DATES: BORING 92-05-06 WATER LEVEL ------

PROJECT No. 10285

BOREHOLE No. P-6

DATUM Geodetic

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N-VALUE OR RQD
0		Grass covered ground surface						
		75 mm dark brown, organic, sandy, silty clay: ROOTMAT						
		Firm to stiff, brownish grey, SILTY CLAY, trace sand						
1					SS	1	600	6
		End of Borehole Groundwater not encountered						
2								
3								
4								
5								

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

- ◘ Field Vane Test, kPa
- □ Remoulded Vane Test, kPa
- △ Pocket Penetrometer Test, kPa

AUGER HOLE RECORDS

Notes

1. Auger hole locations are provided on the Drawing No. 10285-1 in Appendix 2.

2. The auger holes were put down using a post hole auger on June 2, 1992.

3. The auger holes were located relative to existing site features. The ground surface elevations were surveyed by McCormick Rankin. It is our understanding that the elevations are referenced to geodetic datum.

4. All measurements are in millimetres and metres (ie. 800 mm, 1.0 m) , measured from ground surface at the auger hole locations.

5. Refer to attached sheets for symbols and terms used to describe the observed conditions.

AUGER HOLE RECORDS (CONTINUED)

I-13 - Elevation of ground surface 102.27 m Geodetic.
- Huntmar Road north abutment, east of concrete slope treatment.

0 -	100	Brown TOPSOIL/ROOTMAT
100 -	2.9	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
2.9 -	3.2	Compact, brown, sand, trace to some gravel: FILL

Groundwater was not encountered.

Borehole stopped at 2.9 m below ground surface because hole caving in as borehole is advanced.

I-14A - Elevation of ground surface 102.34 m Geodetic.
- Huntmar Road north abutment, west of concrete slope treatment.

0 -	125	Brown TOPSOIL/ROOTMAT
125 -	2.6	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
2.6 -	3.7	Compact, brown sand and gravel, trace silt, frequent cobbles and boulders: FILL

Groundwater was not encountered.

Borehole caving.

I-14B - Elevation of ground surface 101.46 m Geodetic.
- Huntmar Road north abutment, west of concrete slope treatment.

0 -	1.8	Compact, brown sand and gravel, trace silt, occasional cobbles: FILL
1.8 -	3.7	Compact, brown sand and gravel, trace silt, frequent cobbles and boulders: FILL

Groundwater was not encountered.

Borehole caving.

AUGER HOLE RECORDS (CONTINUED)

I-15 Section - North of the WBL at Station 9+963.5

I-15A - Elevation of ground surface 101.84 m Geodetic.
- 0.0 m from edge of pavement.

0 - 25	25 mm ASPHALT
25 - 430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 - 900	Compact, brown, sand, trace silt: FILL

I-15B - Elevation of ground surface 101.76 m Geodetic.
- 1.8 m from edge of pavement.

0 - 380	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
380 - 3.1	Compact, brown sand, trace silt: FILL
3.1 - 3.7	Stiff, grey, SILT and CLAY

I-15C - Elevation of ground surface 101.09 m Geodetic.
- 5.6 m from edge of pavement.

0 - 50	TOPSOIL
50 - 250	Compact, brown sand, trace silt: ROOTMAT
250 - 900	Compact, brown sand, trace silt: FILL

I-15D - Elevation of ground surface 100.69 m Geodetic.
- 7.2 m from edge of pavement.

0 - 250	TOPSOIL/ROOTMAT
250 - 750	Firm, brown/grey, mottled, silt and clay, some organics: FILL
750 - 900	Compact, brown sand, trace silt: FILL

I-15E - Elevation of ground surface 99.95 m Geodetic.
- 9.3 m from edge of pavement.

0 - 300	TOPSOIL/ROOTMAT
300 - 1.2	Firm, brown/grey, mottled, silt and clay, some organics: FILL
1.2 - 2.1	Firm, grey, SILT and CLAY

NOTE: - Groundwater was not observed in any of the I-15 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-16 Section - North of the WBL at Station 9+322.3

I-16A - Elevation of ground surface 104.93 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown, sand, some gravel, trace silt: FILL

I-16B - Elevation of ground surface 104.78 m Geodetic.
- 2.4 m from edge of pavement.

0 -	300	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
300 -	1.2	Compact, brown sand, some gravel, trace silt: FILL

I-16C - Elevation of ground surface 104.38 m Geodetic.
- 5.4 m from edge of pavement.

0 -	150	TOPSOIL
150 -	900	Compact, brown sand, some gravel, trace silt: FILL

I-16D - Elevation of ground surface 103.95 m Geodetic.
- 8.2 m from edge of pavement.

0 -	125	TOPSOIL/ROOTMAT
125 -	600	Firm, brown SILTY CLAY

I-16E - Elevation of ground surface 103.83 m Geodetic.
- 10.4 m from edge of pavement.

0 -	150	TOPSOIL/ROOTMAT
150 -	1.5	Firm, brown, SILTY and CLAY
1.5 -	2.1	Compact, brown, SILTY SAND (moist)
2.1 -	2.5	Compact, brown, silty sand, trace to some gravel: TILL
2.5 -	3.1	Compact, grey, silty sand, some gravel, occasional cobbles and boulders: TILL

NOTE: - Groundwater was not observed in any of the I-16 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-17 Section - North of the WBL at Station 8+826.7

I-17A - Elevation of ground surface 106.81 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown, sand, some gravel, trace silt: FILL

I-17B - Elevation of ground surface 106.60 m Geodetic.
- 2.7 m from edge of pavement.

0 -	300	Dense, brown sand and gravel: BASE and SUBBASE
300 -	1.2	Compact, brown sand, some gravel, trace silt: FILL

I-17C - Elevation of ground surface 106.19 m Geodetic.
- 5.5 m from edge of pavement.

0 -	430	Silty clay: TOPSOIL/ROOTMAT
430 -	1.5	Compact, brown sand, some gravel, trace silt: FILL

I-17D - Elevation of ground surface 105.79 m Geodetic.
- 8.5 m from edge of pavement.

0 -	600	TOPSOIL/ROOTMAT
600 -	900	Compact, brown SILTY SAND

I-17E - Elevation of ground surface 105.49 m Geodetic.
- 10.3 m from edge of pavement.

0 -	480	TOPSOIL/ROOTMAT
150 -	1.1	Compact, brown, SILTY SAND
1.1 -	1.7	Compact, grey, gravelly silty sand: TILL (saturated)
1.7 -	3.1	Compact, grey, gravelly silty sand, frequent cobbles and boulders: TILL (saturated)

NOTE: - Groundwater was not observed in any of the I-17 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-18 Section - South of the EBL at Station 8+730.0

I-18A - Elevation of ground surface 107.49 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	520	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
520 -	1.2	Compact, brown, sand, trace silt and gravel: FILL

I-18B - Elevation of ground surface 107.29 m Geodetic.
- 2.9 m from edge of pavement.

0 -	75	Dense, grey sand and gravel, trace silt: BASE and SUBBASE
75 -	430	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
430 -	1.2	Compact, brown sand, trace silt and gravel: FILL

I-18C - Elevation of ground surface 106.79 m Geodetic.
- 5.7 m from edge of pavement.

0 -	200	Brown sand, trace silt: ROOTMAT
200 -	1.2	PEAT
1.2 -	1.5	Compact, brown, sand, trace silt: FILL (saturated)

I-18D - Elevation of ground surface 106.52 m Geodetic.
- 8.4 m from edge of pavement.

0 -	230	TOPSOIL/ROOTMAT
230 -	600	Loose, brown/black silty sand, some peat layers: FILL
600 -	1.2	Compact, brown, SILTY SAND

I-18E - Elevation of ground surface 106.24 m Geodetic.
- 10.2 m from edge of pavement.

0 -	900	PEAT
900 -	2.0	Compact, brown SILTY SAND
2.0 -	3.1	Compact, grey, silty sand, some gravel, occcasional cobbles and boulders: TILL (saturated)

NOTE: - Groundwater was not observed in any of the I-18 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-19 Section - South of the EBL at Station 9+435.1

I-19A - Elevation of ground surface 104.58 m Geodetic.
- 0.0 m from edge of pavement.

0 -	25	25 mm ASPHALT
25 -	550	Very dense, grey to brown, sand and gravel, trace silt: BASE and SUBBASE
550 -	1.2	Compact, brown, sand, trace silt: FILL

I-19B - Elevation of ground surface 104.48 m Geodetic.
- 2.4 m from edge of pavement.

0 -	430	Dense, brown to grey sand and gravel, trace silt: BASE and SUBBASE
430 -	1.5	Compact, brown sand, some gravel, trace silt: FILL

I-19C - Elevation of ground surface 104.10 m Geodetic.
- 5.4 m from edge of pavement.

0 -	225	TOPSOIL/ROOTMAT
225 -	900	Compact, brown sand, some gravel, trace silt: FILL

I-19D - Elevation of ground surface 103.58 m Geodetic.
- 7.6 m from edge of pavement.

0 -	75	TOPSOIL
75 -	600	Loose, brown sand, trace silt: FILL
600 -	1.2	Grey, silt and clay, trace sand: FILL

I-19E - Elevation of ground surface 103.25 m Geodetic.
- 9.4 m from edge of pavement.

0 -	150	TOPSOIL
150 -	2.8	Firm to Stiff, brown, SILTY CLAY

NOTE: - Groundwater was not observed in any of the I-19 Boreholes.

AUGER HOLE RECORDS (CONTINUED)

I-20 - Elevation of ground surface 101.90 m Geodetic.
- Huntmar Road south abutment, 1.2 m west of concrete slope treatment.

0 -	600	Compact, brown sand and gravel, trace silt: FILL
600 -	1.4	Compact, brown sand, some gravel, trace silt: FILL
1.4 -	2.5	Compact, brown, sand, trace silt and gravel, frequent boulders: FILL

Groundwater was not encountered.

Borehole stopped at 2.5 m below ground surface because difficulty to obtain sample when going through boulders.

I-21 - Elevation of ground surface 101.92 m Geodetic.
- Huntmar Road south abutment, 1.0 m east of concrete slope treatment.

0 -	150	Brown TOPSOIL
150 -	1.2	Compact, brown sand and gravel, trace silt: FILL
1.2 -	1.8	Compact, brown sand and gravel, trace silt, occasional cobbles and boulders: FILL
1.8 -	2.8	Compact, brown sand, trace silt and gravel: FILL
2.8 -	3.7	Firm, SILTY CLAY intermixed with roots and topsoil

Groundwater was not encountered.

AUGER HOLE RECORDS (CONTINUED)

I-22 Section - South of the EBL at Station 10+125

I-22A - Elevation of ground surface 100.81 m Geodetic.
- 0.0 m from edge of pavement.

0 -	50	50 mm ASPHALT
50 -	430	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
430 -	1.5	Compact, brown, sand, trace silt: FILL

I-22B - Elevation of ground surface 100.57 m Geodetic.
- 2.8 m from edge of pavement.

0 -	280	Dense, brown sand and gravel, trace silt: BASE and SUBBASE
280 -	1.2	Compact, brown sand, trace silt: FILL

I-22C - Elevation of ground surface 100.10 m Geodetic.
- 5.7 m from edge of pavement.

0 -	300	TOPSOIL
300 -	1.2	Compact, brown sand, trace silt: FILL

I-22D - Elevation of ground surface 99.62 m Geodetic.
- 8.6 m from edge of pavement.

0 -	460	TOPSOIL/ROOTMAT
460 -	900	Firm, brown/grey, mottled, SILT and CLAY

I-22E - Elevation of ground surface 99.38 m Geodetic.
- 10.5 m from edge of pavement.

0 -	150	TOPSOIL/ROOTMAT
150 -	2.5	Firm, brown/grey, mottled, SILT and CLAY

NOTE: - Groundwater was not observed in any of the I-15 Boreholes.

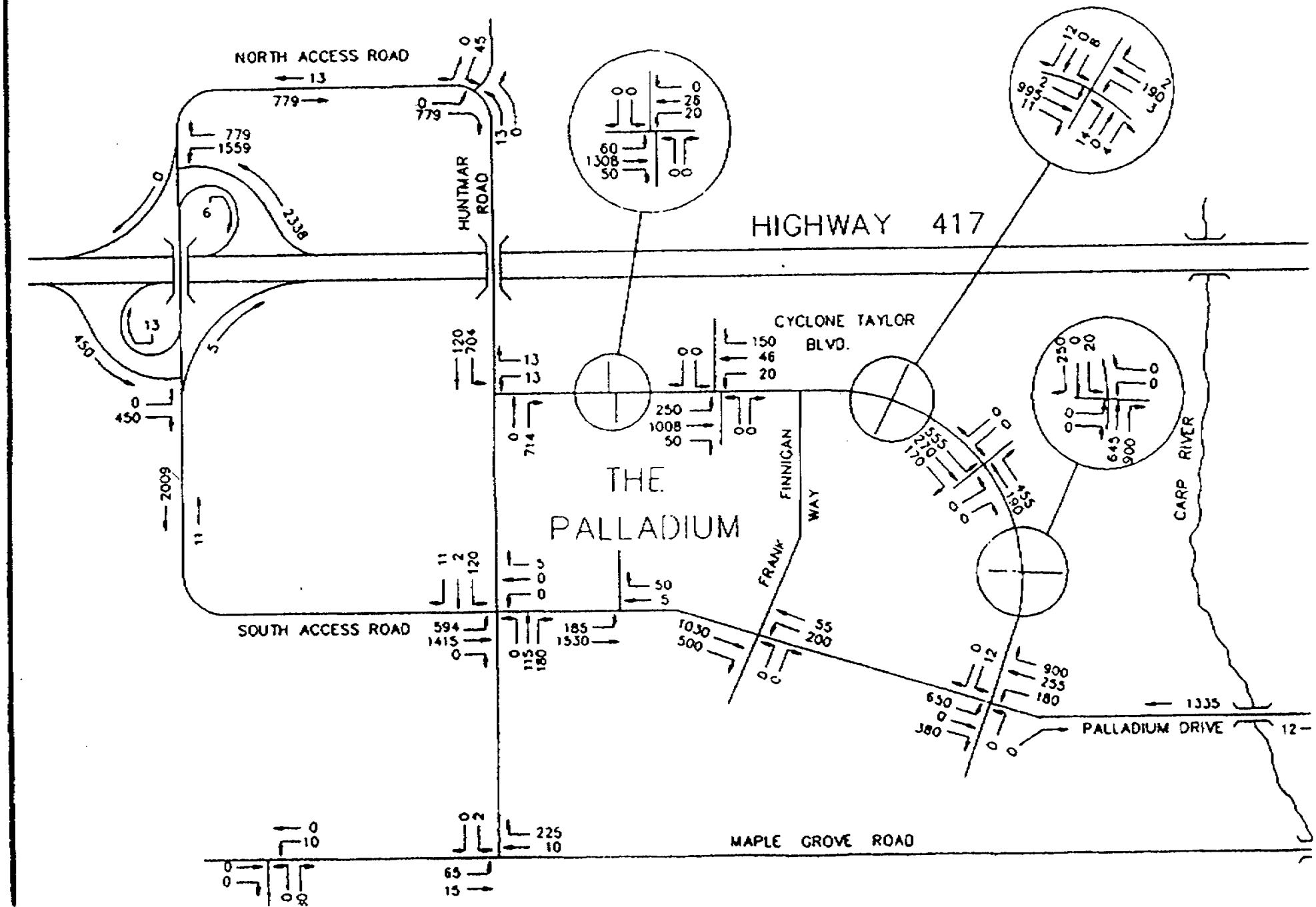
AUGER HOLE RECORDS (CONTINUED)

I-23 -Near Borehole P-6, at about Station 21+212.
-0.0 m west from west edge of pavement.

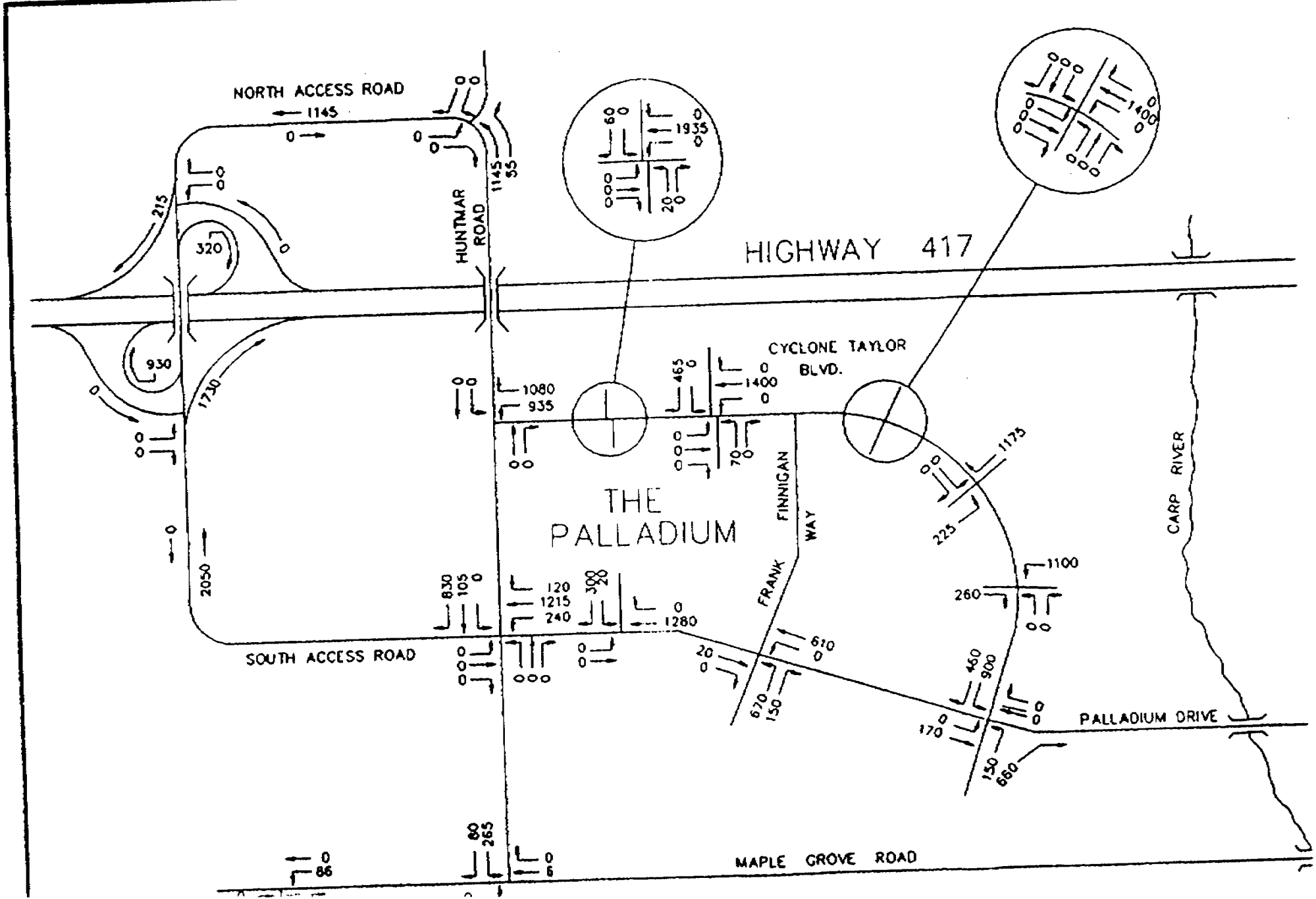
0 - 40	40 mm ASPHALT
40 - 480	Very dense, brown, sand and gravel, trace silt: BASE and SUBBASE
480 - 500	Stiff, brown, SILTY CLAY

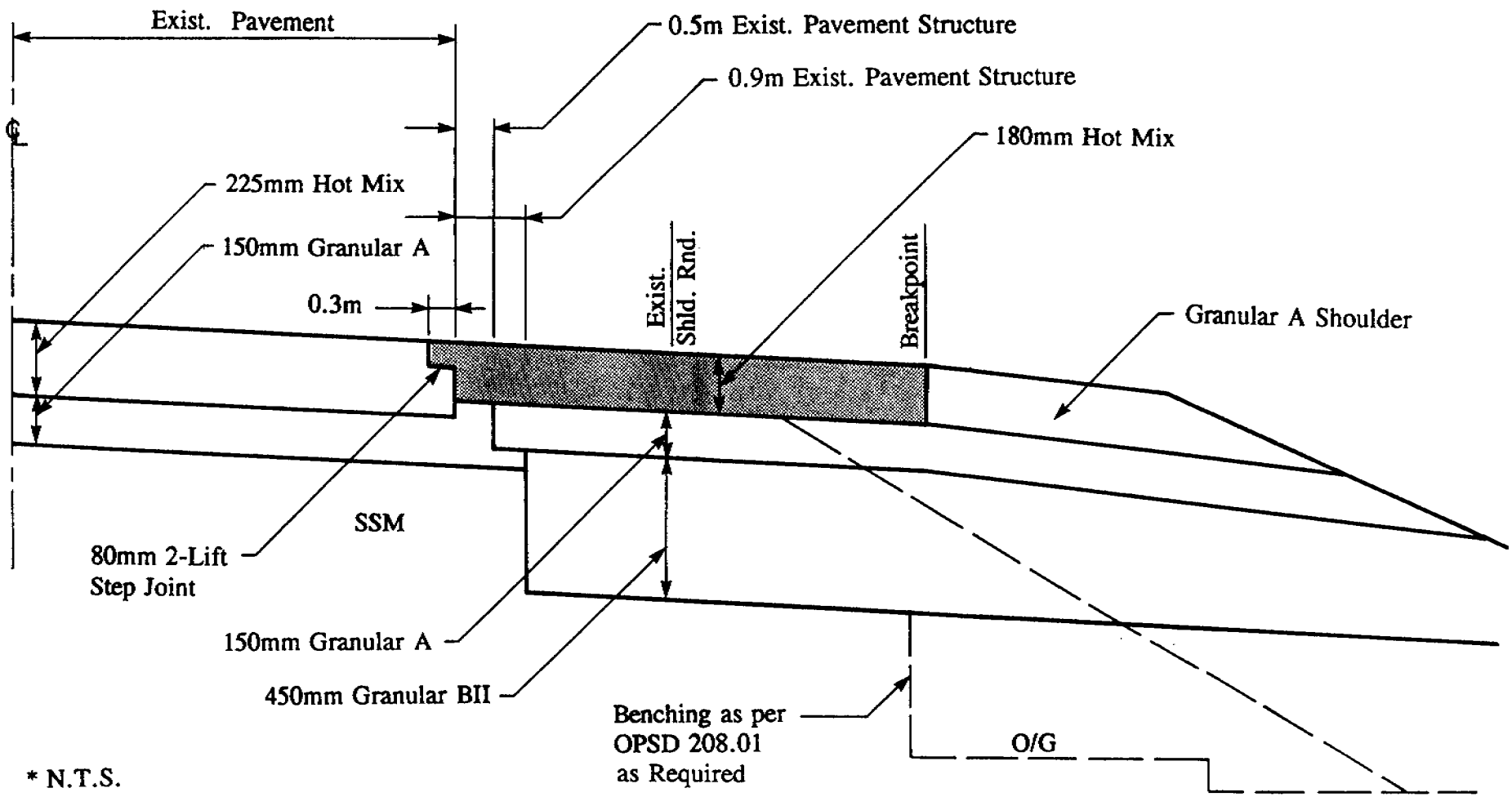
NOTE: - No groundwater observed.

1996 18:30 - 19:30 SATURDAY COMPOSITE TRAFFIC VOLUMES



1996 22:00 TO 23:00 SATURDAY

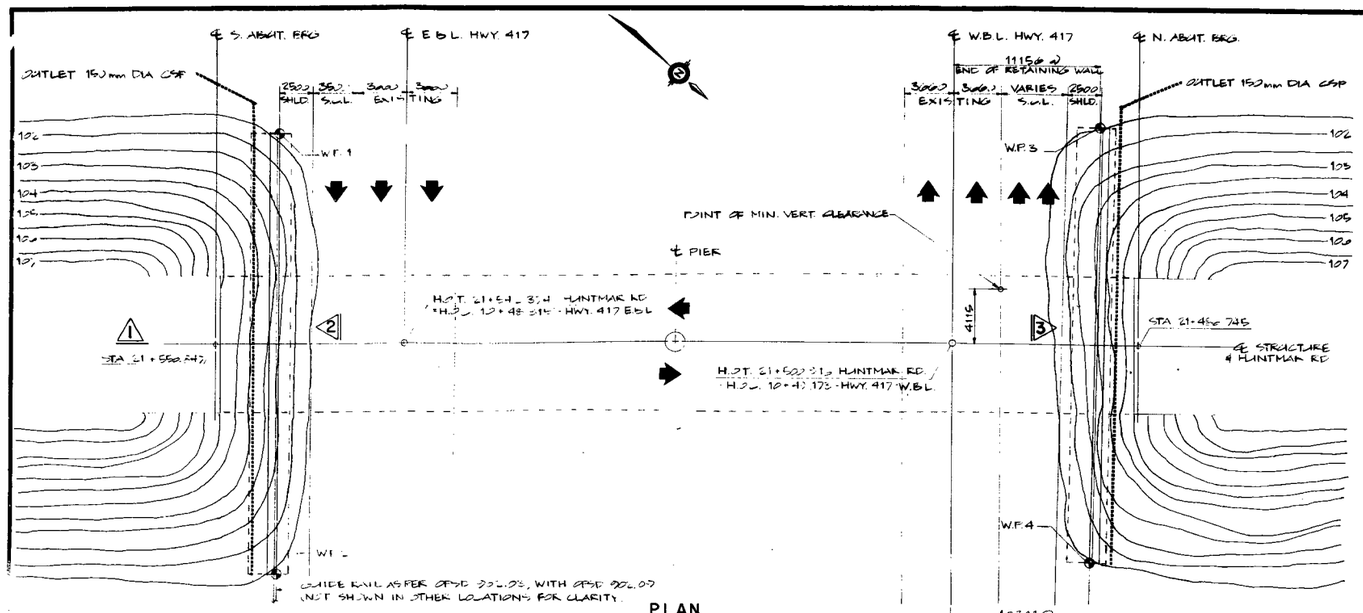




HIGHWAY 417 WIDENING

DRAWING No. 10285-2

STRUCTURAL SET



PLAN
(BRIDGE DECK NOT SHOWN)
1:200

W.P.	COORDINATES	
W.P.	NORTHING	EASTING
1	N5017409.167	E 343392.6[illegible]
2	N5017431.213	E 343417.345
3	N5017454.873	E 343[illegible]50.313
4	N5017476.323	E 343[illegible]76.9.5

GENERAL NOTES:

CLASS OF CONCRETE

UNLESS OTHERWISE NOTED ..... 30 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTINGS ..... 100 ± 25

REMAINDER - UNLESS OTHERWISE SPECIFIED ..... 70 ± 20

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX C DENOTE COATED BARS.

DESIGN STANDARDS

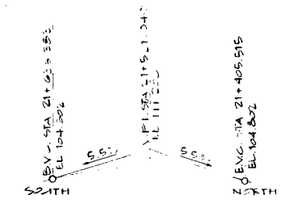
CODE: ONTARIO HIGHWAY BRIDGE DESIGN CODE (OHBDC) 3RD EDITION.

CONSTRUCTION NOTES:

1. ALL MATERIALS SHALL BE SUPPLIED IN ACCORDANCE WITH THE M.T.O. DESIGNATED SOURCES LIST.
2. RETAINING WALLS TO BE FOUNDED ON UNDISTURBED DESICCATED CLAY OR ON COMPACTED GRANULAR 'A' ON UNDISTURBED DESSICATED CLAY.
3. GRANULAR BACKFILL BEHIND RETAINING WALLS NOT TO PROCEED ABOVE ELEVATION 102.0 UNTIL ROADWAY AND SHOULDER SUBGRADE HAS BEEN PLACED AND COMPACTED.

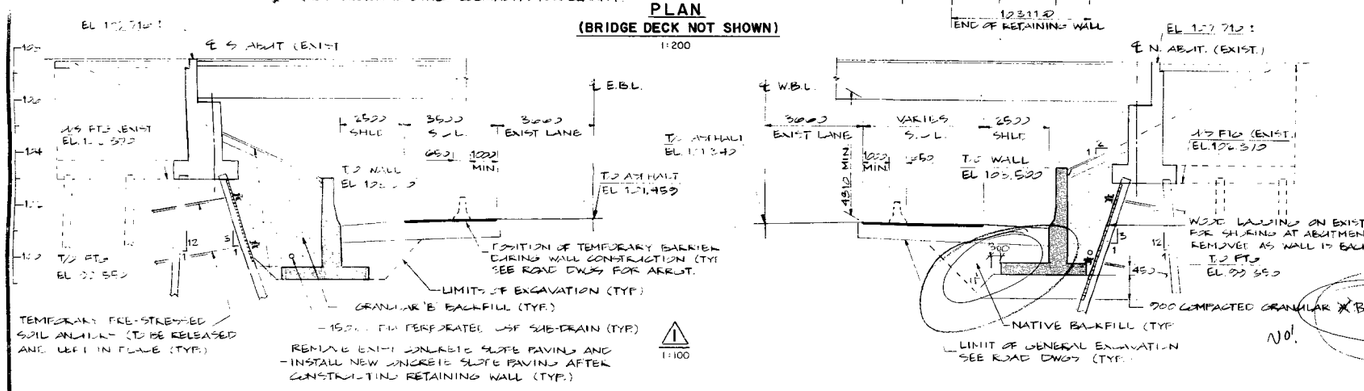
LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATIONS AND SOIL STRATA
3. SHORING ARRANGEMENT AND DETAILS
4. RETAINING WALLS LAYOUT AND REINFORCING
5. CONCRETE SLOPE PAVING



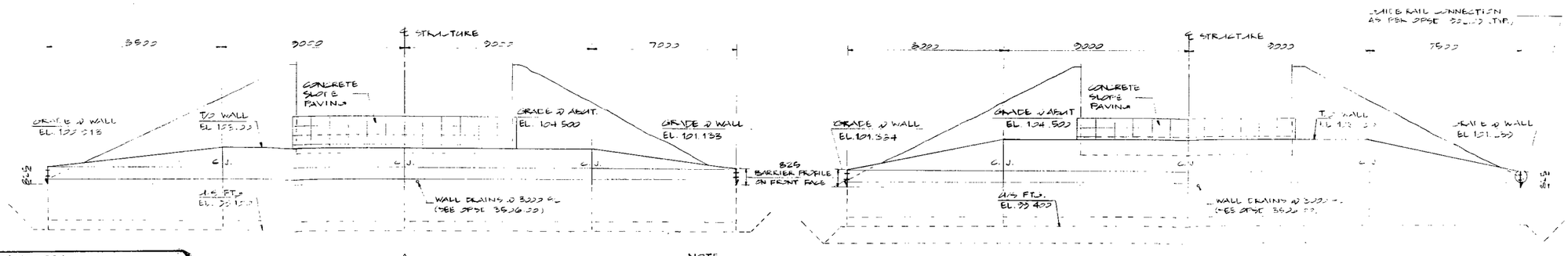
PROFILE OF HUNTMAR RD.
N.T.S.

7/4 94



PROFILE OF HWY. 417 E.B.L.
N.T.S.

PROFILE OF HWY. 417 W.B.L.
N.T.S.



BM 100.724
CUT 'X' ON S.E. FACE OF CONCRETE BRIDGE PIER
20.70 LEFT @ 1+249 ℄ E.B.L. HWY. 417

SOUTH RETAINING WALL
1:100

NOTE
FOR CONTINUATION AND EXTENT OF GUIDE RAIL SEE ROAD DWGS

NORTH RETAINING WALL
1:100

REGISTERED PROFESSIONAL ENGINEER R. S. STOFKO PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER A. S. WING PROVINCE OF ONTARIO

PALLADIUM

NO	DESCRIPTION	DATE	INITIAL
	REVISIONS		

McCORMICK RANKIN
CONSULTING ENGINEERS

SCALE	AS NOTED
DATE	MARCH 1994
DWG.	GSN.
CKD.	ASW.
FLD. BK.	PAGE
SURVEY	APRIL 1993

PALLADIUM DRIVE INTERCHANGE

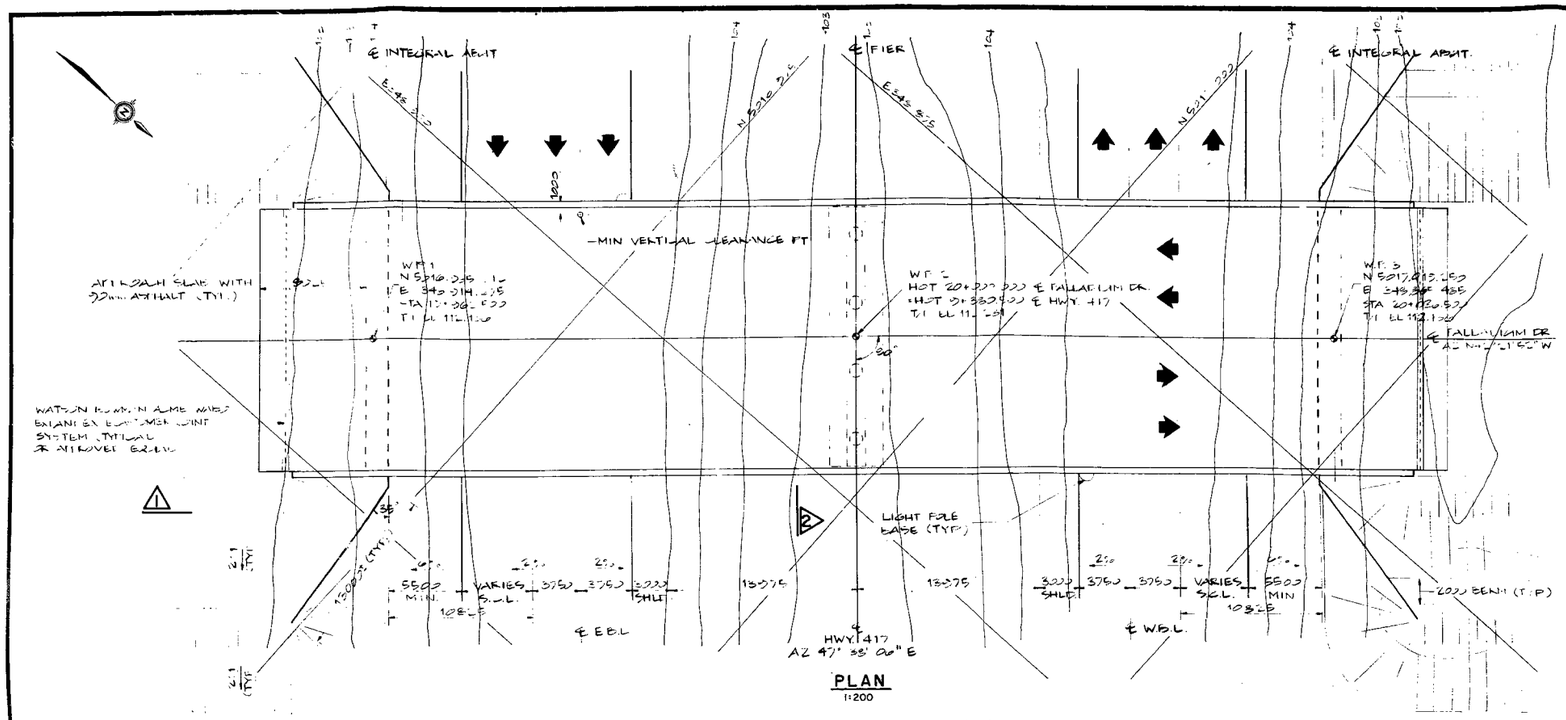
HUNTMAR ROAD UNDERPASS RETAINING WALLS

GENERAL ARRANGEMENT

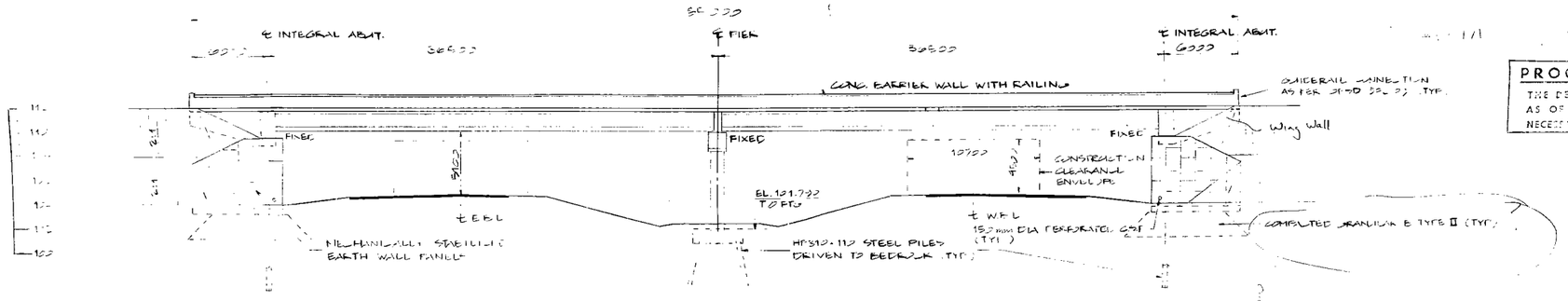
WP-90-43917
CONTRACT NO.

DRAWING NO.
S1

STRUCTURAL SET



PLAN
1:200



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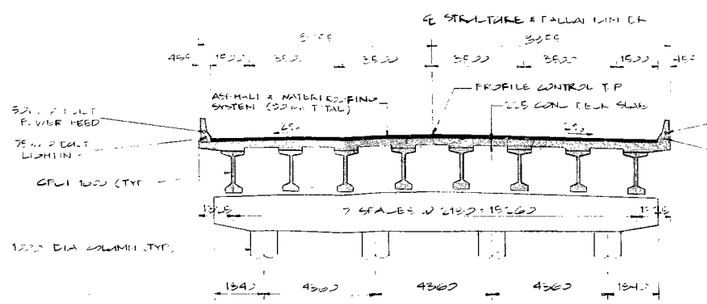

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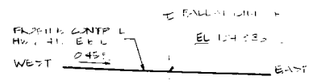
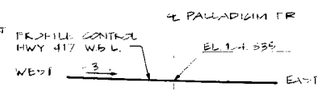
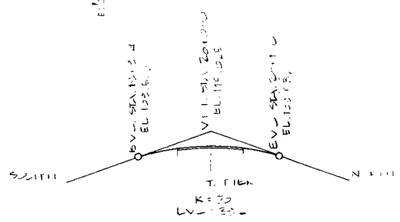


PROFILE OF HWY. 417 E.B.L.
N.T.S.



PROFILE OF HWY. 417 W.B.L.
N.T.S.



PROFILE OF PALLADIUM DR.
N.T.S.

GENERAL NOTES:

CLASS OF CONCRETE

UNLESS OTHERWISE NOTED ..... 30 MPa

CLEAR COVER TO REINFORCING STEEL

FOOTINGS	100 ± 25
DECK TOP	70 ± 20
BOTTOM	40 ± 10
REMAINDER - UNLESS OTHERWISE SPECIFIED	70 ± 20

REINFORCING STEEL

REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX C DENOTE COATED BARS.

DESIGN STANDARDS

CODE: ONTARIO HIGHWAY BRIDGE DESIGN CODE (OHBDC) 3RD EDITION.
LOAD: OHBD LOAD.

CONSTRUCTION NOTES:

ALL MATERIALS SHALL BE SUPPLIED IN ACCORDANCE WITH THE M.T.O. DESIGNATED SOURCES LIST.

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BOREHOLE LOCATIONS AND SOIL STRATA
3. FOOTING LAYOUT AND REINFORCING
4. INTEGRAL ABUTMENT LAYOUT AND REINFORCING
5. WINGWALLS LAYOUT AND REINFORCING
6. PIER DETAILS AND BEARING DATA
7. PRESTRESSED GIRDERS
8. DECK LAYOUT, SCREED ELEVATIONS AND REINFORCING
9. BARRIER WALLS
10. APPROACH SLABS
11. RAILINGS FOR BARRIER WALLS
12. PLASTIC FIGURES
13. STANDARD DETAILS I
14. STANDARD DETAILS II
15. ELECTRICAL EMBEDDED WORK
16. QUANTITIES - STRUCTURE I
17. QUANTITIES - STRUCTURE II
18. RECO MECHANICALLY STABILIZED EARTH PLAN AND DETAILS
19. RECO MECHANICALLY STABILIZED EARTH FRONT FACE ELEVATIONS
20. RECO MECHANICALLY STABILIZED EARTH TYPICAL DETAILS
21. THE NEEL CO. MECHANICALLY STABILIZED EARTH PLAN, ELEV. & SECTION
22. THE NEEL CO. MECHANICALLY STABILIZED EARTH TYPICAL DETAILS

PROGRESS PRINTS ONLY
THIS DESIGN SHEET IS CURRENT AS OF 7/4 94 AND IS NOT NECESSARILY THE CONSTRUCTION.

REGISTERED PROFESSIONAL ENGINEER R. S. STOFKO PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER A. S. WING PROVINCE OF ONTARIO

BM 100 /-/
CUT 'X' ON S.E. FACE OF CONCRETE BRIDGE PIER 20.70 LEFT 12.243 ℄ E.B.L. HWY. 417

PALLADIUM

NO.	DESCRIPTION	DATE	INITIAL
	REVISIONS		

McCORMICK RANKIN
CONSULTING ENGINEERS

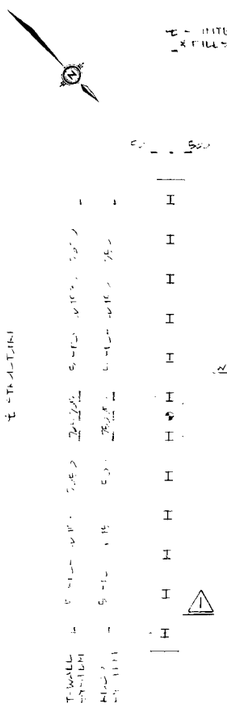
SCALE	AS NOTED	CONC. 1, LOTS 263 TWP. W. GLOUCESTER	
DATE	JAN 1994	REGIONAL MUNI. OF OTTAWA-CARLETON	
DWG.	C. NORELL	DIST. 3-OTTAWA EAST REGION	
CKD.	A.S. WING	PROJECT	PALLADIUM DR. INTERCHANGE
SITE	3-630		
SURVEY	APRIL 1992		W.P. 3/6-94

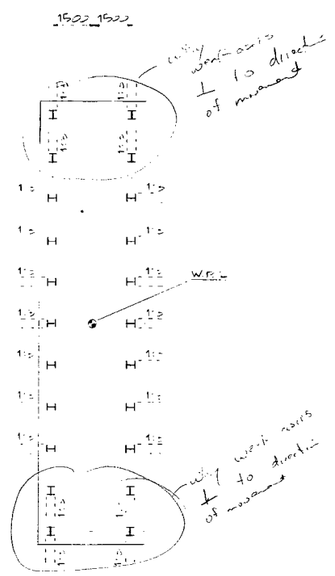
PALLADIUM DRIVE STRUCTURE

GENERAL ARRANGEMENT

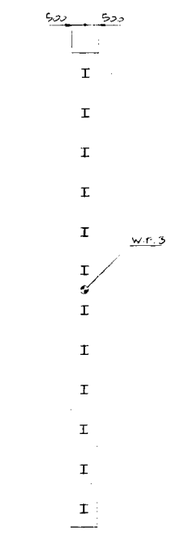
WP-90-43917
CONTRACT NO.

DRAWING NO.
S1

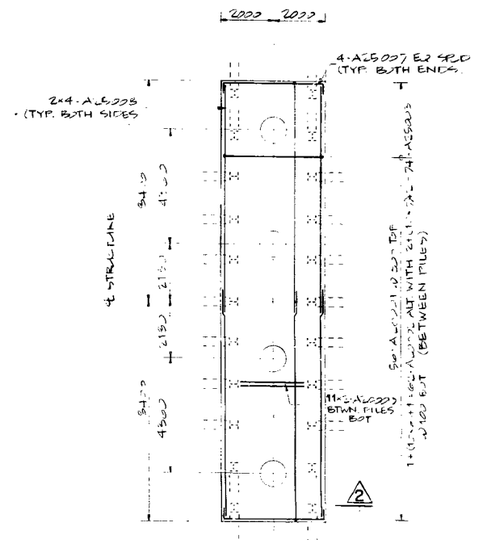




PILE LAYOUT
1:100



PILE LAYOUT SAME AS SOUTH ABUTMENT



FOOTING REINFORCING
1:100

NOTES:

1. PILE SPLICES AND DRIVING SHOES SHALL BE IN ACCORDANCE WITH OPSD 3301.00
2. ENDS OF ALL PILES SHALL BE CUT AT RIGHT ANGLES. CUT-OFF ELEVATIONS GIVEN IN TABLE REPRESENTS LOWEST POINT OF BATTERED PILE TOP.
3. PILE DESIGN DATA

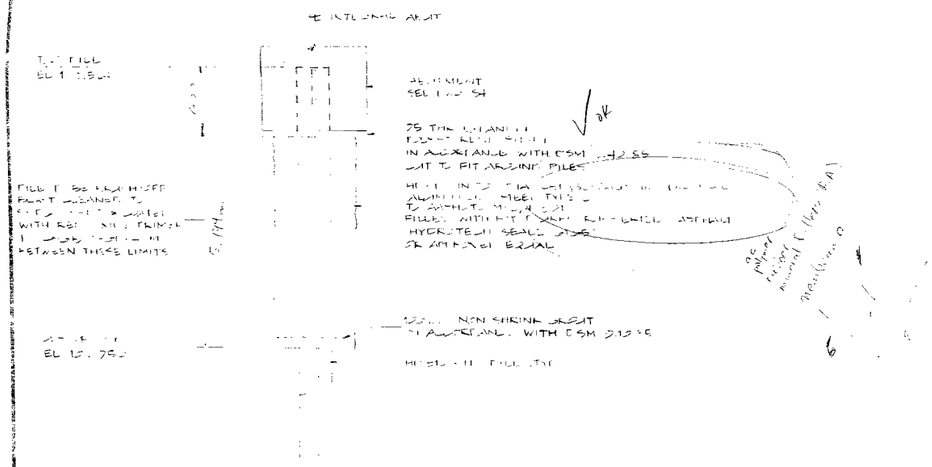
CAPACITY AT SLS	1150 kN
FACTORED CAPACITY AT ULS	1600 kN

4. CONSTRUCTION SEQUENCE AT ABUTMENTS
   - STRIP TOPSOIL
   - EXCAVATE WHERE REQUIRED FOR PLACEMENT OF GRANULAR B PAD BELOW MECHANICALLY STABILIZED EARTH WALLS
   - PLACE AND COMPACT GRANULAR B PAD BELOW MECHANICALLY STABILIZED EARTH WALLS
   - DRIVE PILES
   - PLACE CSP AROUND PILES, PLACE GROUT AND RUBBERIZED ASPHALT WITHIN CSP.
   - CONSTRUCT MECHANICALLY STABILIZED EARTH WALLS

PILE DATA

LOCATION	BATTER	QUANTITY	APPROXIMATE LENGTH (m)	CUT-OFF ELEVATION
SOUTH ABUTMENT	VERTICAL	12	13.3	109.524
PIER	1:3	22	4.5	100.89
NORTH ABUTMENT	VERTICAL	12	13.9	109.524

Tip Elev
96.2
95.684



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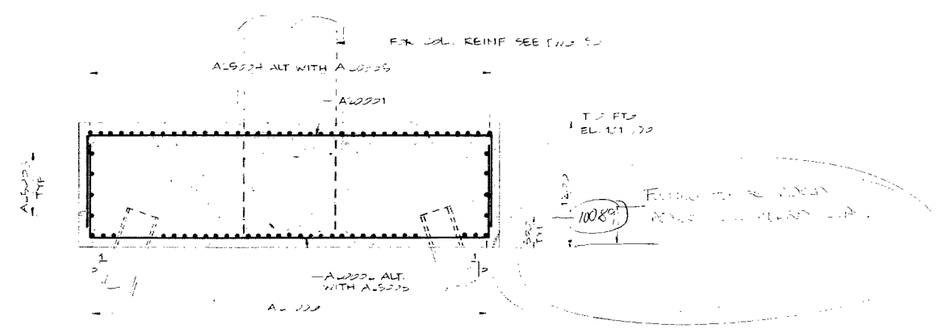

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REGISTERED PROFESSIONAL ENGINEER R. S. STOFKO PROVINCE OF ONTARIO	REGISTERED PROFESSIONAL ENGINEER A. S. WING PROVINCE OF ONTARIO	PALLADIUM	NO. / DESCRIPTION / DATE / INITIAL — REVISIONS

McCORMICK RANKIN
CONSULTING ENGINEERS

SCALE	AS NOTED
DATE	APRIL 1994
DWG.	GSN
CKD.	ASW
SITE	5-250
BENCH M	

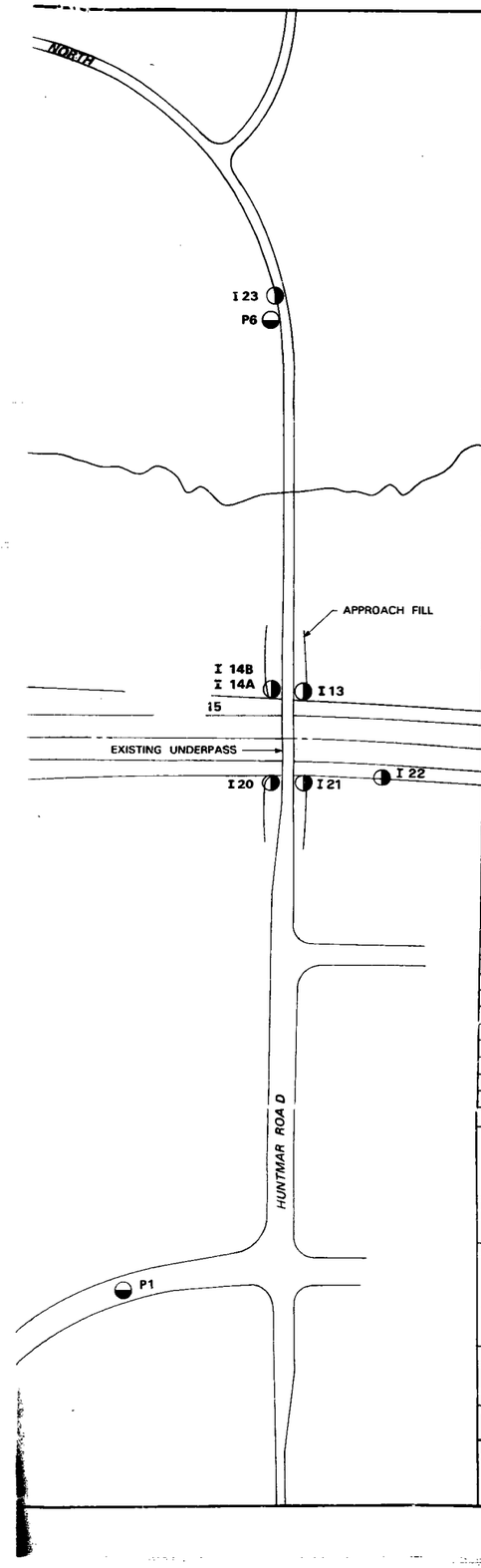
PALLADIUM DRIVE INTERCHANGE

PALLADIUM DRIVE STRUCTURE

FOOTING AND PILE LAYOUT AND REINFORCING

WP-90-43917
CONTRACT NO.

DRAWING NO.
S3



THIS DRAWING FORMS PART OF JACQUES, WHITFORD LTD. REPORT No. [redacted], AND SHOULD BE READ IN CONJUNCTION WITH THE REPORT.

LEGEND :

- I1 INTERCHANGE SERIES (MTO)
- P1 PALLADIUM DRIVE SERIES (RMOC)
- F1 FOUNDATIONS (COMPLETED)
- I13 AUGER HOLES

APP'D	NO	DETAILS	DATE
		REVISIONS	
		BASE PLAN PROVIDED BY McCORMICK RANKIN	
DWG NO		DESCRIPTION	DATE
		REFERENCES	

McCORMICK RANKIN

PALLADIUM INTERCHANGE

KANATA, ONTAR

BOREHOLE LOCATION PLAN

Jacques, Whitford Limited
CONSULTING ENGINEERS

DATE	SCALE	DRAWN BY
92/06/23	1 : 2000	GBB

APPROVED BY

DRAWING NO 10285-1

P4
I8
I10
I9
I7
I11
F1
I16
HIGHWAY
F2
I19
HIGHWAY
F3
I2
I6
I4
I3
I5
P3
PALLADIUM