TECHNICAL ADDENDUM

The following changes in the tender documents are effective immediately. This addendum will form part of the contract documents.

1 TENDER INQUIRY

Refer to the Following Proejct Submittals:

.1 Specification Section 26 36 23 clause 2.3.7 indicates a WCR of 60KA confirm if this is actual available fault current at the ATS?

Revise to 50KA.

.2 Addendum 1 Section 28 13 00: How many ACSMS workstations are required? Where are they located?

Two (2) workstations are required one (1) in Office 102 and one (1) in Front Office 210.

.3 Addendum 1 Section 28 13 00: What are the cabling requirements for the Access Control System? Is separate cabling required?

Yes – separate conduit system is required.

.4 Addendum #1 Section 28 13 00 Clause 1.8.1: What is the card technology required for the Access Control System?

To be determined after contract is awarded.

.5 Addendum 1 Section 28 13 0: How many cards are required?

200 cards will be required.

.6 Addendum 1 Section 28 13 00 Clause 1.4.1: is ID card badge printing required?

Yes

.7 If the answer is yes to previous, how many card encoding workstations are required?

One (1) encoding workstation is required.

.8 Where are the workstations to be located?

In Computer Room 115

.9 Does the selected card technology support card printing technology?

To be determined after contract award.

.10 What ID capture camera is required?

To be determined after contract award.

.11 Is a back drop required?

To be determined after contract award.

.12 One (1) or two (2) sided printing?

To be determined after award of contract.

.13 If the selected card technology is encodeable, must the printer include an encoder?

Yes.

.14 Addendum 1 Section 2813 00 Clause 1.4.1- is the Access Control System to be integrated with the Video Management System?

No

.15 Addendum 1 Section 28 13 00 Clauses 1.42/2.6: Duress System: A number of capabilities are listed some of which may be attributed in part to the ACMS System, a mass notification system and to a duress system. Please provide a description of the operation of the system as outlined in 1.4.2 and 2.6?

ACSMS system can act as a head end to the other systems or as a stand-alone system for mass notification/duress system.

.16 Provide a recommended make and model of the various items discussed in this description as well as Section 2.6 would help to clarify the desired roles. Some additional questions: Is the access control system to function as the primary duress system (1.4.2)?

No as an Access Control primary and duress as a add on or completely separate.

.17 Is it to utilize wired duress buttons ?

System matching.

.18 Is it to utilize wireless duress buttons?

No.

.19 Is it to utilize other duress activation devises? If so what type?

Provide capability to do so for now.

.20 What type of audible duress alerts are required?

System matching

.21 Specification Section 28 13 00 Clause 2.6.5 please provide more information on this Visual Graphics Control Panel.

As described in 2.6.3.3 and system compatible.

.22 What role is the ACSMS to have in the operation of the Duress System?

As a head end if compatible or Duress System can be Stand Alone.

.23 There are several Cameras mounted on poles shown in Drawing EC2.0., with the details for each of these cameras shown in the details on Dwg E6.0. These drawings show a separate connection, junction box and power for each pole how are they to be installed?

Install as per Drawings.

.24 However, on page# 9 , paragraph 2 (Sec 28 23 00) of Attachment A, we are told to group IP devices in to junction boxes (indoor or outdoor) connecting all standard IP devices within 80M to the box and using Fibre Optic to connect the junction box to the server room. Advise on how to proceed?

Install as per Drawings.

.25 Which way are we to proceed? Following pg#9 would provide the same level of functionality would significantly improve the serviceability of the system and would significantly reduce the cost of this system. The cost savings would come from an 80% reduction in:

Install as per Drawings.

.26 Confirm the poles the cameras are to be mounted to are supplied by the GC as per DWG6.0?

This will be determined after contract awarded.

.27 Is UPS required for all of the cameras shown on poles. Note each of these is powered by a 347v circuit.

UPS is not required.

.28 A cooling system is discussed for the server room, but this does not seem to appear in the Mechanical portion of the project. Who is to provide this?

Provided by others

.29 The server room is to be fed with up to 6.8KW of power, what panel is this to come from?

Provided by others

.30 Will Geo-Technical Report be included in Tender Documents?

See attached

.31 Has the site experienced overland flooding from the Red River in the past?

The CBSA site at Emerson has been impacted by flooding of the Red River in both 1997 and 2011. Specifically, the eastern half of pavement located to the east of the commercial building was flooded. Flood conditions lasted several months. Bidders are not to include costs in their bid for impacts caused by potential flooding, as there may be no flooding. In the event of flooding, substantiated flood impact costs would be addressed via a change order

2 REQUEST FOR EQUIVALENCY

.1 Lighting Package

Lighting package as submitted by listed Technical Sales shall be acceptable upon meeting all requirements of Drawings and Specifications for Type 5 and 6 luminaires.

- Philips LF4 FR 31 35 U DZT
- EcoPower WMB 50W NW V4 XZ
- Philips SFCR DIM 5W 80LA NW 347 NP
- Philips LF4 FR 31 35 U DZT
- SpecGrade SPL 1000W 1100W 15X15 347-480V CW BL VR 74 CL DMX
- SpecGrade SPL 1000W 1100W 15X15 347-480V CW BL VR 74 CL DMX
- Philips CSFS 16L 530 NW G1 YK SP/RSP/A33 347 DD WH / BD-CSFS BP-WH
- 3G 3G-4RLI L1 40K 120 DIM WT DD1 4'
- Philips 523-000081-58 / 120-000190-07 / 120-000190-06

.2 Electrical Heating Package:

The following Electric heating package submitted by Hitech Sales (1989) Limited shall be acceptable:

- Commercial Fan Forced Heater Dimplex RFI series FFH1, FFH2, FFH3
- Steel Architectural Draft Barrier Heater – slope top Dimplex BBH1

3 SPECIFICATIONS

N/A

4 REFER TO ELECTRICAL DRAWINGS:

.1 Refer to Drawing E4.0 and E1.2 Note 7;

.1 Provide as per E1.2 Note 7.

.2 Clarification to all underground wiring installations:

  .1 Provide wire Type RWU 90 for all horizontal direction boring technic installations , sized as required to meet code.

.3 Drawing EC 2.0:

  .1 Injector/weatherproof enclosure shall be NEMA Type 3S and insulated to maintain 10° Celsius
  in winter.
  .2 Provide exhaust system side mounted complete with relief air grill with aluminum filter grill and air filter. Minimum 105 cfm air delivery.
  .3 Provide radiant heater with a minimum of 150 watt output.
  .4 Provide a single thermostat to control both heating and cooling from one device.
  .5 Provide separate 200VA 347 volt transformer for heating requirements.
  .6 Junction/injector enclosure shall be prewired with code required barriers between voltages.
  .7 Add additional circuits to CCTV poles so that each pole is on a separate circuit from Panel V1next available circuit.
  .8 All enclosures shall be keyed alike.

--------------------END--------------------

M. Block & Associates Ltd.
Consulting Engineers
CSA CERTIFIED CONCRETE LABORATORY

· Geotechnical Investigations · Environmental Assessments · C.S.A. Certified Material Testing

September 21st, 2015

Public Works and Government Services Canada (PWGSC)
Suite 100 – 167 Lombard Avenue
Winnipeg, Manitoba
R3C 0T6
Attention: Mr. James Hutchings, M. Arch. MAA, Project Manager

Dear Sir:

RE: GEOTECHNICAL INVESTIGATION FOR THE PROPOSED WAREHOUSE BUILDING ADDITION, PIL BOOTHS, CANOPY AND TERTIARY GARAGE AT THE EMERSON POINT OF ENTRY IN EMERSON, MANITOBA

1.0 TERMS OF REFERENCE

On August 27th, 2015, M. Block & Associates Ltd. (MBA) received written e-mailed authorization from Mr. James Hutchings, M. Arch MAA, representing PWGSC, the project's developer, to proceed with the geotechnical investigation for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba. Therefore, on September 3rd and 4th, 2015, eleven test holes in total were bored implementing a track-mounted Acker MP-5 drill rig, using interconnected 5' long x 5" diameter continuous flight solid stem augers, supplied by Maple Leaf Drilling Ltd. of Winnipeg, Manitoba. Representative "undisturbed" and "disturbed" soil samples were retrieved from the test holes and brought back to MBA's CSA certified materials testing laboratory in Winnipeg for unconfined compression and unit weight testing, and atterberg limits, moisture content and particle size distribution testing, respectively, and verification of the field soil classifications. Alternatively, during the field investigation, the fine grained soils' respective 'disturbed' undrained shear strengths were measured implementing a hand-held calibrated Pocket Geotester. Upon the completion of this investigation, the test holes' elevations and the groundwater elevations in them, if any, were measured and referenced to their respective surfaces and also the top of the fire hydrant situated near test hole #4's location, as illustrated on pages 17 - 29 of this report. Finally, the test holes were completely backfilled with bentonite, soil cuttings and asphalt patch.

2.0 SOIL LITHOLOGY AND GROUNDWATER CONDITIONS

Test holes #1, #2, #3, #4, #7, #8 and #11, were covered with 0.295', 0.262', 0.7222' (concrete), 0.23', 0.295', 0.377' and nil of asphalt and then 1.345', 0.738', 0.2787', 1.41', 2.705', 1.193' and 5' of brown, damp, dense, gravelly silty sand fill (pit run granular) with and without some silty clay, respectively. Black/grey/brown, very stiff, damp, silty clay fill with and without granular was then traversed in test holes #1, #2, #3, #4, #5, #6, #7, #8, #9 and #10 down to the 6', 5'6", 6', 7'6", 2', 1'6", 5'6", 5', 2' and 2' depths, respectively. Next, in, only, test hole #3, black, alluvially deposited, stiff, moist, silty clay was observed down to the 7' depth. Brown, alluvially deposited, firm to soft, moist to saturated, clayey silt was then noted in test holes #1, #2, #3, #4 and the shallow probe holes down to the 18', 20', 19', 18' and 10' depths, respectively. Finally, grey, glaciolacustrine, firm, moist, silty clay with silt inclusions was recorded in, only, the deep test holes, #1, #2, #3 and #4, down to the 40', 40', 100' and 40' depths, respectively. The deep test holes and the shallow probe holes were discontinued at the aforementioned depths. During this investigation, groundwater seepage and soil sloughing, emanating from the saturated clayey silt alluvial deposition, currently flowed and sloughed into all the test holes at moderate inflow rates, respectively. The soil lithology in the test holes and their specific locations were appended to this report on pages 17 – 29.

3.0 SUMMARY OF FIELD AND LABORATORY TESTS

TH #	DEPTH	UNCONFINED COMPRESSION	BULK UNIT WEIGHT	MOISTURE CONTENT
3	26'	1599 psf	102.31 pcf	67.01 %
3	36'	1790 psf	101.54 pcf	62.62 %
3	46'	1682 psf	112.65 pcf	43.74 %
3	56'	1550 psf	98.58 pcf	72.83 %
3	66'	1488 psf	102.27 pcf	59.47 %
3	76'	1637 psf	101.92 pcf	63.52 %

The unconfined compressive strengths are also located on test hole #3's log sheets.
The soils' measured Pocket Geotester strengths are located on the test holes' log sheets.
Atterberg limits vs. Depth graphs are located on the test holes' log sheets.
The particle size distribution graphs are appended to this report on pages 34 – 35.

The soils' classifications from the plasticity chart are located on page 36.
Moisture content vs. Depth graphs are located on the test holes' log sheets.
A summary of the laboratory data is appended to this report on pages 37 – 40.

4.0 FOUNDATION DESIGN ALTERNATIVES

4.1 SHALLOW OR DEEP CONCRETE STRIP FOOTINGS

Based upon the depth of the fill layer and also the alluvially deposited, saturated, silt stratum observed in the test holes, it is the writer's professional opinion that a shallow or deep concrete footing foundation design, potentially constructed on or over the aforementioned potentially deleterious depositions underlying this site, is susceptible to significant and/or differential foundation settlement, and, as such, strongly not recommended as a feasible superstructure support system for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba.

4.2 DRILLED CAST IN PLACE CONCRETE FRICTION PILES

Alternatively, drilled cast in place concrete friction piles could be implemented as the foundation design for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba. Predicated upon the neutral plane of this pile type modeled near the 7' depth, the soft, saturated silt layer extending down to the 20' depth and the soil necking into the deepest test hole below the 80' depth below present grade, the allowable effective functional friction length of glaciolacustrine silty clay at this site, from the present grade of test hole #3, is **80' – 20' = 60'.** The laboratory data indicates that the factored geotechnical resistance (FGR), using ultimate limit states (ULS) where $\Phi = 0.4$, of the soil/concrete interface from the 7' to 20' depths and the 20' to 80' depths, only, is 160 psf and 357 psf, respectively, (293 psf in the SLS analysis for 1" deflection). Based upon these calculations, a 16" diameter friction pile drilled 80' deep, properly constructed, would safely transfer, using ULS, 94 kips of load down to the underlying glaciolacustrine deposition. The concrete, relative to the soil, has an additional net weight of, approximately, 40 pcf in the upper 80' of overburden. Therefore, the additional net weight of the concrete is included in the above analysis. In addition, in order to avoid reducing the piles' net efficiency, they must be spaced at least three pile diameters, on center. Furthermore, in order to resist potential soil swelling and frost jacking uplift stresses, these piles shall have minimum embedment lengths of 40' and 50' in heated and unheated areas of the site, respectively. Finally, full-length reinforcing steel shall also be installed in all the piles implemented in an unheated service condition.

It is recommended that the geotechnical engineer's personnel inspect the installation of this foundation type in order to verify that it conforms to the contents of this report, the structural drawings and project's specifications.

The foundation contractor should be fully cognizant that the alluvially deposited, soft, saturated, clayey silt stratum will slough and seep severely into all the piles' drilled open excavations during almost all seasons and/or years. Therefore, when that situation transpires, steel casing through that stratum would be required. Since soil sloughing during concreting may cause improper foundation performance, special care must be given when removing the steel sleeve not to cause sloughing soil from entering a pile's excavation from in behind it. As such, the foundation contractor should be diligent when removing the steel sleeve not to cause sloughing soil from entering a pile's excavation from in behind it. Lastly, the top 8' of embedment length in all the concrete piles should be mechanically vibrated.

The advantages of this piling system are its dimensionally dependant, potentially significant, allowable axial compressive, tensile and rotational overturning moment resistances, its relatively fast rate of pile installation, frequency of being more economical than other piled foundation designs in this area, efficiency of installation in comparison with driven pre-cast concrete frictional piles, the many piling businesses located in the vicinity and minimal magnitude of modeled long-term foundation settlement. The disadvantages of this piling system are the limited functional depth of serviceable firm, moist, glaciolacustrine, silty clay and, as such, frictional pile capacity on this site, the additional cost associated with the aforementioned length of steel sleeving required to properly install this pile type, and the potential for pile settlement, if constructed improperly.

4.3 DRIVEN TREATED TIMBER FRICTION PILES

Similarly, properly driven treated timber friction piles are also a feasible foundation system for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba for, only, heated applications. All treated timber piles shall be pre-drilled through the depth of frost penetration, if any, prior to being driven down to their specified embedment depth. Based upon, the FGR, using ULS where $\Phi = 0.4$, a properly driven 50' long treated Lodgepole Pine or Douglas Fir timber pile with 8" tip and 12" butt diameters would transfer, down to the underlying depositions, 0.40 kips per lineal foot of pile and 1.17 kips per lineal foot of pile from the ***7' to 20' depths and the 20' to 50' depths, respectively, in relation to the present ground elevation of test hole #1***. However, in this geotechnical design, the surface 7' length of timber pile shall be neglected as positive frictional resistance. The pile driving shall be performed using a driving energy of 10 foot-kips. In addition, in order to avoid reducing the piles' net efficiency, these piles shall be spaced at least four butt diameters, on center, from each other.

The geotechnical engineer's personnel shall inspect the piling installation in order to ascertain whether or not they have been damaged during installation or that they are capable of supporting the aforementioned designed axial compressive load.

The advantages of this piling system are its typically lower cost per foot of driven pile, efficiency of installation in comparison with drilled straight shaft cast in place and driven pre-cast concrete friction piled foundation systems and minimal magnitude of modeled long-term foundation settlement. The disadvantages of this piling system are its frequently significant lower frost jacking, moment and axial compressive pile capacities, and cost per foot of timber pile that is approaching that of pre-cast concrete piles.

4.4 DRIVEN PRE-CAST CONCRETE FRICTION PILES

Finally, driven pre-cast concrete friction piles could also be implemented as the foundation design for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba. All pre-cast concrete friction piles shall be pre-drilled through the depth of frost penetration, if any, prior to being driven down to their specified embedment depth. A properly driven 80' long pre-cast concrete friction pile with a 305 mm hexagonally shaped diameter would have a FGR, using ULS where Φ = 0.4, would transfer 52 kips of load down to the underlying soil, where the piling installation would be supervised by qualified geotechnical personnel. However, in this design, the upper 7' of embedment length of all pre-cast concrete piles is neglected as positive frictional resistance. The pile driving should be performed using a driving energy of 30 foot-kips. In addition, in order to avoid reducing the piles' net efficiency, these piles shall be spaced at least four diameters, on centre, from each other.

The geotechnical engineer's personnel shall inspect the piling installation in order to ascertain whether or not they have been damaged during installation or that they are capable of supporting the aforementioned designed axial compressive load.

In addition to the aforementioned specifications for driven pre-cast concrete piles, MBA offers the following recommendations:

- Pre-drilling through the zone of frost may be required for winter or early spring construction.
- If a drop hammer is to be used to install these piles. The mass of the hammer should be 3 times greater than the mass of the pile.

The advantages of this piling system are its significantly higher moment resistance in comparison with the aforementioned timber friction foundation type and minimal amount of modeled long-term foundation settlement. The disadvantages of this piling system are its typically significantly greater cost per foot of pile and minimized coefficient of friction with the underlying soil due to the pre-cast concrete pile's smooth hexagonal exterior surfaces.

5.0 CONCRETE DESIGN

Due to the visibly high concentration of sulphate in the glaciolacustrine deposition at this site, Sulphate Resisting Cement shall be used in all the concrete implemented for the aforementioned concrete foundation systems. Its concrete shall have a minimum 28-Day laboratory compressive strength of 32 mPa. Furthermore, the concrete shall contain at least 550 pounds of cement per cubic yard, have a maximum water cement ratio, a plastic concrete air content and slump of 0.45, 4 to 6 percent and 60 mm to 100 mm, respectively.

Alternatively, due to the higher elevation of the proposed structure in relation to the elevations of these test holes and the likely low concentration of sulphate in the filled and alluvial depositions traversed across this site, Normal Portland Cement could be used in all the concrete implemented for the structure's grade beams and floor slabs.

All other concrete exposed to freezing and thawing cycles shall contain an air entraining admixture that corresponds to the applicable class of exposure listed in tables 2-4 of the recent addition of CSA. Concrete poured in cold weather shall be heated and protected in accordance with CSA A23.1-04 clause 21.2.3.

In addition, all concrete poured shall be tested in accordance with CSA A23.1-04 every day and at least once every 50 m^3 per day by a CSA certified concrete testing laboratory.

6.0 SURFACE SLAB ON GRADE CONCRETE FLOOR SLAB DESIGN

The designated working sub-grade elevation for the proposed concrete slab on grade shall be situated just below the existing asphalt elevation. As such, all the asphalt located above the project's recommended working sub-grade elevation shall be milled and then transported off of the property. In addition, all the deleterious soil encountered at or below the project's recommended working sub-grade elevation, if any, shall also be excavated and then transported off of the site. Next, prior to placing the proposed concrete floor slab's granular base structure, the in-situ coarse-grained granular fill located at or below the working sub-grade elevation shall then be proof-rolled by a heavy roller until it has at least 95 % of its standard proctor density (SPD). Areas failing the aforementioned proof-roll test and any other deleterious material encountered at or below the working sub-grade elevation shall be verified and documented by the geotechnical engineer's personnel. Predicated upon this consultant's recommendations, the project's slab on grade sub-contractor shall then excavate and replace the documented failed proof-rolled soil and the other deleterious material encountered at or below the working sub-grade elevation with 100 mm or 50 mm down crushed rock fill or another pre-approved equivalent bridging material placed in sufficient 200 mm deep lifts and compacted until each layer has at least 95 % of its SPD.

Next, any segments of the proposed building's footprint naturally lower than the proposed sub-grade elevation, if any, shall then be brought up to the sub-grade elevation implementing either a 100 mm or 50 mm down crushed rock fill, granular C-Base fill or another pre-approved equivalent bridging material, placed in sufficient 200 mm deep lifts and compacted until each layer has at least 95 % of its SPD.

In order to raise the proposed slab on grade up to the underside of the granular base course elevation, the sub-base, consisting of at least one lift of C-Base, 50 mm or 20 mm down crushed rock fill or another pre-approved equivalent material shall be placed in 150 mm deep layers and compacted until every lift has at least 98 % of its SPD. Finally, the granular base course, composed of a 150 mm deep lift of A-Base, shall be placed and compacted until it has at least 100 % of its SPD. The 150 mm deep reinforced concrete floor slab shall then be poured having a slump in the range of 70 mm to 100 mm. The concrete shall have a maximum water cement ratio of 0.45 and contain a water reducing admixture. An elevation drawing of the building's slab on grade base structure is illustrated on page 30 of this report.

However, if the structural engineer or owner cannot accept the possibility of differential slab displacement of up to 25 mm and 50 mm, in heated and unheated applications, respectively, then a structurally supported concrete floor slab shall be implemented for this project.

7.0 PAVEMENT DESIGNS

The only areas that required a new pavement were in the vicinity of test holes #5, #6, #9 and #10, as the remaining test holes' respective logs illustrate, the remaining test holes' respective surfaces were covered with well performing asphalt or concrete.

TEST HOLES #5, #6, #9 and #10

The working sub-grade elevations in the areas designated for heavy truck traffic, light truck traffic and the concrete driveways shall be situated 1740 mm, 1564 mm 1850 mm below their future grades, respectively.

All the deleterious materials, vegetation and organic topsoil shall be stripped and transported off of the site. In addition, the remaining soil located above the project's designated working sub-grade elevations, if any, shall also be excavated and then transported off of the site. Prior to placing the proposed granular(sub)sub-base, sub-base and base courses of these various pavement structures, the in-situ, firm to soft, clayey silt stratum, with a low plasticity index, located at and possibly below the working sub-grade elevation shall then be properly covered by a pre-approved geo-textile fabric, such as, Amoco Woven Geo-textile #2016.

Next, any segments of the proposed pavement areas naturally lower than the proposed sub-grade elevations, if any, shall then be brought up to the working sub-grade elevation implementing either a highly plastic silty clay fill, 100 mm or 50 mm down crushed rock fill, granular C-Base fill or another pre-approved equivalent bridging material, placed in sufficient 200 mm deep lifts and compacted until each layer has at least 95 % of its SPD.

As per the existing roadway's successful construction and performance on this heavily traveled roadway, following the placement of the approved geo-textile fabric, the soil situated at the sub-grade elevation located, approximately, 900 mm below the overlying bridging lift, 1500 mm to 1800 mm below present site grade, should be built up with a silty clay fill or another pre-approved equivalent soil compacted in 200 mm deep lifts with each layer consolidated until it has at least 98 % of its standard proctor density. Next, in order to provide adequate structural (sub)-sub-base support in all traffic areas and to minimize frost heave, a bridging lift consisting of 100 mm down crushed rock fill or another pre-approved equivalent bridging material shall be placed in one - 300 mm deep layer and proof-rolled until minimal deflection under a tandem axle dump truck's heavy axle loading is noted by this consultant's personnel. Next, in areas designated for heavy truck traffic and the concrete driveways, only, their similar sub-bases shall consist of two layers of 50 mm or 20 mm down crushed rock fill, C-Base fill or another pre-approved equivalent material placed in 150 mm deep lifts and compacted until each layer has at least 98 % of its SPD. However, only one lift of granular sub-base is structurally required for the light car traffic's pavement construction. Next, in all traffic areas, the granular base course, composed of a 150 mm deep lift of A-Base, shall be placed and compacted until it has at least 100 % of its SPD. Finally, the light car traffic's asphalt pavement shall be laid in two layers with each lift having a minimum thickness of 32 mm. Similarly, areas with heavier truck traffic shall have two – 45 mm lifts of asphalt pavement. Each asphalt pavement area shall be consolidated until it has at least 98 % of its respective laboratory Marshall Density. An elevation drawing of the car and heavy truck traffic's respective pavement structures is illustrated on page 31 of this report.

The concrete driveways shall have a concrete design thickness of 200 mm overlying its aforementioned granular base's structural support, and an air-entrainment, slump and water cement ratio in accordance with all the relevant CSA standards in A23.1-00.

The asphalt aggregate shall have a crushed count of >60%. The asphalt shall be placed at a temperature of 125°C to 155°C. The ambient temperature may be no less than 6°C when the asphalt is to be laid. The geotechnical engineer's personnel shall test the asphalt of the following aggregate gradation specifications and physical properties.

METRIC SIEVE SIZE (microns)	(% Passing)
16,000	100
10,000	70 – 85
5,000	55 – 70
2,500	40 – 60
1,250	25 – 50
630	15 – 40
315	5 – 20
160	4 – 11
80	3 – 7

Asphalt Cement, % total sample weight	5.0 % - 6.0 %
Voids in Mineral Aggregate	14% minimum
Air Voids	3.0% - 5.0%
Marshall Stability, N at 60° C	7 kN minimum
Flow Index, units of 250 µm	6.0 – 16.0

The pavement's slope and catch basin placement shall be designed by the project's municipal engineering consultant. Finally, the pavement shall be sufficiently sloped at a minimum grading of 2 % for expedient drainage into catch basins or towards the perimeter of the property.

8.0 LATERAL EARTH PRESSURE

Typically, new structures, such as, the one proposed for this site, have all of their below grade walls rigidly designed and constructed. Therefore, the "at-rest" earth pressures (K_o) will apply for all cases on this project. The distribution of the lateral earth pressures are dependent upon the following key factors; backfill type, compaction effort and drainage conditions. As such, the following two equations should be used for the calculation of the lateral earth pressures where sub-drainage is provided and not provided, respectively.

Sub-drainage provided

$$P_h = K_o \gamma H$$

where:

P_h = lateral earth pressure at any depth (psf)
K_o = earth pressure coefficient
γ = unit weight of the soil (pcf)
H = height of the wall in (ft.)

Sub-drainage not provided

$P_h = K_o \gamma' H + \gamma_w H$

where:

P_h = lateral earth pressure at any depth (psf)
K_o = earth pressure coefficient
γ' = buoyant unit weight of the soil (pcf)
γ_w = unit weight of water (pcf)
H = height of the wall in (ft.)

If the sub-grade located adjacent to the structures is utilized to support a surface concrete slab on grade or any pavement structures, 98% - 100% of its SPD (well compacted) will be required and therefore the following K_o values listed in the table below should be used.

COMPACTION SPEC. & SOIL TYPE	K_o	TOTAL UNIT WEIGHT (pcf)
98% - 100% of its SPD (Sands & Gravels)	0.43	145
98% - 100% of its SPD (Silty Clays)	0.58	110

When the sub-grade soils compaction is required to be in the range of 90% - 95% of its SPD (moderate compaction) then the following table of K_o values should be implemented.

COMPACTION SPEC. & SOIL TYPE	K_o	TOTAL UNIT WEIGHT (pcf)
90% - 95% of its SPD (Sands & Gravels)	0.55	135
90% - 95% of its SPD (Silty Clays)	0.71	100

If surcharge loadings (i.e. line loads and point loads) are to be incorporated into this projects design then the figure located on page 32, obtained from the Canadian Engineering Foundation Manual, should be used to determine their associated respective lateral pressures on the rigidly structurally designed member. For a uniformly distributed surcharge load, the lateral earth pressure is simply determined by multiplying the load by the aforementioned applicable K_o factor. In addition, for the soils that require 98% - 100% of their SPD (well compacted), the size and type of compaction equipment used to compact the backfill induces additional lateral earth pressures. Therefore, in order to calculate the lateral earth pressures caused by the compaction equipment, a design chart has been provided on page 33 of this report. In addition, it still may also be necessary to provide temporary bracing of the wall during construction in order to resist those lateral earth pressures associated with the compaction equipment. Alternatively, if the sub-grade located adjacent to the basement is not required to support surface concrete slab on grade or pavement structures, then the standard triangular earth pressure distribution should be used for design purposes.

9.0 RECOMMENDATIONS

Predicated upon the soils' aforementioned respective strength parameters, lithology and physical properties, the current and potential future modeled groundwater elevations, the field and laboratory test data, and the proposed project's anticipated moderate applied foundation stresses, drilled cast in place concrete friction piles, driven treated Douglas Fir or Lodgepole Pine timber frictional piles or driven pre-cast concrete friction piles could be implemented as the foundation design for the proposed warehouse building addition, PIL booths, canopy and Tertiary Garage at the Emerson Port of Entry in Emerson, Manitoba. Based upon the aforementioned advantages and disadvantages of these foundation systems, a drilled cast in place concrete friction piled foundation design would likely be a well performing, more economical and efficient one for the proposed one-storey, moderately-loaded, structures placed on a site with the aforementioned geotechnical design parameters and implemented in a heated service condition. However, the choice of foundation type implemented for this project will ultimately depend upon their respective, previously described, advantages and disadvantages, estimated installation costs and the applied foundation loads that will be calculated by the project's structural engineering consultant.

It is recommended in the strongest of terms that the geotechnical engineer's personnel inspect the installation of all the foundation elements in order to verify that they all conform with the contents of this report, the structural drawings and the project's specifications.

Any areas of the yard naturally lower in elevation, if any, shall be brought up to its future grade implementing a highly plastic silty clay fill, 50 mm down limestone fill, granular C-Base fill or another pre-approved equivalent material, placed in sufficient 200 mm deep lifts and compacted until each layer has at least 95 % of its SPD.

The backfill material around the perimeter of the proposed structure shall be brought up to its future grade implementing either a 20 mm down limestone fill; granular C-Base fill; or another pre-approved equivalent material, placed in sufficient 150 mm deep lifts and compacted until each layer has densities in the range of 92 % to 97 % of its SPD.

In order to minimize frost penetration under the building, 50 mm thick rigid horizontal insulation, or another pre-approved equivalent frost protection, shall be placed around the exterior of the entire structure. This insulation shall be placed along the face of the proposed building out to a distance 1200 mm away from it at a depth of 300 mm below future ground elevation and also along the outside faces of the structure's exterior concrete grade beams.

The proposed surface concrete slab on grade and all the various proposed asphalt pavement surfaces shall be constructed as per the recommendations outlined in section 6.0 and 7.0 of this report, respectively. If the owner or structural engineer cannot accept the possibility of the aforementioned differential slab on grade displacement, then a structurally supported floor slab shall be implemented for this project. Furthermore, the surface slab on grade and pavement contractors shall also take precautions to prevent the fine-grained sub-grade soil from the following conditions; freezing, excessive soil moisture loss or gain, water ponding and heavily loaded axle traffic. In addition, the granular fill placed for this project shall be free of frost, frozen material and placed at an ambient air temperature of at least 6° Celsius. In order to verify compliance with the aforementioned standard proctor and Marshall Density specifications, field compaction tests shall be taken on every lift of granular material and asphalt placed for this project, respectively. All concrete poured shall be tested in accordance with CSA A23.1-04 every day and at least once every 50 m^3 per day by a CSA Certified concrete testing laboratory.

The selected 50 mm down and 20 mm down crushed rock, A-Base and C-Base gravels implemented for this project shall all meet the following gradation specifications:

METRIC SIEVE SIZE (µm)	20 mm Crushed rock (% Passing)	50 mm Crushed rock (% Passing)	A-BASE (% Passing)	C-BASE (% Passing)
50,000		100		
25,000			100	100
20,000	100		80 – 100	
5,000	40 – 70	25 – 80	40 – 70	25 – 80
2,500	25 – 60		25 – 55	
315	8 - 25		13 – 30	
80	6 - 17	5 – 18	5 – 15	5 – 18

The building's superstructure should only be supported by only one of the aforementioned approved foundation systems. In addition, in all the aforementioned feasible piled foundation designs, a void space, of at least 150 mm in thickness, should be constructed under all pile caps, grade beams and walls to allow for the potential expansive capability of the various filled and silty soil depositions underlying this site. Lastly, the writer understands that basements and/or crawlspaces are not intended for the proposed structures.

Since underground pits and walls are intended underlying the parts of the proposed structures, their associated lateral earth pressures should be calculated as per section 8.0 of this report. Furthermore, the proposed pits' and walls' excavations and shoring should, at a minimum, comply with all the Manitoba Department's Workplace Health and Safety guidelines for confined underground work and be designed by the project's structural engineering consultant, respectively. Their construction should then proceed as per those standards and the project's sealed drawings and specifications.

If any of the aforementioned design elements are modified or deleted, please contact the undersigned to determine if that course of action will be acceptable.

In addition, MBA respectfully requests an opportunity to review all the relevant finalized structural drawings and the project's foundation and materials testing specifications for this project in order to verify their conformance with the contents of this report.

The test holes drilled during the investigation represent only those specific areas tested. The soil conditions on this site may vary from that described in this report. Should that situation occur, please contact this office for further instructions.

All the geotechnical engineering design recommendations presented in this report are predicated upon the assumption that a sufficient degree of inspection will be provided during the project's construction and that a qualified and experienced foundation contractor properly installs an aforementioned pre-approved, engineered and sealed foundation type.

Any uses which a third party makes of this report, or any reliance on decisions to be made based on it, are the sole responsibility of such third parties. MBA accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based upon this report.

Yours Truly,
M. Block & Associates Ltd.

PROVINCE OF MANITOBA
9/21/15
S. J.
BLOCK
REGISTERED PROFESSIONAL ENGINEER

APEGM
Certificate of Authorization
M. Block & Associates Ltd.
No. 1527 Expiry: April 30, 2015

Jeffrey Block, P. Eng., Senior Geotechnical Engineer

M. Block & Associates Ltd.

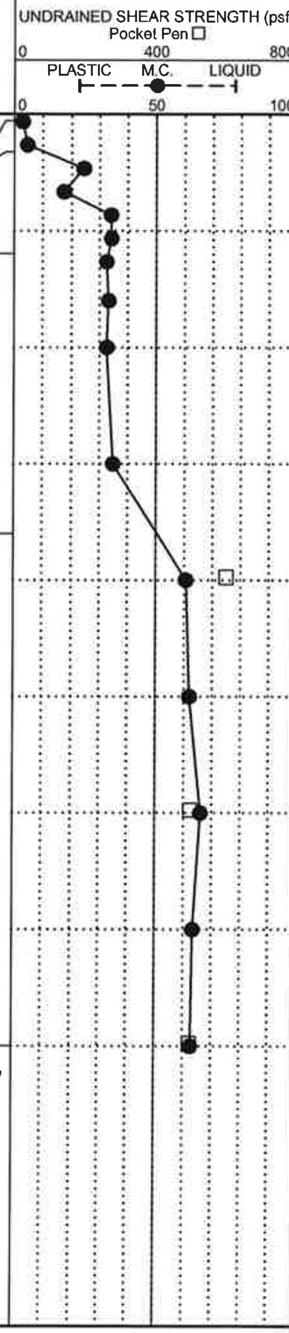
2484 Ferrier Street
Winnipeg, Manitoba, R2V 4P6
Telephone: 204-334-5356
Fax: 204-339-7976

TEST HOLE NO.: 1

Sheet 1 of 1

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 3/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 9:05 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 99.02m	Drawing Number: 5747	

Depth, ft	Sample Number	U S C S	MATERIAL DESCRIPTION
0	1	ASPHALT	ASPHALT - 90 mm thick
	2	SM	Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
	3, 4, 5, 6	CH	Black/grey/brown, very stiff, damp, silty CLAY FILL with granular
5	7, 8 (▽ 8.0 ft), 9, 10	CL	Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
20	11, 12, 13, 14, 15	CH	Grey, glaciolacustrine, firm, moist, silty CLAY with silt inclusions
40			40' - End of test hole; - Upon completion, the groundwater & sloughed soil was measured at the 20' and 38' depths, respectively



SAMPLE TYPE SYMBOLS

Split Spoon, Shelby Tube, Vane Shear, Auger Cuttings, Grab Sample, Rock Core

49.001319 N ; -97.236195 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

▽ Phreatic Surface #1: 8.0 ft

TEST HOLE NO.: 2

Sheet 1 of 1

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Winnipeg, Manitoba, R2V 4P6
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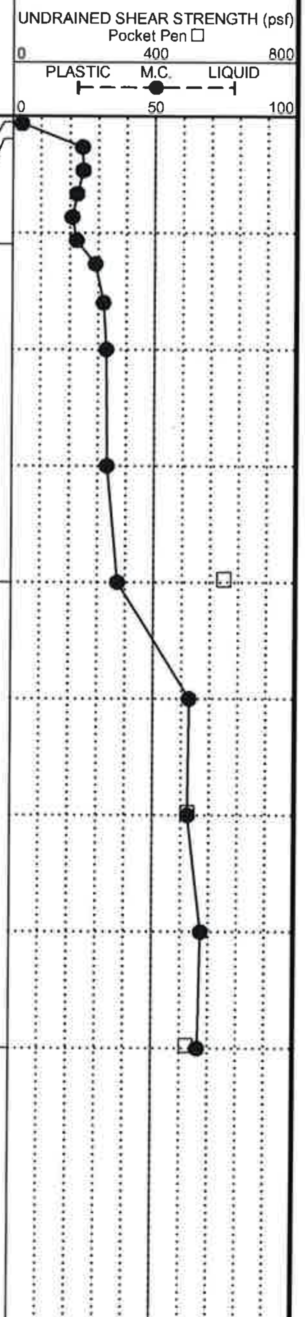
Fax: 204-339-7976

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 3/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 10:00 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 99.19m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		16	ASPHALT		ASPHALT - 80 mm thick
		17	SM		Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
		18	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL with granular
		19			
		20			
5		21			
		22	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
		23			
10		24			
15		25			
20		26	CH		Grey, glaciolacustrine, firm, moist, silty CLAY with silt inclusions
25		27			
30		28			
35		29			
40		30			40' - End of test hole; - Upon completion, the groundwater & sloughed soil was measured at the 10' depth
45					
50					



SAMPLE TYPE SYMBOLS

Split Spoon
Shelby Tube
Vane Shear
Auger Cuttings
Grab Sample
Rock Core

49.001375 N ; -97.236410 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

∇ Phreatic Surface #1:	7.0 ft

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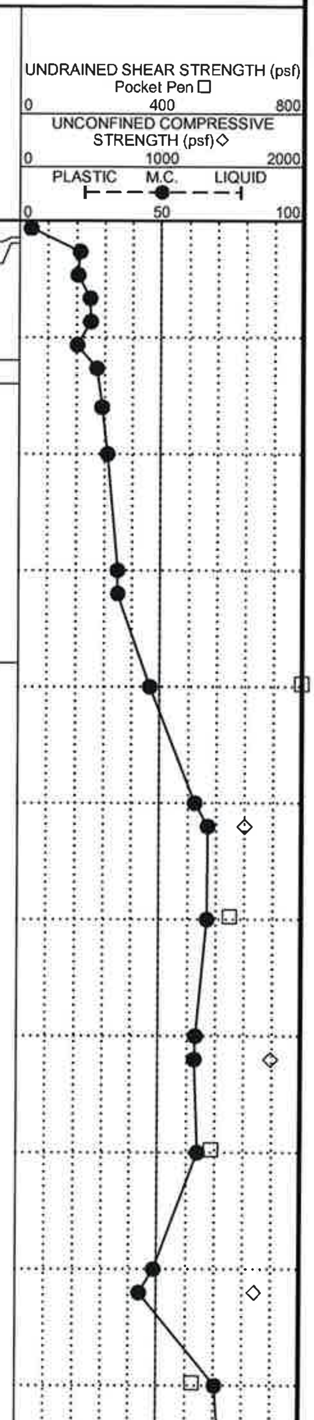
TEST HOLE NO.: 3

Sheet 1 of 2

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 3/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 10:55 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 99.24m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	USCS	Graphic Log	MATERIAL DESCRIPTION
0		31	CONCRETE		CONCRETE - 220 mm thick
		32	SM		Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
		33, 34, 35, 36	CH		Brown, stiff, moist, silty CLAY FILL
5		37	CH		Black, alluvially deposited, stiff, moist, silty CLAY
		38, 39, 40, 41	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
20		42, 43, 44, 45, 46, 47, 48, 49, 50, 51	CH		Grey, glaciolacustrine, firm, moist, silty CLAY with silt inclusions

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50



Continued Next Page

SAMPLE TYPE SYMBOLS

Split Spoon, Shelby Tube, Vane Shear, Auger Cuttings, Grab Sample, Rock Core

49.002525 N ; -97.237388 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1: 7.0 ft

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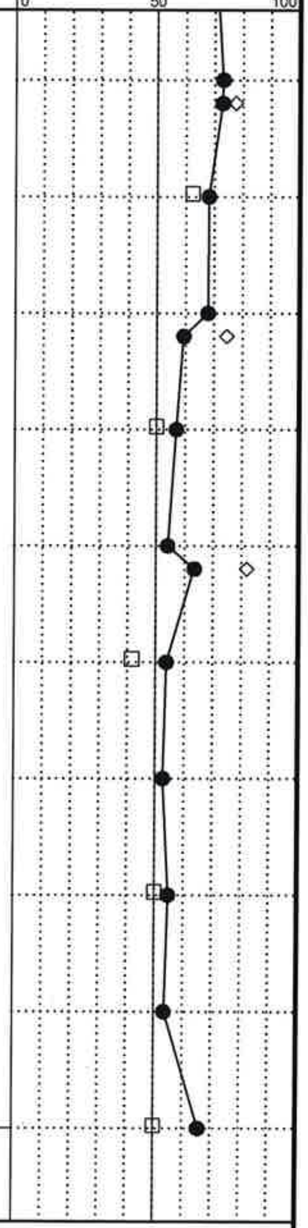
TEST HOLE NO.: 3

Client:	Public Works and Government Services Canada	Job No.: 2015-1537	Logged By:	Matthew Appleyard	Date: 3/9/15
Project:	Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By:	J. Block, P. Eng.	Time: 10:55 AM
Location:	Emerson Point of Entry, Emerson, Manitoba	Elevation: 99.24m	Drawing Number:	5747	

Depth, ft	Sample Type	Sample Number	USCS	Graphic Log	MATERIAL DESCRIPTION
			CH		Grey, glaciolacustrine, firm, moist, silty CLAY with silt inclusions *(continued)*
55	Shelby Tube	52, 53			
60		54			
65	Shelby Tube	55, 56			
70		57			
75	Shelby Tube	58, 59			
80		60			
85		61			
90		62			
95		63			
100		64			100' - End of test hole; - Upon completion, the groundwater & sloughed soil was measured at the 7' and 31' depths, respectively

UNDRAINED SHEAR STRENGTH (psf) Pocket Pen □ 0 400 800
UNCONFINED COMPRESSIVE STRENGTH (psf) ◇ 0 1000 2000
PLASTIC M.C. LIQUID 0 50 100



SAMPLE TYPE SYMBOLS

Split Spoon; Shelby Tube; Vane Shear; Auger Cuttings; Grab Sample; Rock Core

49.002525 N ; -97.237388 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1: 7.0 ft

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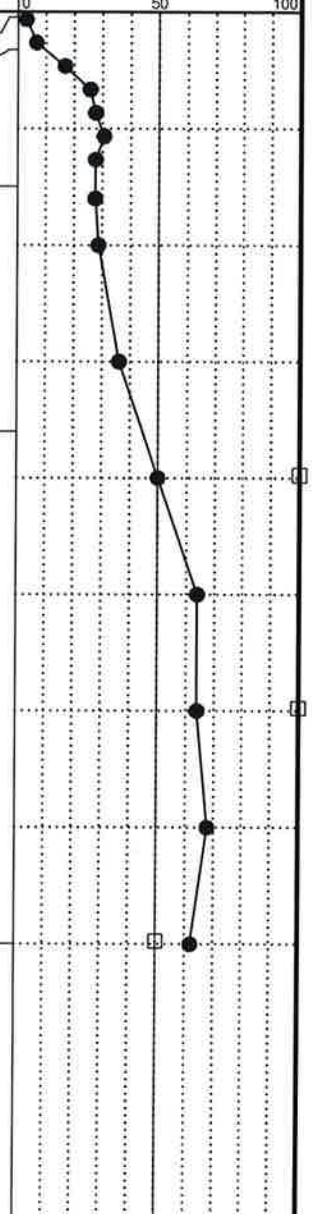
TEST HOLE NO.: 4

Sheet 1 of 1

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 4/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 7:12 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 99.16m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		65	ASPHALT		ASPHALT - 70 mm thick
		66	SM		Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
		67, 68, 69, 70, 71	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL
		72, 73, 74	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
		75, 76, 77, 78, 79	CH		Grey, glaciolacustrine, firm, moist, silty CLAY with silt inclusions
40					40' - End of test hole; - Upon completion, the groundwater & sloughed soil was measured at the 8'6" depth

UNDRAINED SHEAR STRENGTH (psf)
Pocket Pen ☐
0 400 800
PLASTIC M.C. LIQUID
0 50 100



SAMPLE TYPE SYMBOLS

Split Spoon
Shelby Tube
Vane Shear
Auger Cuttings
Grab Sample
Rock Core

49.001176 N ; -97.236436 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

∇ Phreatic Surface #1: 7.5 ft

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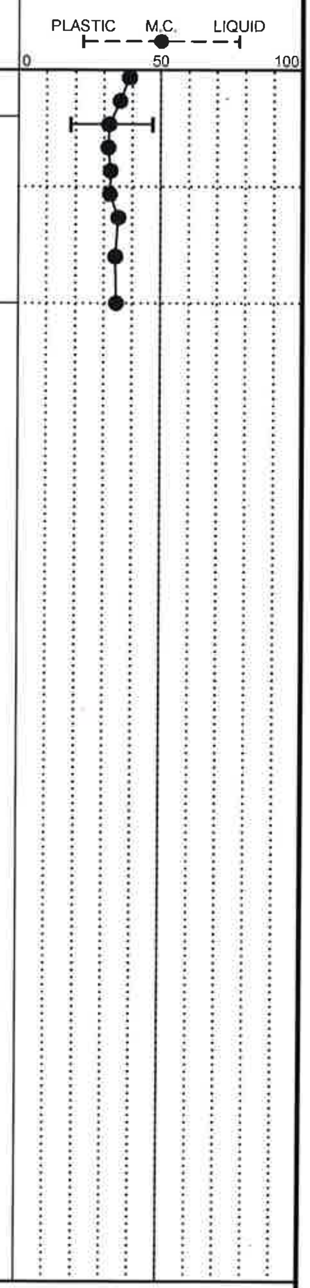
TEST HOLE NO.: 5

Sheet 1 of 1

Client:	Public Works and Government Services Canada	Job No.: 2015-1537	Logged By:	Matthew Appleyard	Date: 4/9/15
Project:	Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By:	J. Block, P. Eng.	Time: 8:18 AM
Location:	Emerson Point of Entry, Emerson, Manitoba	Elevation: 97.64m	Drawing Number:	5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		80, 81	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL
		82, 83, 84, 85, 86, 87, 88	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
10					10' - End of test hole



Depth scale, ft: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

SAMPLE TYPE SYMBOLS

Split Spoon
Shelby Tube
Vane Shear
Auger Cuttings
Grab Sample
Rock Core

49.000549 N ; -97.236001 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1: 6.0 ft

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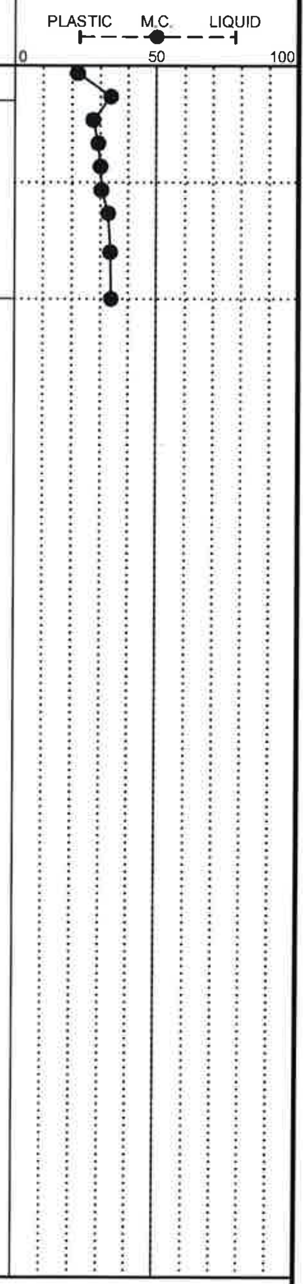
TEST HOLE NO.: 6

Sheet 1 of 1

Client:	Public Works and Government Services Canada	Job No.: 2015-1537	Logged By:	Matthew Appleyard	Date: 4/9/15
Project:	Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By:	J. Block, P. Eng.	Time: 8:40 AM
Location:	Emerson Point of Entry, Emerson, Manitoba	Elevation: 98.29m	Drawing Number:	5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		89	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL
		90	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
		91			
		92			
		93			
5		94			
		95			
		96			
10		97			10' - End of test hole
15					
20					
25					
30					
35					
40					
45					
50					



SAMPLE TYPE SYMBOLS

Split Spoon
Shelby Tube
Vane Shear
Auger Cuttings
Grab Sample
Rock Core

49.000919 N ; -97.235964 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

∇ Phreatic Surface #1: 6.0 ft

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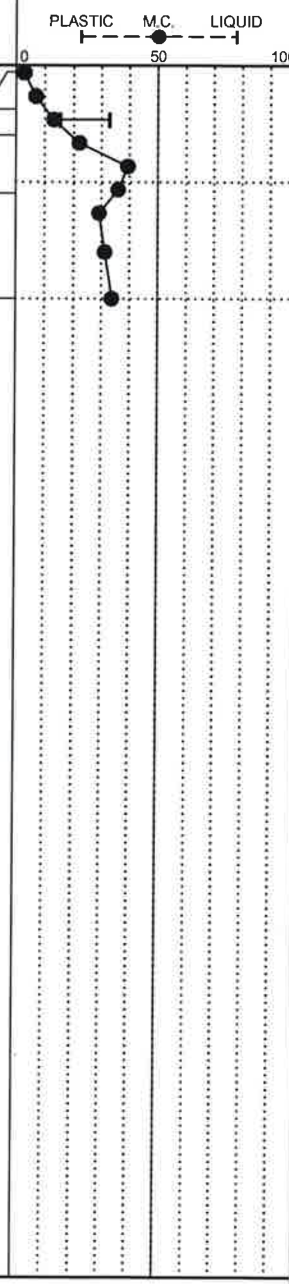
TEST HOLE NO.: 7

Sheet 1 of 1

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 4/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 8:55 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 98.90m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		98	ASPHALT		ASPHALT - 90 mm thick
		99	SM		Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
		100	SC		Brown, damp, dense, gravelly silty SAND (PIT RUN) mixed with silty clay FILL
		101, 102, 103	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL
5		104, 105, 106	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
10					10' - End of test hole



SAMPLE TYPE SYMBOLS

Split Spoon	Shelby Tube
Vane Shear	Auger Cuttings
Grab Sample	Rock Core

49.001582 N ; -97.235835 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1: 6.0 ft

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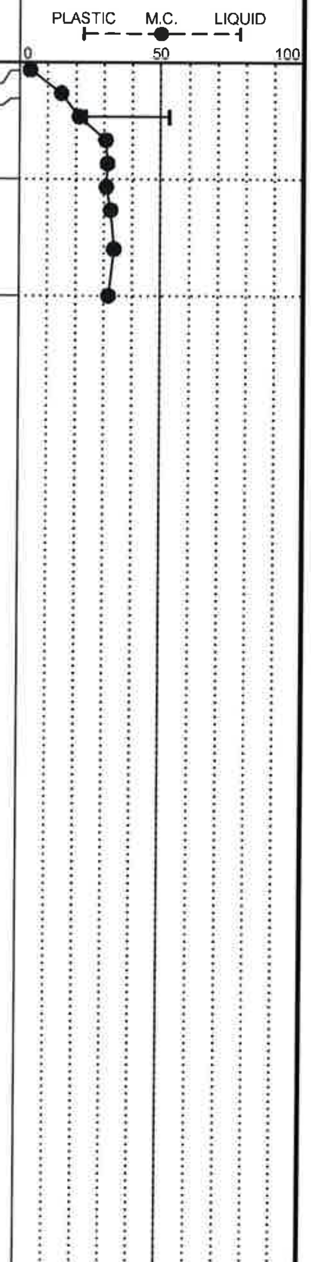
TEST HOLE NO.: 8

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 4/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 9:15 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 98.44m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		107	ASPHALT		ASPHALT - 115 mm thick
		108	SM		Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
		109	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL with granular
		110			
		111			
5		112	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
		113			
		114			
10		115			10' - End of test hole
15					
20					
25					
30					
35					
40					
45					
50					



SAMPLE TYPE SYMBOLS

Split Spoon	Shelby Tube
Vane Shear	Auger Cuttings
Grab Sample	Rock Core

49.002257 N ; -97.235823 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1:	6.0 ft

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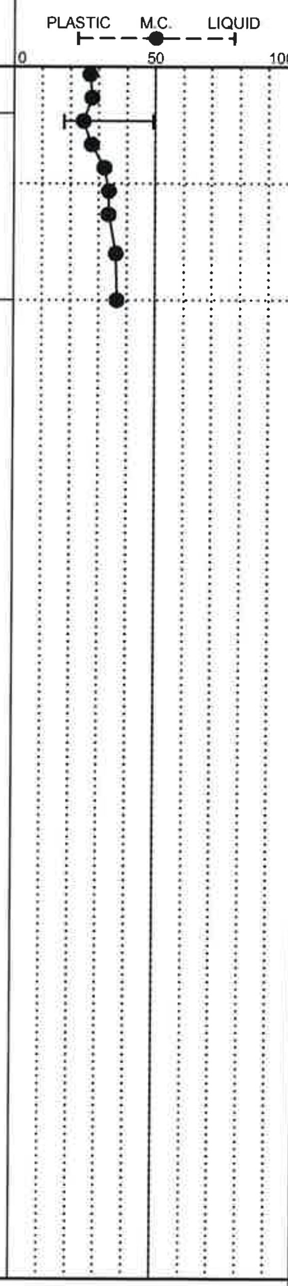
TEST HOLE NO.: 9

Sheet 1 of 1

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 4/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 9:40 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 98.10m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		116	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL with granular
		117			
		118	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
		119			
		120			
5		121			
		122			
		123			
10		124			10' - End of test hole
15					
20					
25					
30					
35					
40					
45					
50					



SAMPLE TYPE SYMBOLS

- Split Spoon
- Shelby Tube
- Vane Shear
- Auger Cuttings
- Grab Sample
- Rock Core

49.003035 N ; -97.235915 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

∇ Phreatic Surface #1:	6.0 ft

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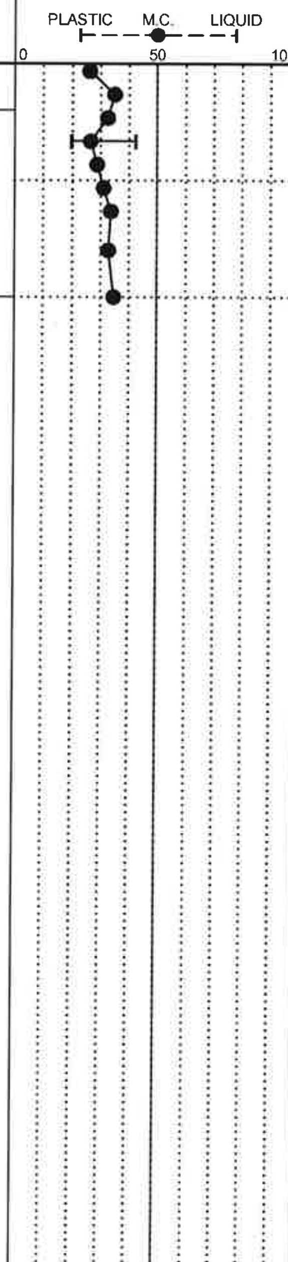
Fax: 204-339-7976

TEST HOLE NO.: 10

Sheet 1 of 1

Client: Public Works and Government Services Canada	Job No.: 2015-1537	Logged By: Matthew Appleyard	Date: 4/9/15
Project: Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By: J. Block, P. Eng.	Time: 10:00 AM
Location: Emerson Point of Entry, Emerson, Manitoba	Elevation: 98.17m	Drawing Number: 5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0		125, 126	CH		Black/grey/brown, very stiff, damp, silty CLAY FILL with granular
		127, 128, 129, 130, 131, 132, 133	CL		Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
10					10' - End of test hole



SAMPLE TYPE SYMBOLS

Split Spoon, Shelby Tube, Vane Shear, Auger Cuttings, Grab Sample, Rock Core

49.007572 N ; -97.227485 W

Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

Phreatic Surface #1: 7.5 ft

TEST HOLE LOG 2015-1536-PWC-EMERSON POINT OF ENTRY.GPJ M BLOCK ASSOC.GDT 21/9/15

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Winnipeg, Manitoba, R2V 4P6
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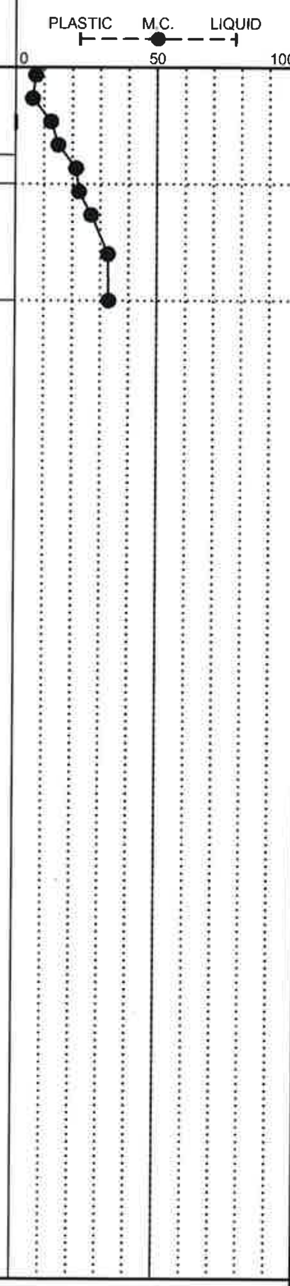
Fax: 204-339-7976

TEST HOLE NO.: 11

Sheet 1 of 1

Client:	Public Works and Government Services Canada	Job No.: 2015-1537	Logged By:	Matthew Appleyard	Date: 4/9/15
Project:	Warehouse building addition, PIL booths, canopy & Tertiary Garage		Reviewed By:	J. Block, P. Eng.	Time: 10:15 AM
Location:	Emerson Point of Entry, Emerson, Manitoba	Elevation: 97.98m	Drawing Number:	5747	

Depth, ft	Sample Type	Sample Number	U S C S	Graphic Log	MATERIAL DESCRIPTION
0	⊠	134	SM	▩	Brown, damp, dense, gravelly silty SAND (PIT RUN) FILL
	⊠	135			
	⊠	136			
	⊠	137			
	⊠	138	SC	▩	Brown, damp, dense, gravelly silty SAND (PIT RUN) mixed with silty clay FILL
5	⊠	139	CL	▨	Brown, alluvially deposited, firm to soft, moist to saturated, clayey SILT - Moderate soil sloughing and groundwater seepage
	⊠	140			
⊻	⊠	141			
10	⊠	142			
					10' - End of test hole
15					
20					
25					
30					
35					
40					
45					
50					



SAMPLE TYPE SYMBOLS

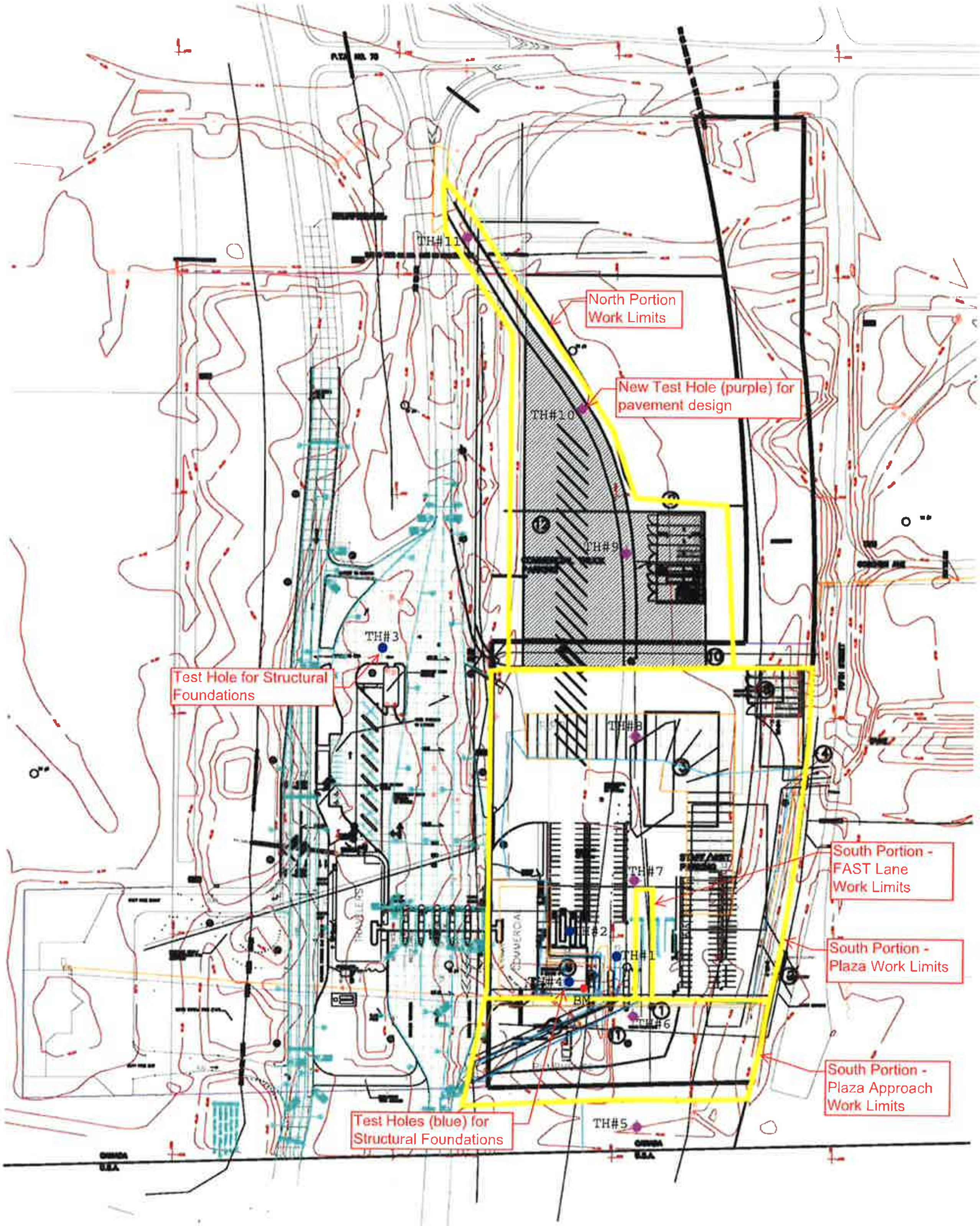
⊠ Split Spoon	■ Shelby Tube
Vane Shear	Auger Cuttings
Grab Sample	Rock Core

49.004065 N ; -97.236600 W

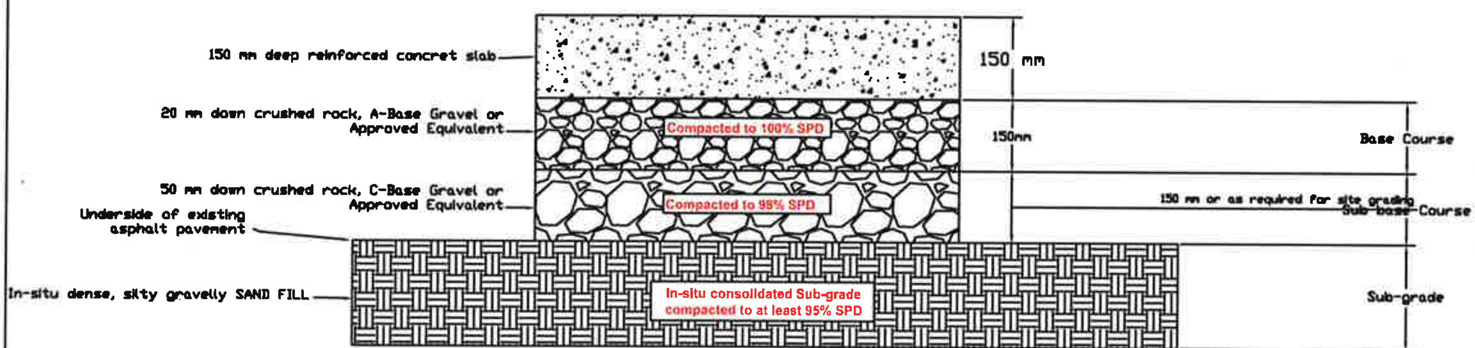
Drill Rig:	Track-mounted Acker drill rig
Auger:	5" dia. continuous flight augers
Contractor:	Maple Leaf Drilling Ltd.

WATER LEVELS

⊻ Phreatic Surface #1:	7.5 ft


TH#11
North Portion
Work Limits
New Test Hole (purple) for
pavement design
TH#10
TH#9
TH#3
Test Hole for Structural
Foundations
TH#8
TH#7
South Portion -
FAST Lane
Work Limits
TH#2
TH#1
South Portion -
Plaza Work Limits
TH#4
BM
TH#6
South Portion -
Plaza Approach
Work Limits
Test Holes (blue) for
Structural Foundations
TH#5

SURFACE CONCRETE SLAB-ON-GRADE DESIGN



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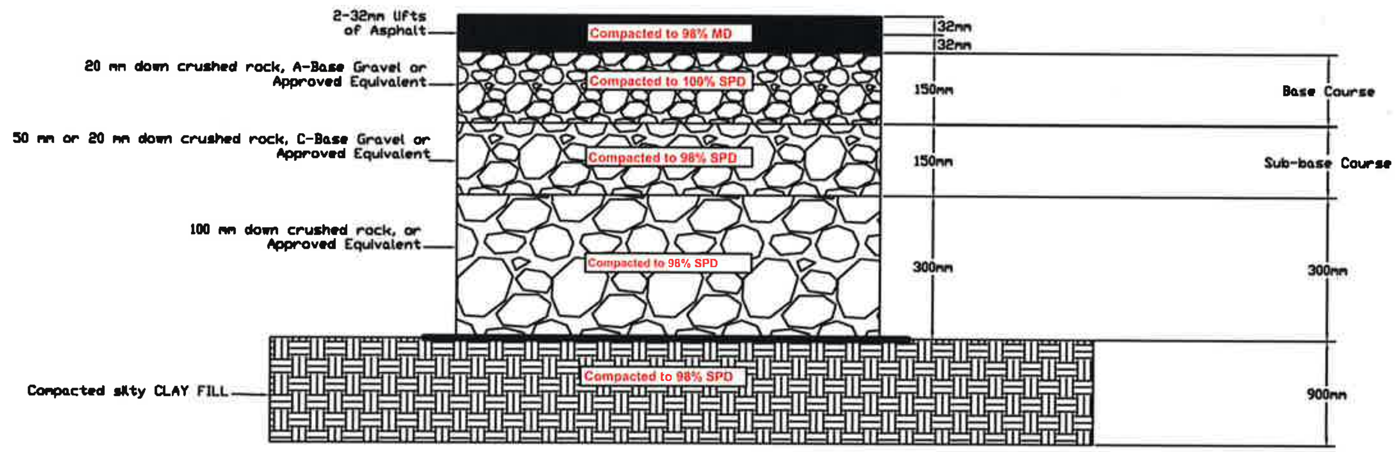
Drawing: Surface Slab-on-grade Design
Drawn By: J. Block, P. Eng.
Reviewed By: J. Block, P. Eng.

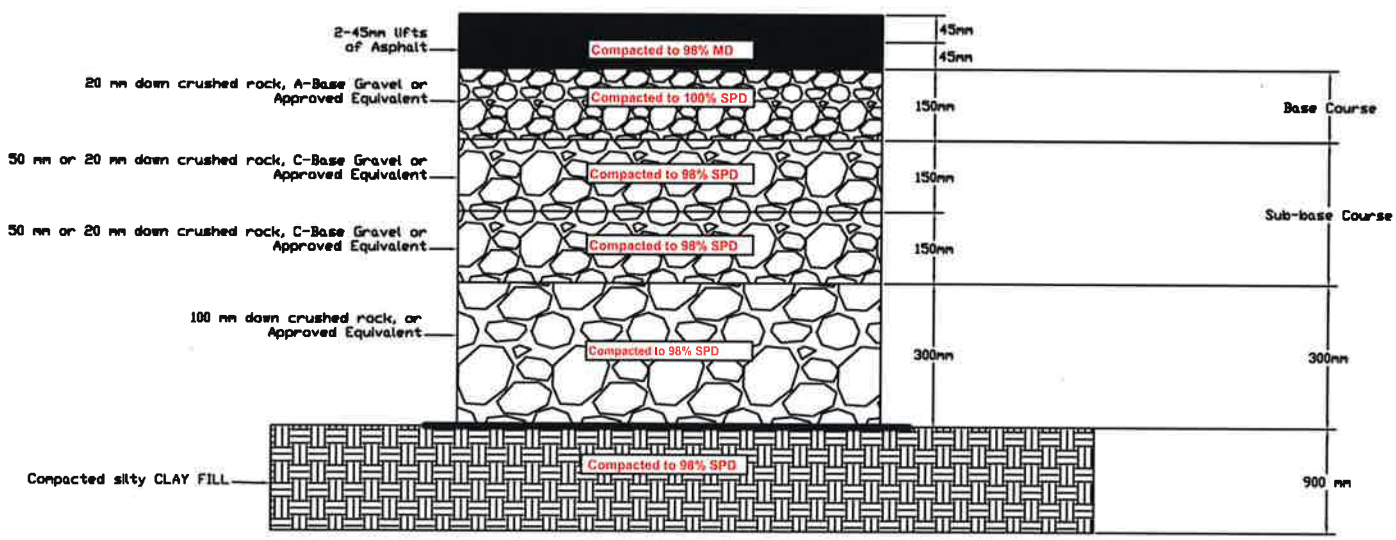
Project: Emerson Point of Entry, Emerson
Project Number: 2015-1537
Drawing Number: 5747

NOT TO SCALE

Car Traffic Areas



Truck Traffic Areas



	M. Block & Associates Ltd. 2484 Ferrier Street Winnipeg, Manitoba R2V 4P6 Phone: (204)-334-5356 Fax: (204)-339-7976	Drawing: PAVEMENTS' STRUCTURES Drawn By: TG/JB Reviewed By: J. Block, P. Eng.
		Project: Emerson Point of Entry, Emerson Project Number: 2015-1537 Drawing Number: 5747

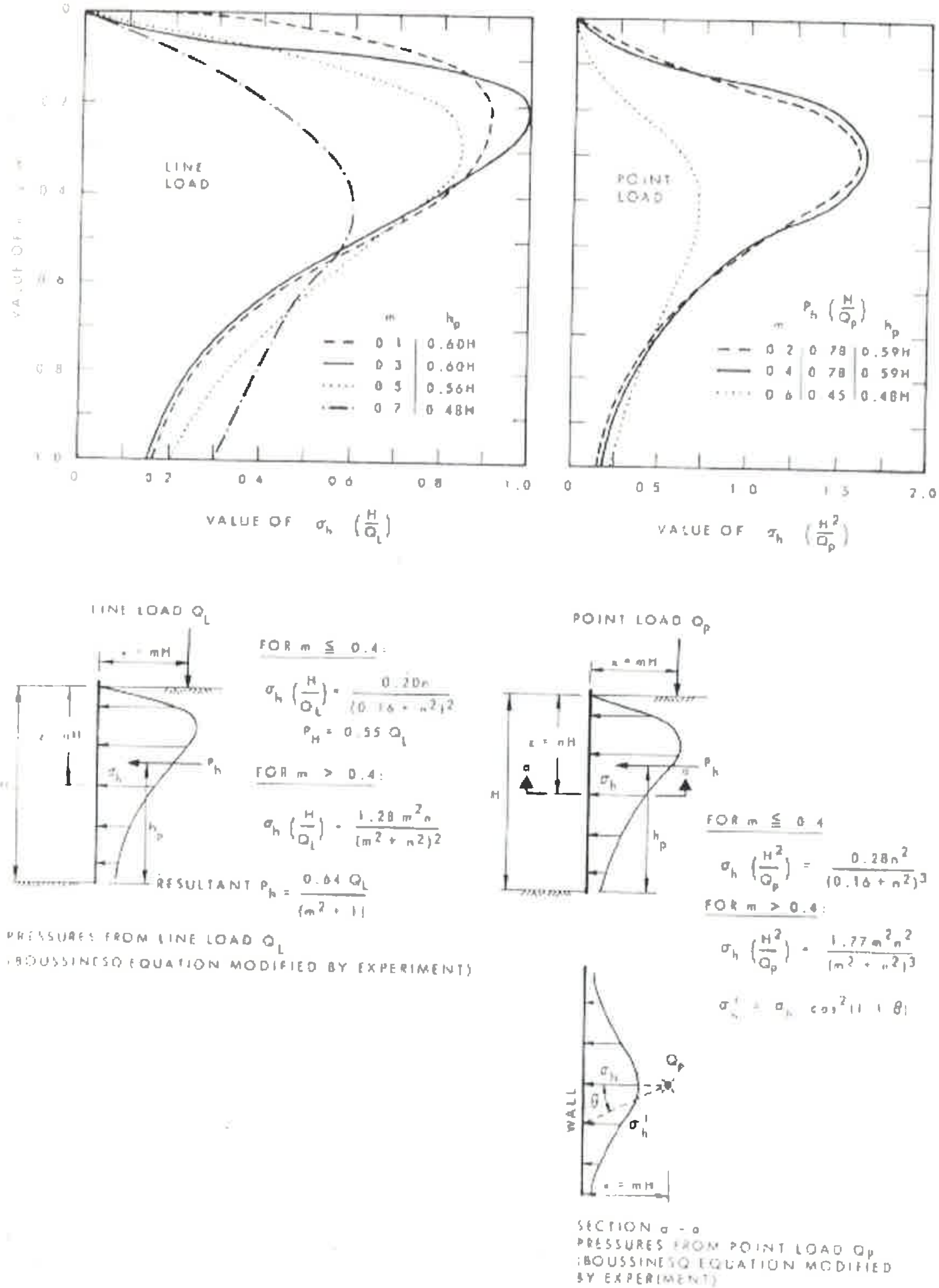
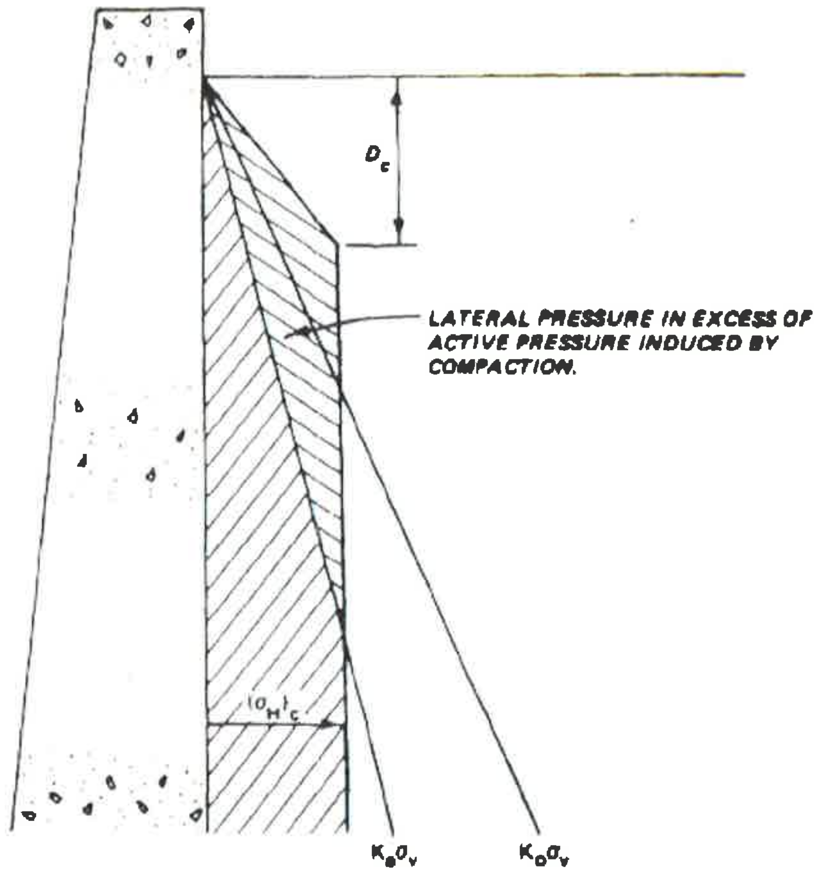
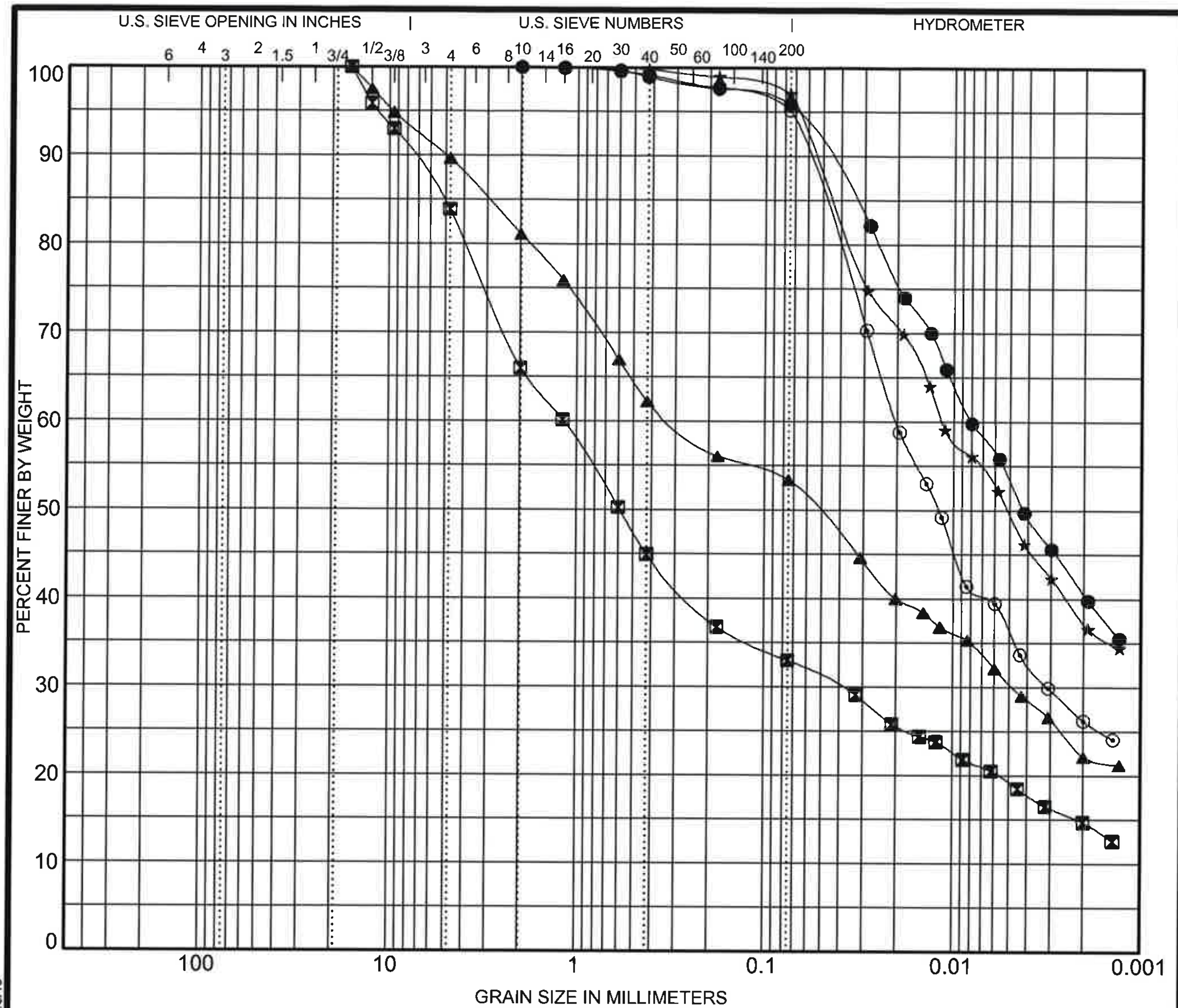


Figure 25.5: Horizontal pressures on a wall due to point and line load surcharges.



COMPACTION EQUIPMENT	CRITICAL DEPTH, D_c, ft	$(\sigma_H)_c$ psf
10-TON SMOOTH WHEEL ROLLER	1.9	420
3.2-TON VIBRATORY ROLLER	1.7	400
1.4-TON VIBRATORY ROLLER	1.2	280
400-KG VIBRATORY PLATE	1.5	340
120-KG VIBRATORY PLATE	1.0	240



Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	5	2.3	**LEAN CLAY(CI)**	47	18	29		
⊠	7	2.3	**CLAYEY SAND with GRAVEL(SC)**	33	15	18		
▲	8	2.3	**SANDY FAT CLAY(CH)**	53	23	30		
★	9	2.3	**LEAN CLAY(CI)**	49	18	31		
⊙	10	3.3	**LEAN CLAY(CI)**	42	20	22		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	5	2.3	2	0.008			0.0	4.2	55.4	40.5
⊠	7	2.3	16	1.17	0.04		16.1	50.9	18.3	14.7
▲	8	2.3	16	0.312	0.005		10.4	36.2	31.3	22.1
★	9	2.3	2	0.012			0.0	2.9	59.8	37.2
⊙	10	3.3	2	0.02	0.003		0.0	4.8	69.0	26.2

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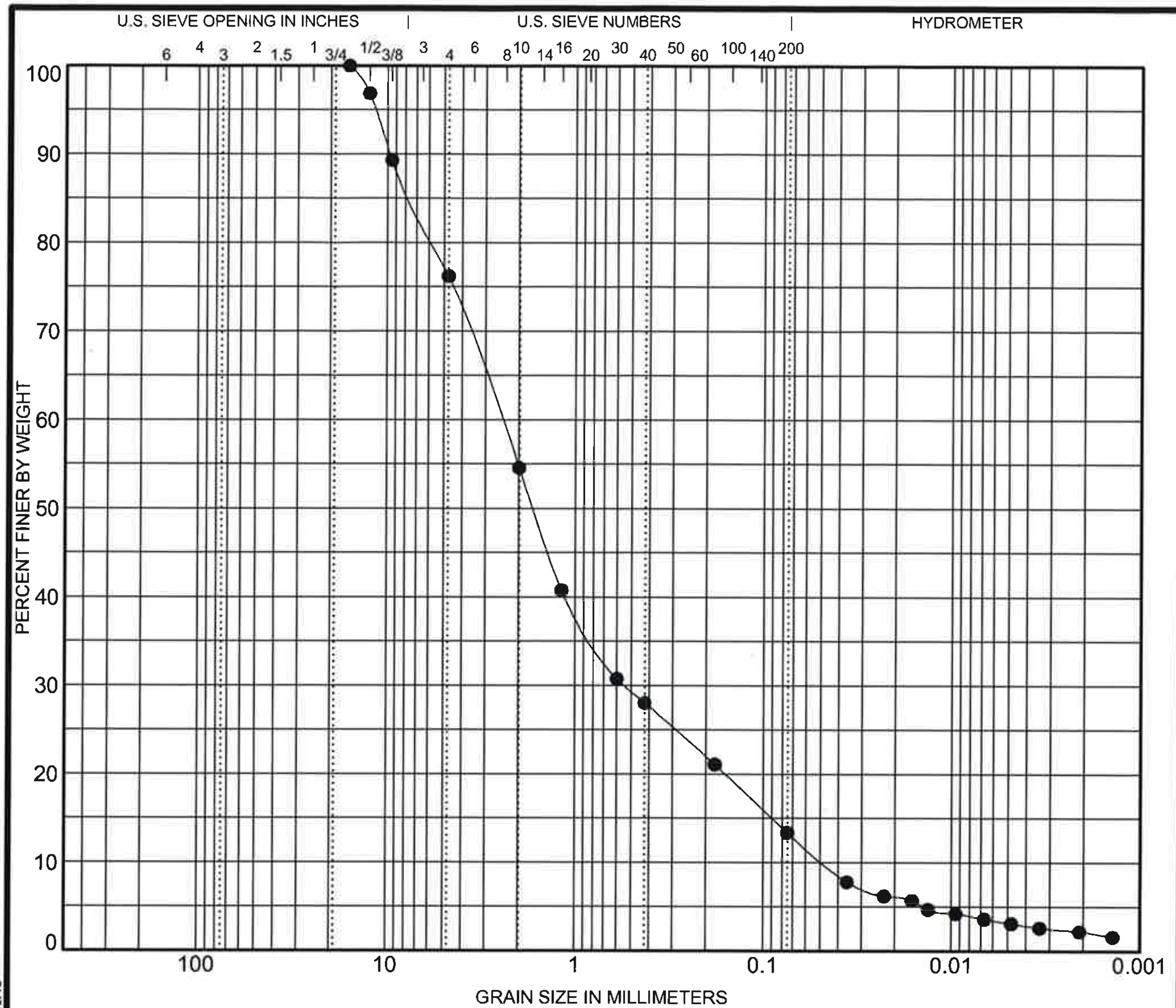
GRAIN SIZE DISTRIBUTION

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	11	2.3	**SILTY SAND with GRAVEL(SM)**	**NP**	**NP**	**NP**	**2.49**	**51.76**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	11	2.3	**16**	**2.484**	**0.544**	**0.048**	**23.8**	**62.8**	**11.3**	**2.1**

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GRAIN SIZE DISTRIBUTION

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
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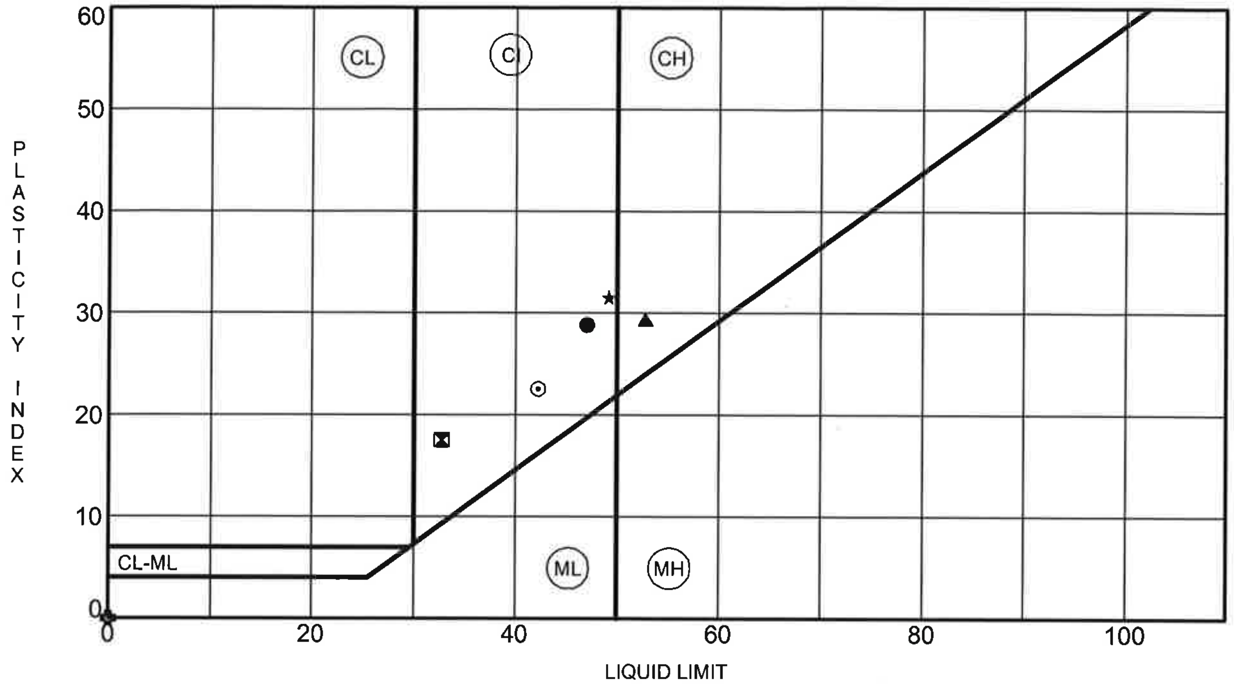

	Specimen Identification		LL	PL	PI	Fines	Classification
●	5	2.3	47	18	29	96	**LEAN CLAY(CI)**
⊠	7	2.3	33	15	18	33	**CLAYEY SAND with GRAVEL(SC)**
▲	8	2.3	53	23	30	53	**SANDY FAT CLAY(CH)**
★	9	2.3	49	18	31	97	**LEAN CLAY(CI)**
⊙	10	3.3	42	20	22	95	**LEAN CLAY(CI)**
✪	11	2.3	NP	NP	NP	13	**SILTY SAND with GRAVEL(SM)**

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ATTERBERG LIMITS' RESULTS

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
1	0.3							2.9			
1	1.3							4.5			
1	2.3							24.4			
1	3.3							17.4			
1	4.3							34.1			
1	5.3							34.2			
1	6.3							32.5			
1	8.0							33.2			
1	10.0							32.6			
1	15.0							34.8			
1	20.0							60.6			
1	25.0							62.0			
1	30.0							66.0			
1	35.0							63.5			
1	40.0							62.8			
2	0.3							3.0			
2	1.3							24.4			
2	2.3							24.6			
2	3.3							22.5			
2	4.3							20.8			
2	5.3							22.4			
2	6.3							29.0			
2	8.0							31.9			
2	10.0							32.9			
2	15.0							33.3			
2	20.0							37.3			
2	25.0							62.7			
2	30.0							62.4			
2	35.0							67.3			
2	40.0							66.3			
3	0.3							4.0			
3	1.3							21.2			
3	2.3							20.5			
3	3.3							24.8			
3	4.3							24.9			
3	5.3							20.3			
3	6.3							27.2			
3	8.0							29.1			
3	10.0							31.1			
3	15.0							34.8			
3	16.0							34.9			
3	20.0							46.6			
3	25.0							62.4			

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Summary of Laboratory Results

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
3	26.0							67.0			
3	30.0							66.8			
3	35.0							62.9			
3	36.0							62.6			
3	40.0							63.8			
3	45.0							48.8			
3	46.0							43.7			
3	50.0							70.4			
3	55.0							73.1			
3	56.0							72.8			
3	60.0							68.2			
3	65.0							67.9			
3	66.0							59.5			
3	70.0							56.9			
3	75.0							54.1			
3	76.0							63.5			
3	80.0							53.8			
3	85.0							52.7			
3	90.0							54.7			
3	95.0							53.4			
3	100.0							65.7			
4	0.3							2.9			
4	1.3							6.5			
4	2.3							16.8			
4	3.3							25.8			
4	4.3							27.7			
4	5.3							30.6			
4	6.3							27.7			
4	8.0							27.6			
4	10.0							28.7			
4	15.0							36.1			
4	20.0							49.9			
4	25.0							63.9			
4	30.0							64.0			
4	35.0							67.8			
4	40.0							62.0			
5	0.3							39.0			
5	1.3							35.7			
5	2.3	47	18	29	2	96	CI	31.8			
5	3.3							31.5			
5	4.3							32.4			
5	5.3							32.1			
5	6.3							35.2			

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Summary of Laboratory Results

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
5	8.0							34.1			
5	10.0							34.5			
6	0.3							22.0			
6	1.3							33.7			
6	2.3							27.4			
6	3.3							29.2			
6	4.3							30.0			
6	5.3							30.3			
6	6.3							32.8			
6	8.0							33.5			
6	10.0							33.9			
7	0.3							2.8			
7	1.3							6.8			
7	2.3	33	15	18	16	33	SC	13.2			
7	3.3							22.1			
7	4.3							39.4			
7	5.3							35.9			
7	6.3							29.1			
7	8.0							31.2			
7	10.0							33.8			
8	0.3							3.6			
8	1.3							14.7			
8	2.3	53	23	30	16	53	CH	21.1			
8	3.3							30.6			
8	4.3							31.2			
8	5.3							30.8			
8	6.3							32.4			
8	8.0							33.5			
8	10.0							31.6			
9	0.3							26.8			
9	1.3							27.6			
9	2.3	49	18	31	2	97	CI	24.6			
9	3.3							27.4			
9	4.3							32.0			
9	5.3							33.6			
9	6.3							33.5			
9	8.0							36.1			
9	10.0							36.5			
10	0.3							26.1			
10	1.3							34.9			
10	2.3							32.4			
10	3.3	42	20	22	2	95	CI	26.4			
10	4.3							28.7			

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Summary of Laboratory Results

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537

Borehole	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
10	5.3							31.0			
10	6.3							33.6			
10	8.0							32.8			
10	10.0							34.6			
11	0.3							7.0			
11	1.3							5.9			
11	2.3	NP	NP	NP	16	13	SM	12.3			
11	3.3							14.9			
11	4.3							21.3			
11	5.3							22.4			
11	6.3							26.8			
11	8.0							32.8			
11	10.0							33.0			

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Summary of Laboratory Results

Client: Public Works and Government Services Canada
Project: Warehouse building addition, PIL booths, canopy & Terl
Location: Emerson Point of Entry, Emerson, Manitoba
Number: 2015-1537