

G.I.-30 SEPT. 1976

GEOCRES No. 31C-153DIST. 41 REGION W.P. No. 303-89-00CONT. No. W. O. No. STR. SITE No. HWY. No. 7LOCATION Hwy 7 - from Klemys  
to Perth (Truck Inspection  
No. of PAGES - Station)

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.REMARKS:



**Ministry of  
Transportation and  
Communications**

**FILE No.** \_\_\_\_\_

**DATE** \_\_\_\_\_

**REMARKS**

Bill McClatchre 613 545-4808

Hwy 37 to Hwy 7



Ministry  
of  
Transportation

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## **FOUNDATION DESIGN SECTION**

**foundation  
investigation and  
design report**

**ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION**

WP 303-89-00 DIST 41  
HWY 7 STR SITE

**Glen Tay Truck Inspection Station**

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**GEOCRES 31C-153**

**DATE**

**FEB 19 1996**

# FOUNDATION INVESTIGATION REPORT

For

Glen Tay Truck Inspection Station

W.P. 303-89-00, Highway 7

Distict 41, Kingston

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## INTRODUCTION

This report summarizes the results of a foundation investigation conducted in conjunction with proposed improvements to the Glen Tay Truck Inspection Station. It is planned to replace the existing static scale with a new multi platform scale pit. The new scale pit is to be situated along the same general alignment.

## SITE DESCRIPTION AND GEOLOGY

The site is located at the existing Truck Inspection Station (TIS) situated immediately north of Highway 7 Westbound approximately 3 km west of Perth as shown on the Key Plan in the Appendix. The existing TIS is comprised of an asphaltic roadway, concrete approach slabs and a steel plate covered static scale.

A TIS building is located immediately north of the TIS scale pit. A grass covered median ditch separates the Highway 7 and the TIS roadway.

The land in the area is primarily forested consisting of tall deciduous trees. A low lying swampy area exists immediately north of the TIS area.

Physiographically, the site is located within a clay plain area situated within the Algonquin Highlands Geological Region. The thickness of soils overlying the Precambrian rock in the Algonquin Highlands are generally shallow and vary in composition. At the site, outwash silty sands and glaciolacustrine clayey silts and clays were deposited during the advance and retreat of the Wisconsin glacier that covered all of the Ontario approximately 12,000 years ago.

## INVESTIGATION

### General

The subsurface conditions at the site were obtained by conducting a field investigation at the site. Soil and rock properties were determined by in-situ testing methods and by laboratory testing. Details of the field investigation and the laboratory testing program are discussed below.

### Field Investigation

The fieldwork for this project consisted of the advancement of two sampled boreholes that were completed on 95 06 27. The boreholes were advanced to depths of 6.0 and 6.8 m using a truck mounted drilling unit. The boreholes were advanced through the overburden employing conventional continuous flight hollow stem auguring techniques. Conventional rock coring techniques employing NW casing and a NX core barrel were used to retrieve 1.5 of rock core at each borehole location.

Subsoil samples were generally retrieved at 0.76 metre intervals in accordance with the Standard Penetration Test (ASTM D1586) using a standard split spoon sampler. All subsoil samples were identified in the field and then placed in sealed plastic containers to preserve natural moisture contents in the soil. The samples were then transported to the laboratory where additional visual classifications were carried out and laboratory testing conducted on selected samples.

Groundwater levels were determined by monitoring the water levels in the open boreholes throughout the duration of the field investigation. All boreholes were backfilled upon completion of the fieldwork. The survey related to the location and elevation of the individual boreholes was provided by the Eastern Region Surveys and Plans.

A plan of the site illustrating the locations and elevations of the boreholes are shown on Drawing 3038900-A in the Appendix.

### Laboratory Analyses

All subsoil samples were visually examined in the laboratory in accordance with the procedures outlined in the Visual Method described in Chapter 2 of the MTO Soil Classification Manual. Laboratory testing of samples consisted of the routine physical and index property testing and included atterberg limits, particle size analyses, natural moisture contents and bulk unit weights. The testing enabled the behaviour of cohesive soils and the gradation of cohesive and cohesionless soils to be determined.

Sample preparation and testing were conducted in accordance with the MTO Laboratory Testing Manual.

Laboratory test results have been summarized below in the subsequent section of this report entitled "Subsurface Conditions" and are illustrated on the corresponding boreholes and figures included in the Appendix to this report.

### SUBSURFACE CONDITIONS

#### General

Subsurface conditions at the site are generally uniform. Beneath the asphaltic roadway surface, a fill material comprised of a compact sand with some silt and a trace of gravel has been placed for a thickness of approximately 1 metre. This fill material is underlain by a native soil comprised of a very loose silty sand with traces of gravel of a shallow thickness ranging between 0.8 metres and 1.1 metres. The cohesionless silty sand stratum is in turn underlain by a very stiff cohesive layer of clayey silt to clay that extends to the bedrock surface. The thickness of the clayey silt to clay stratum varies between 2.1 and 3.3 metres. Bedrock at the site consists of interlayered marble and quartzite.

A subsoil stratigraphical section illustrating the subsurface conditions at the site is provided on Drawing 3038900-B. The boundaries between the various soil types, in situ and laboratory test results as well as groundwater levels established at the time of the investigation are illustrated on the stratigraphical profile and also on the individual Record of Borehole sheets in the Appendix.

Sand, Some Silt, trace Gravel (Fill Material)

Fill material consisting of brown sand, with some silt and traces of gravel has been placed in thickness of approximately one (1) metre at the site. Figure 1 in the Appendix illustrates gradation curves produced by mechanical sieve and hydrometer analysis on two samples of this material. The gradation curves illustrate sand percentages of 45 to 70%, and silt percentages of 18 to 23%. Traces of gravel, clay and organics are also present within the fill material.

Based on SPT (N) values ranging from 12 blows/0.3 m to 17 blows/0.3 m, it is concluded that this fill material is in a compact state of denseness.

Silty Sand, trace Gravel

The fill material is underlain by a grey cohesionless deposit comprised of a silty sand with traces of gravel. The deposit is of a thickness ranging between 0.8 metres and 1.1 metres. Figure 2 in the Appendix illustrates gradation curves produced by mechanical sieve and hydrometer analysis on two samples of this material. The gradation curves illustrate sand percentages of 45 to 53% and silt percentages of 38 to 39%. Traces of gravel and clay are also present within this deposit.

Natural moisture contents are in the 20 to 22% ranges. Samples retrieved were noticeably wet.

Based on SPT 'N' values of less than 2 blows/0.3 m encountered within this deposit, it is concluded that this deposit is in a very loose state of denseness.

Clayey Silt to Clay

The silty sand, trace gravel is in turn underlain by a cohesive stratum of grey clayey silt to clay that extends for thicknesses ranging from 2.1 metres to 3.3 metres to the bedrock surface. Some traces of black organic material exists within the surficial metre or so of this stratum.

Figure 3 in the Appendix illustrates grain size distribution curves produced on representative samples of this material. The curves, produced by mechanical sieve and hydrometer analysis clearly illustrate



that the stratum is comprised primarily of grain sizes smaller than 75 micrometres. Silt percentages range from 39% to 60% and clay percentages range from 33% to 58%. This range in silt/clay percentages account for the range in the behaviour of the soil as described below. Traces of gravel were also encountered within the lower metre of the stratum. In accordance with the MTO Soil Classification Manual, soils with more than 50% of the material finer than 75 micrometre are categorized according to their behaviour. Consequently, Atterberg Limit tests were conducted to define the behaviour and plasticity of the soil. The results of the Atterberg Limit Tests are illustrated on Figure 4 in the Appendix. The test results reveal that the soil has a plasticity ranging from low to high and hence is categorized as a clayey silt (CL) to clay (CH). Liquid limits range from 32% to 55% and plasticity indexes range from 17 to 26%.

Natural moisture contents range between 23 and 38% and are within the plastic and liquid limit range. Built unit weights range between 16.5 kN/m<sup>3</sup> and 20.3 kN/m<sup>3</sup>.

The consistency of the soil was determined by the interpretation of the blow counts or 'N' values as produced by the Standard Penetration Test and also by conducting an in-situ vane test. The in-situ vane test was carried out using an MTO 'N' vane. Based on 'N' values ranging from 7 blows/0.3 m to 14 blow/0.3 m and the observation that the MTO 'N' vane could not be torqued in this stratum, it is concluded that this material has a very stiff consistency.

#### Bedrock - Marble with Interbedded Quartzite

The overburden at the site is underlain by interlayered marble and quartzite bedrock of the Grenville Province Formation at an elevation of approximately 141.7 m to 142.6 m or depths of 4.4 m and 5.3 m respectively. The bedrock surface appears to be relatively flat across the site and is unweathered to slightly weathered.

The marble is very light grey to white in colour whereas the quartzite is dark greenish grey to light grey. The marble is coarse to medium grained and the quartzite is medium to fine grained. The interbedded marble and quartzite are thinly bedded with moderate to extremely closed spaced fractures. Detailed descriptions of the bedrock are attached in the Appendix in a report entitled "Description of Rock Core".

An assessment of the quality and strength of the rock was carried out by measuring core recoveries and Rock Quality Designations (RQD's) in the field and hardness testing in the laboratory. Recoveries were 100% and the rock quality designations ranged from 43% to 62% indicating that the rock is of poor to fair quality. Rock strengths can be described as medium strong and estimated to have unconfined compressive strengths ranging from 50 to 100 MPa.

#### GROUNDWATER CONDITIONS

Observations of the groundwater level was carried out by measuring the water levels in the open boreholes. Prior to introducing drilling fluid to facilitate the rock coring, water levels were approximately 3.6 metres below the ground surface. (Elevation 143.4). However, these levels were not stabilized and based on the observation of water present within the native sandy silt deposit during auguring and sampling, it is expected that the water level could stabilize within this layer at an elevation ranging from 144.7 m to 145.8 m.

Groundwater levels in general, are subject to seasonal fluctuations and hence can vary from the values given in this report.

## DISCUSSION AND RECOMMENDATIONS

It is proposed to upgrade the existing Truck Inspection Station (TIS) located approximately 3 km west of Perth along Highway 7. The upgrading will include the replacement of the existing single platform static scale with multiplatform scales complete with a new scale pit. It is expected that the static scale pit will be similar in design to scale pits recently constructed at other locations across the province. These scale pits have dimensions of approximately 25 m length, 4.5 m width and 2.5 m in depth and usually support five (5) separate load platforms. Approach slabs are located at either end of the static scale pit for an approximate length of 5 m and a 10 m levelling pad is generally designed and constructed beyond the approach slab. A plan that shows the existing TIS roadway and the approximate location of the proposed static scale pit is illustrated on drawing 3038900-A.

It is understood that the profile grade of the TIS roadway will remain the same as existing. The profile grade is also shown on Drawing 3038900-B.

Recommendations pertaining to the following foundation and geotechnical considerations are included in the scope of this report.

1. Structure Foundations
2. Backfill to Scale Pit Walls
3. Approach Slabs and Levelling Slabs
4. Construction Considerations

### Structure Foundations

#### General

It is recommended that the static scale pit be founded on a conventional raft slab type shallow foundation bearing on the native clayey silt to clay subsoil or alternatively founded on a granular 'A' pad constructed from the bedrock surface. It is understood that the load cells used to weigh the trucks and located within the static scale pit are sensitive to differential settlement. Consequently, bearing capacities at the Serviceability Limit State are provided for both pressures that will yield 25 mm as well as 10 mm of settlement. Founding elevations and bearing capacities are given for both options.

The scale pit foundation shall be provided with adequate frost protection. A minimum 1.8 m earth cover or equivalent is recommended at the site.

The design of the scale pit shall consider any additional loadings induced by the existing TIS building foundations. A temporary shoring wall will be needed for facilitate the construction of the new scale pit as described under the Construction Considerations, section of this report.

Under slab and perimeter foundation drainage is recommended. Subdrains consisting of 150 mm diameter pipe wrapped in a suitable geotextile and/or soil filter can be used to drain any groundwater seepage. The subdrains should be connected to a permanent drainage system. Surface runoff water should also be controlled and drained away from the pit.

The options given below are both technically feasible. However, the most economical and practical alternative most suitable to the subsurface and site conditions shall be chosen.

#### Option 1 - Raft Slab on Native Soil

It is recommended that the static scale pit be founded on a raft slab type shallow foundation within the native clayey silt to clay soil at a founding elevation of 144.5. It is cautioned that traces of organics were encountered within the surficial metre or so of this deposit. Any softened, deleterious or organic material present at the founding elevation shall be removed and replaced with a compacted Granular 'A' material or mass concrete. A NSSP shall also be included in the contract documents that specifies that the founding soil be protected by placement of the mass concrete or granular 'A' material within four (4) hours of exposure.

Table 1 below summarizes the bearing capacities at the Serviceability and Ultimate Limit State. The foundation design shall be carried out in accordance with Section 6-8 of the 3rd Edition of the OHBDC. The bearing capacities tabulated represent the net bearing capacities.

Table 1 - Static Pit on Native Soil

Foundation Elevation (m)	Bearing Capacity at S.L.S. (kPa)		Factored Capacity at U.L.S. (kPa)
	10 mm	25 mm	
144.5	100	250	350

The settlements produced as a result of the applied pressures will be the result of the recompression of the native soil and hence will be elastic and immediate in nature. The bearing capacities tabulated in Table 1 are based on a footing width of four (4) metres.

*Option 2 - Raft Slab on Compacted Granular 'A' Pad*

Alternatively, consideration can be given to subexcavating the native clayey silt to clay stratum to the bedrock surface and constructing the scale pit on a raft slab founded on a built up compacted granular 'A' pad. The bedrock surface ranges in elevation from 142.6 m to 141.7 m at the site. Therefore for a 2.5 metre scale pit depth, subexcavation depths ranging from approximately 1.9 metres to 2.8 metres would be required. Temporary slopes to facilitate the subexcavation shall be constructed at 1.5H:1V. The Granular 'A' pad shall then be constructed at 1H:1V slopes in both the transverse and longitudinal directions to the required concrete pit soffit elevation. A one (1) metre edge distance shall be provided from the crest of the pad and the edge of the footing as illustrated in Figure 5.

The Granular 'A' pad shall be placed and compacted in accordance with OPSS 501series to achieve 100% standard proctor maximum dry density.

For a Granular 'A' pad constructed as described above, not bearing capacities as tabulated in Table 2 can be employed. The foundation design shall be carried out in accordance with Section 6-8 of the OHBDC.

**Table 2 - Static Scale Pit on Granular 'A' Pad**

Scale at Soffit Elev. (m)	Subexcavation to Bedrock		Bearing Capacity at S.L.S. (kPa)		Factored Capacity at U.L.S. (kPa)
	Elevation (m)	Depth (m)	10 mm	25 mm	
144.5	142.6 m to 141.7	1.9 to 2.8	150	350	900

The settlements yielded as a result of the applied pressures will be as a result of the recompression of the native soil and hence will be elastic and immediate in nature. The bearing capacities tabulated in Table 2 are based on a footing width of four (4) metres.

**2) Backfill to Scale at Walls**

It is recommended that the backfill to the static scale pit walls consist of a Granular 'A' or Granular 'B' material. The combination of granular material and the perimeter foundation drainage will prevent the accumulation of any hydrostatic pressure. The granular backfill material shall be placed in accordance with OPSS 501 series using hand compaction equipment.

Lateral earth pressures exerted against the scale pit walls including compaction pressures shall be computed in accordance with Section 6-7 of the 3rd edition of the OHBDC. The at-rest earth pressure shall be used. Soil parameters to facilitate this computation are given in Table 3 below.

Table 3 - Backfill Soil Properties

	Granular A	Granular B
Angle of Internal Friction ( $\phi$ )	35°	30
Bulk Unit Weight (kN/m <sup>3</sup> ), $\gamma$	22.8	21.2
Coefficient of At-Rest Earth Pressure ( $K_o$ )	0.43	0.5

### 3) Approach Slabs and Levelling Slabs

To avoid differential settlements between the scales and the approach ramps, it is recommended that any organic, deleterious or loosened material be subexcavated and the exposed surface be proof-rolled by suitable compaction equipment. Any new fill material placed on the proof-rolled material shall consist of Granular 'A' or Granular 'B'. The material shall be placed in accordance with OPSS 501 series and compacted to achieve 100% standard proctor maximum dry density.

### 4) Construction Considerations

#### Excavation

Temporary excavation slopes within the existing fill material and native material at the site to facilitate the removal of the existing scale pit and the construction of the new scale pit shall not be steeper than 1.5H:1V.

#### Temporary Shoring

In view of the presence of the existing truck inspection building and the recommended 1.5H:1V temporary slope geometry, a temporary shoring system will be required to facilitate the construction of the new scale pit. Figure C6-8.3e in the 3rd edition of the OHBDC commentary illustrates that a shoring wall is required to preserve the integrity of the existing structure foundations whenever excavation for an adjacent structure encroaches within the zone of influence of the existing foundation.

The temporary shoring system shall be designed and constructed in accordance with Section 6-7 of the OHBDC and OPSS 539. A conventional soldier pile-timber lagging wall is recommended. The wall can be designed as a cantilever system if feasible. Should additional lateral resistance be required consideration can be given to an anchored wall or a raker supported wall. Design parameters for an owner design wall are given below. A contractor design shoring wall shall be reviewed by the Structural Office and our office.

#### Earth Pressure Calculation

Lateral earth pressures shall be calculated in accordance with Section 6-7 of the OHBDC. Any surcharge effects caused by the existing TIS building shall be included in the design. Design parameters to compute earth pressure coefficients are tabulated in Table 4 below. The at-rest earth pressure coefficient shall be used.

Table 4 - Lateral Earth Pressure Calculation  
Parameters

Soil	Elevation (m)	Angle of Internal Friction ( $\phi$ )	Horizontal Capacity (kPa)	Bulk Unit Weight $\gamma$ (kN/m <sup>3</sup> )
Sand, some Silt trace Gravel (Fill)	147 - 146	30°		20
Silty Sand trace Gravel	146 - 145	28°		20
Clayey Silt to Clay	145 - 142	28°		17
Marble with Interbedded Quartzite	<142		1000	25

#### Rock Anchors

Should anchors be required, tiebacks can be drilled and anchored in the bedrock. A bond stress of 500 kPa can be used in designing the bond zone of the rock anchor. It is recommended that a NSSP specifying the materials, installation and stressing of the anchors be included in the contract documents. This NSSP can be obtained from our office.



### Raker Foundations

Raker foundations can also be considered to laterally support the shoring wall. Raker foundations can be installed within the native clayey silt to clay at or below the founding elevations recommended for the scale pit foundation using the capacities tabulated in Table 1.

Alternatively raker foundations can be founded on the bedrock surface using a factored capacity at U.L.S. of 10,000 kPa. Due to the unyielding nature of the rock, the bearing capacity at the Serviceability Limit State will not govern the design because the bearing pressure required to yield the rock will exceed the capacity at the U.L.S.

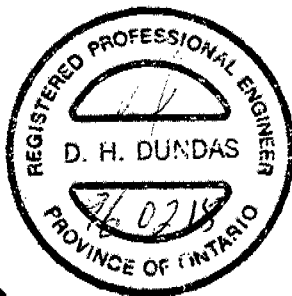
### Dewatering

No dewatering problems are anticipated during the construction of the scale pit. Conventional sump pumping techniques can be used to control any localized seepage within the silty sand stratum, clayey silt to clay stratum or bedrock.

### MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of W.J. McLatchie, Geotechnical Engineer and T. Sangiuliano, Foundation Engineer utilizing equipment owned and operated by Marathon Drilling.

The project was carried out by T. Sangiuliano under the general supervision of D. Dundas, Senior Foundation Engineer. The report was written by T. Sangiuliano and reviewed by D. Dundas.

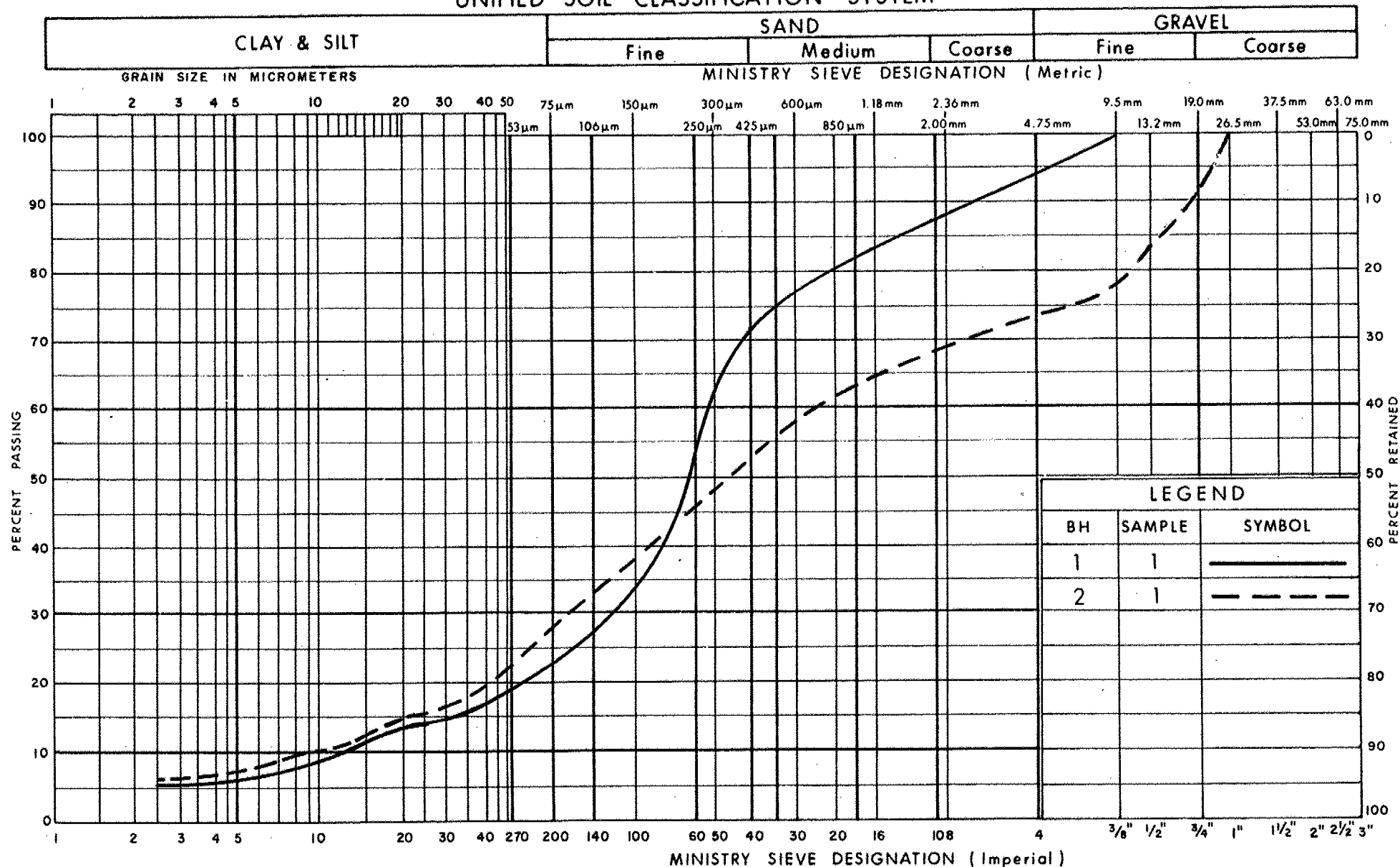


*D. Dundas*  
D. Dundas, P. Eng.  
Senior Foundation Engineer

*T. Sangiuliano*  
T. Sangiuliano, P. Eng.  
Foundation Engineer

## **APPENDIX**

## UNIFIED SOIL CLASSIFICATION SYSTEM



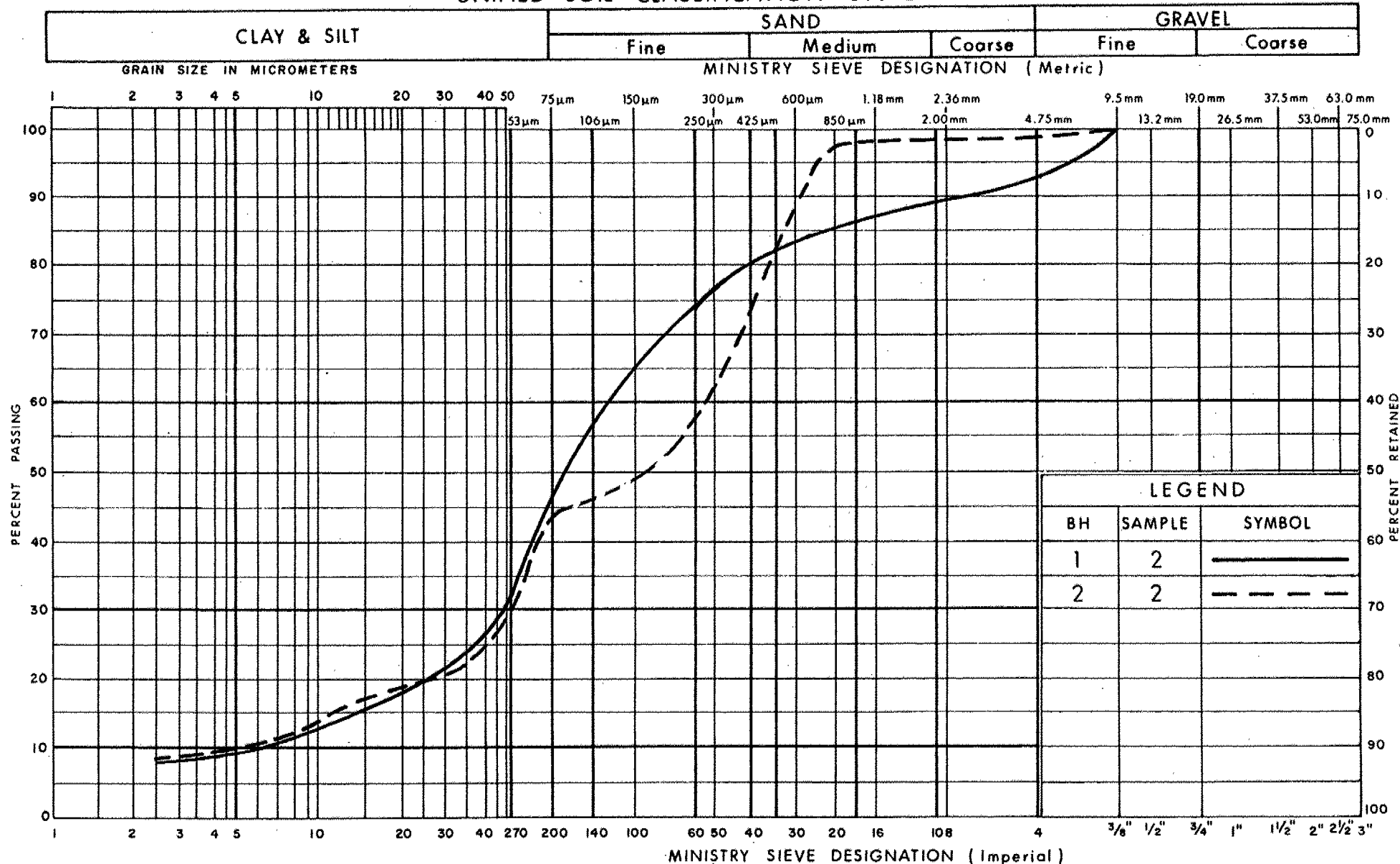
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**GRAIN SIZE DISTRIBUTION**  
**SAND, SOME SILT, TRACE GRAVEL**  
**( FILL MATERIAL )**

**FIG No 1**

**W P 303 - 89 - 00**

## UNIFIED SOIL CLASSIFICATION SYSTEM



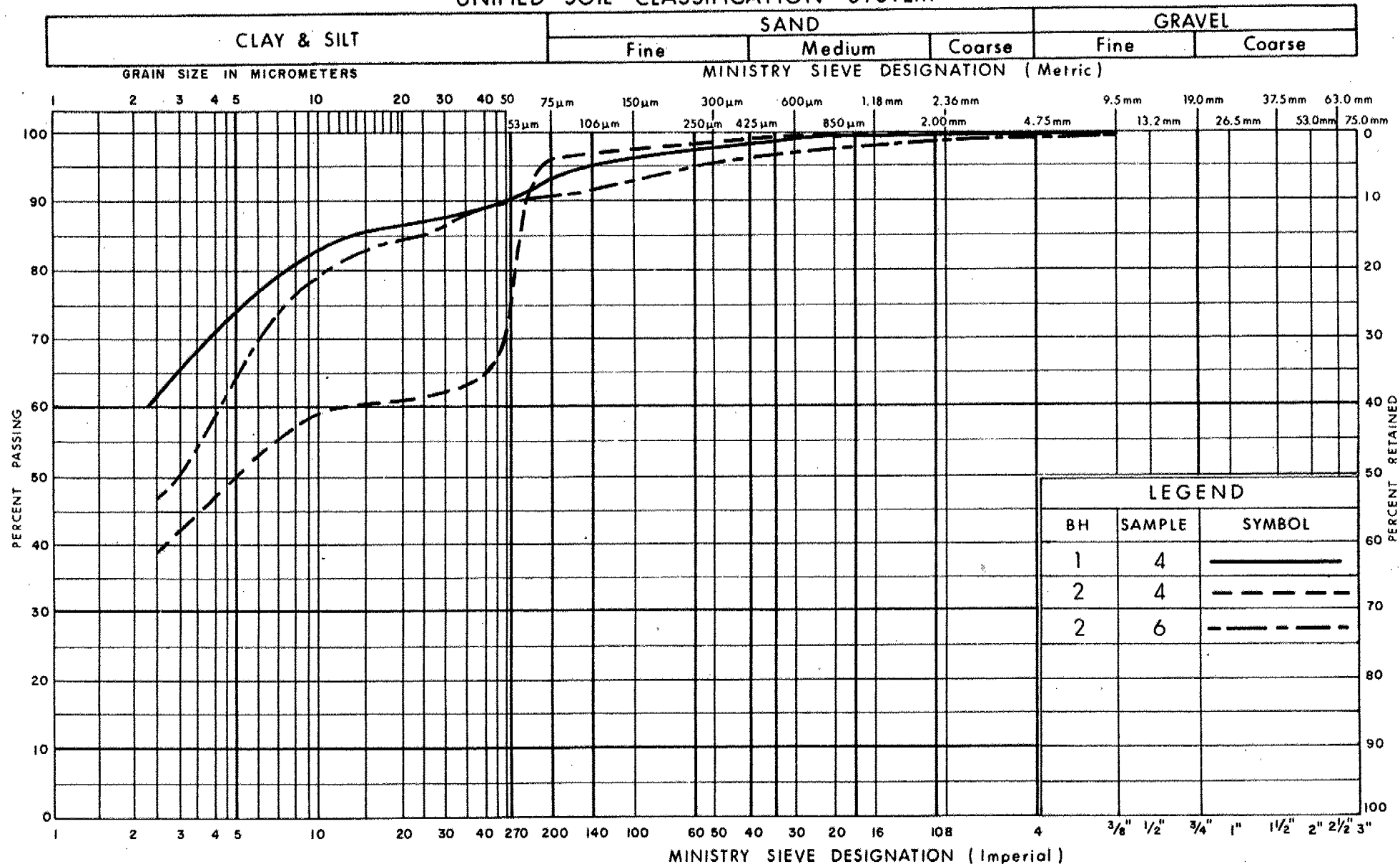
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GRAIN SIZE DISTRIBUTION  
SILTY SAND, TRACE GRAVEL

FIG No 2

W P 303-89-00

## UNIFIED SOIL CLASSIFICATION SYSTEM

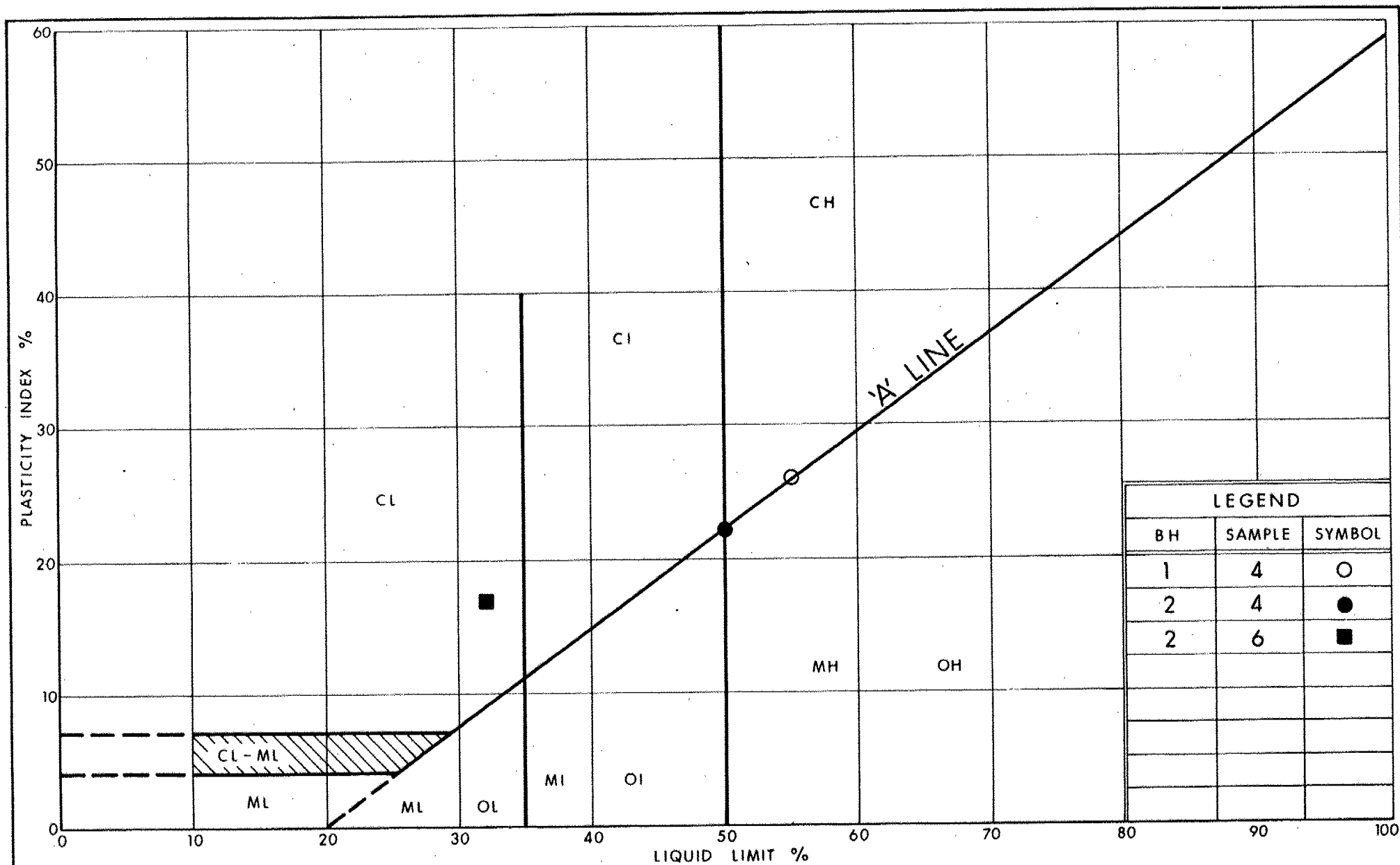


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## GRAIN SIZE DISTRIBUTION CLAYEY SILT TO CLAY

FIG No 3

W P 303-89-00



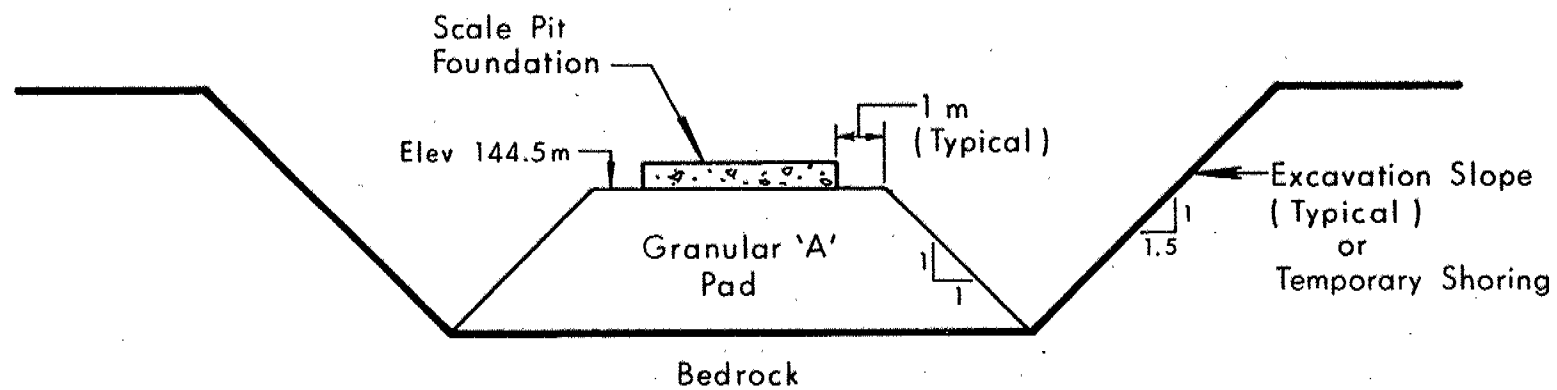
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# PLASTICITY CHART CLAYEY SILT TO CLAY

FIG No 4

W P 303-89-00

Figure 5 - GRANULAR 'A' PAD CONSTRUCTION



NOT TO SCALE

WP 303-89-00

# RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. 303-89-00 LOCATION Coords: N 4 971 337.9; E 319 211.2 ORIGINATED BY TS  
DIST 41 HWY 7 BOREHOLE TYPE HS Auger/NW Casing/Rock Coring COMPILED BY DB  
DATUM Geodetic DATE 95 06 27 CHECKED BY TS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
147.0	Ground Surface													
0.0	Asphalt													
0.2	SAND, some Silt, trace Gravel Brown, Compact													
145.8	(FILL MATERIAL)		1	SS	17		146							6 70 18 6
1.2	SILTY SAND, trace Gravel		2	SS	1		145							8 45 39 8
144.7	Grey, Very Loose													
2.3	Block, trace Organics		3	SS	7		144							
	CLAYEY SILT to CLAY													
	Grey, Very Stiff		4	SS	15		143							0 6 39 55
142.6			5	SS	**43 /26cm									
4.4	BEDROCK MARBLE with interbedded QUARTZITE						142							
	Unweathered to Slightly Weathered		6	RC	REC 100%									RQD =43%
141.0	Very Light Grey to White, Medium Strong													
6.0	End of Borehole													
	* GWL prior to Rock Core, ( Not Stabilized )													
	** Sampler Bouncing													



# RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. 303-89-00 LOCATION Coords: N 4 971 349.0; E 319 233.3 ORIGINATED BY TS  
 DIST 41 HWY 7 BOREHOLE TYPE HS Auger/NW Casing/Rock Coring COMPILED BY DB  
 DATUM Geodetic DATE 95 06 27 CHECKED BY TS

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
147.0	Ground Surface													
0.0	Asphalt													
0.2	SAND, some Silt, trace Gravel Brown, Compact (FILL MATERIAL)		1	SS	12		146							26 45 23 6
1.2	SILTY SAND, trace Gravel Brown, Very Loose		2	SS	2		145							2 53 38 7
145.0														
2.0	Black, trace Organics		3	SS	10		144							
	CLAYEY SILT to CLAY		4	SS	9		143						16.5	0 3 60 37
	Grey		5	SS	14		142							
	Very Stiff		6	SS	7		141						20.3	1 8 58 33
141.7														
5.3	BEDROCK MARBLE with interbedded QUARTZITE		7	RC	REC									RQD =62%
	Unweathered to Slightly Weathered													
	Very Light Grey to White, Medium Strong													
140.2														
6.8	End of Borehole													
	* GWL prior to Rock Core, ( Not Stabilized )													

# ROCK CORE DESCRIPTION

## WP 303-89-00

Page 1 of 1

CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
1	6	4.44-5.97	100	43	4.44-5.61	<b>MARBLE</b> (containing graphite, pyrite, and serpentine), very light grey to white; coarse to medium grained; unconfined compressive strength 50-100 MPa; unweathered to slightly weathered; fractures moderate to very close spaced, dipping to flat, undulating to planar, rough.
					5.61-5.97	<b>QUARTZITE</b> (containing calcite, serpentine, pyrite, and garnet), dark greenish grey to light grey; fine to medium grained; unconfined compressive strength 50-100 MPa; unweathered to slightly weathered; fractures close to very close spaced, dipping to near vertical, undulating to planar, rough to smooth.
2	7	5.26-6.78	100	62	5.26-6.17	<b>MARBLE</b> (containing graphite and serpentine), very light grey to white; coarse to medium grained; unconfined compressive strength 50-100 MPa; unweathered to slightly weathered; fractures moderate to very close spaced, dipping to flat, undulating to planar, rough.
					6.17-6.78	<b>QUARTZITE</b> (containing calcite, serpentine, and pyrite), dark greenish grey to light grey; fine to medium grained; unconfined compressive strength 50-100 MPa; unweathered to slightly weathered; fractures close to extremely close spaced, dipping to near vertical, undulating to planar, rough to smooth.

\*CR = CORE RECOVERY

\*RQD = ROCK QUALITY DESIGNATION

*Note: Depths are approximated where core recovery is less than 100%*

Logged by: DAW, Soils and Aggregates Section

## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ( $c_u$ ) AS FOLLOWS:

$c_u$ (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

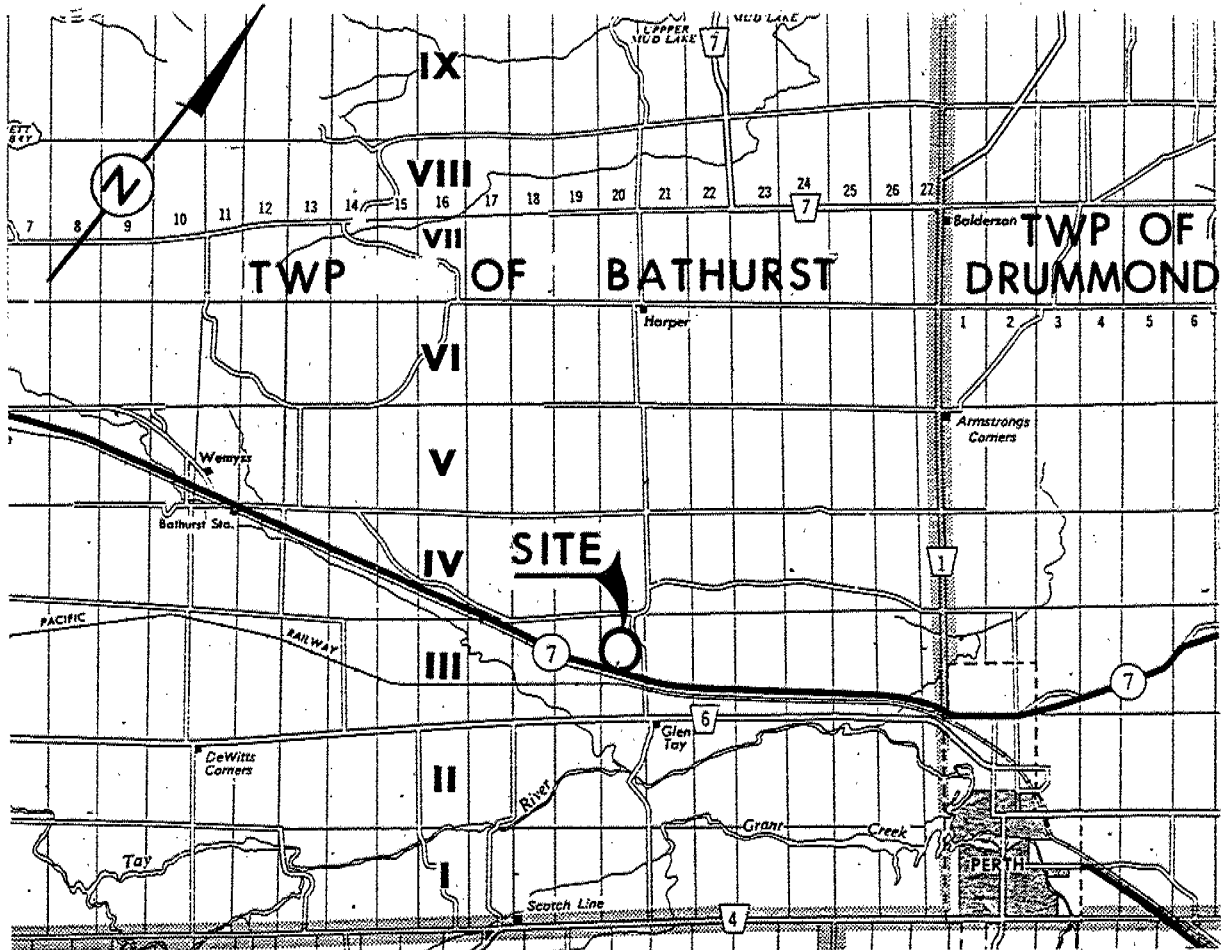
### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

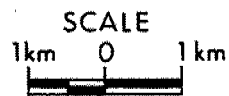
### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kN/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kN/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kN/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kN/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kN/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

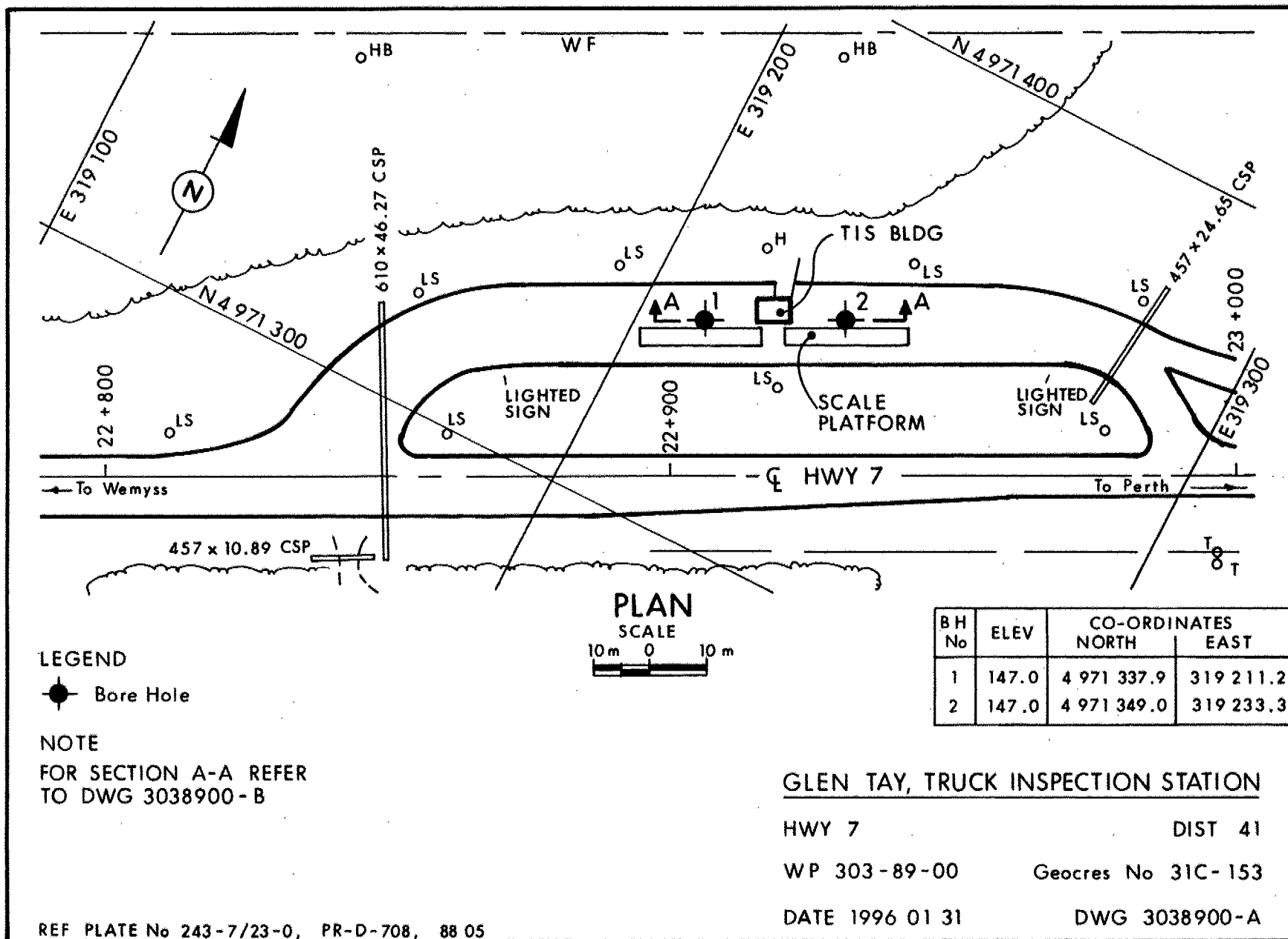
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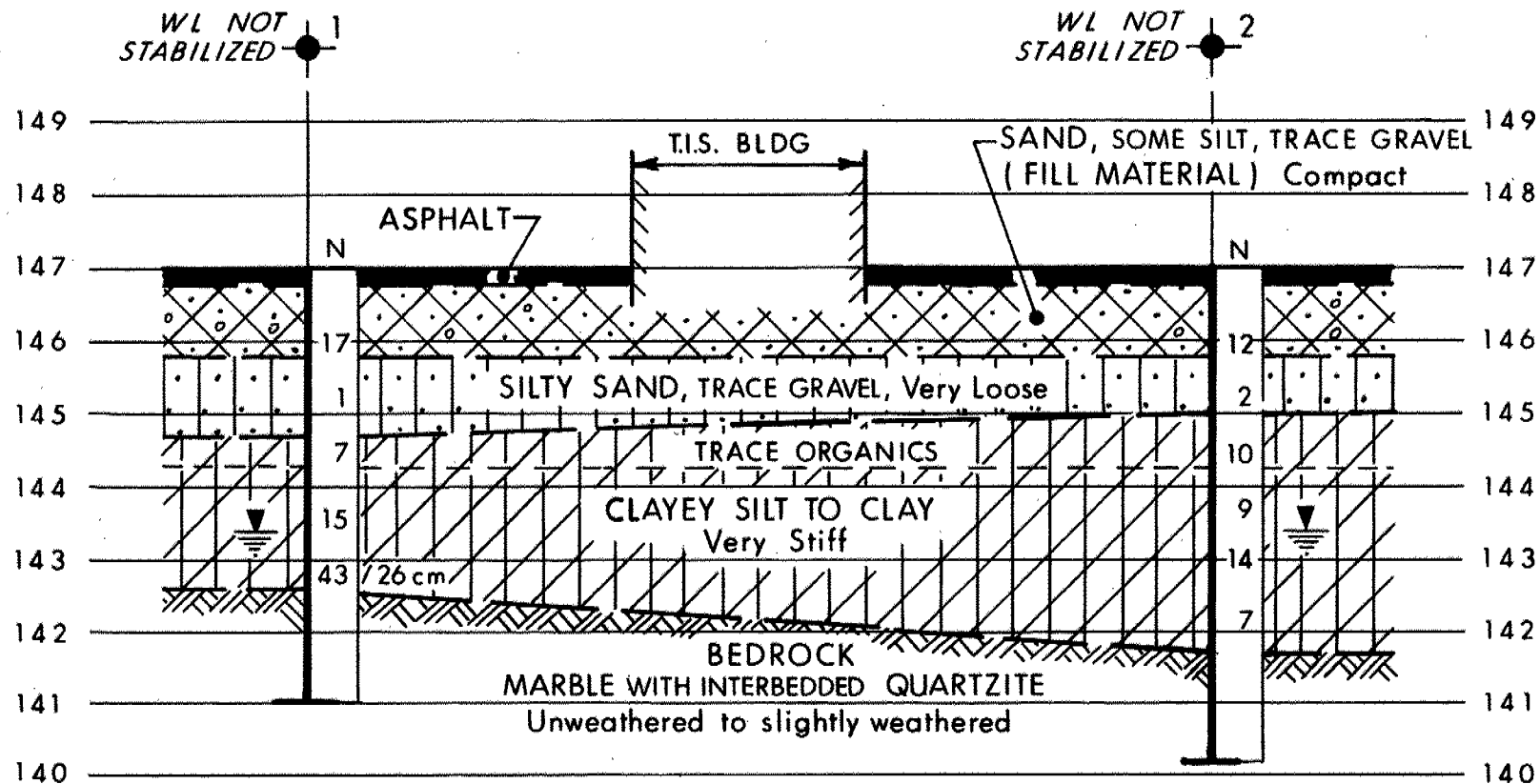


## KEY PLAN





WP 303-89-00



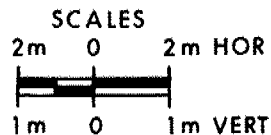


### SECTION A-A

#### LEGEND

-  Bore Hole
-  Water Level

NOTE  
FOR PLAN REFER TO  
DWG 3038900 - A



#### GLEN TAY, TRUCK INSPECTION STATION

HWY 7

DIST 41

WP 303-89-00

Geocres No 31C-153

DATE 1996 01 31

DWG 3038900-B



80 Commerce Valley Dr. East  
Thornhill, Ontario  
Canada L3T 7N4  
Tel: (416) 882-1100  
Fax: (416) 882-0055

Mr. D. Wong  
File: 16-90098  
February 28, 1991  
Page 2



In the meantime, should you require more detail with respect to the scale designs, please don't hesitate to call.

Yours very truly

**MARSHALL MACKLIN MONAGHAN LIMITED**

L.A. Martin, M. Eng.  
Senior Project Engineer  
Transportation Engineering

IW:sc:LAM2:5

Enclosure

cc: S. Jacobs, MTO  
S. Brown, MMM  
J. Fung, MMM





METRIC  
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AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

PLATE No  
CONT No  
WP No2501-86-00

STATIC SCALE PIT  
SECTIONS & DETAILS

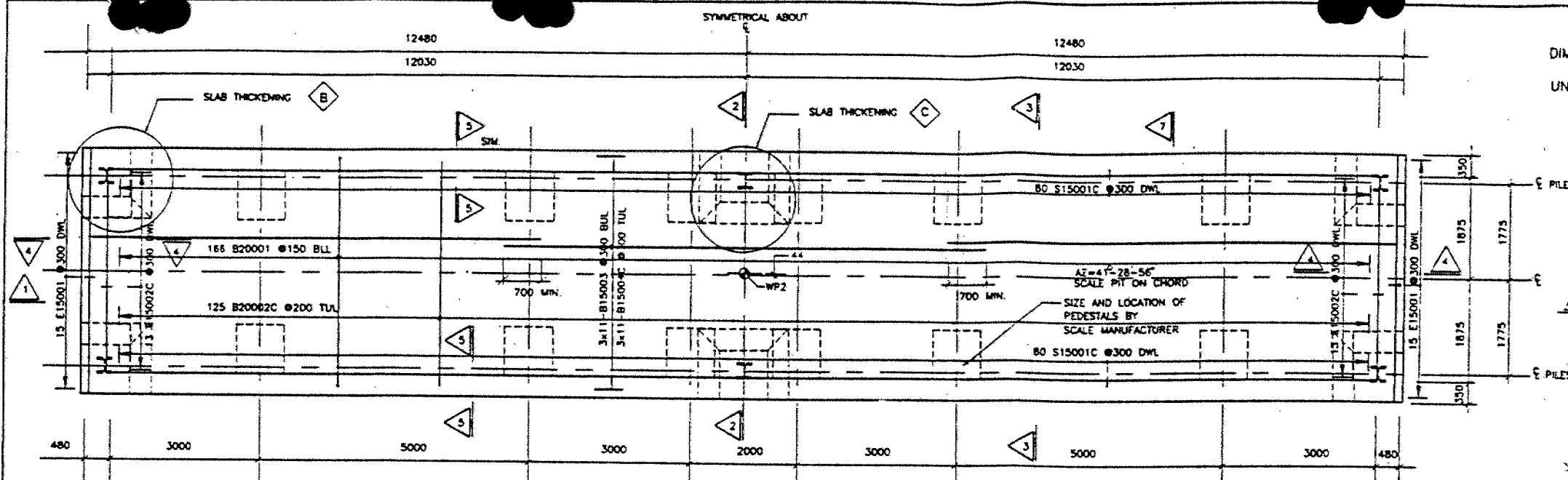
130

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275 Dundas St. W. 2nd Fl., Ont. 449-2500

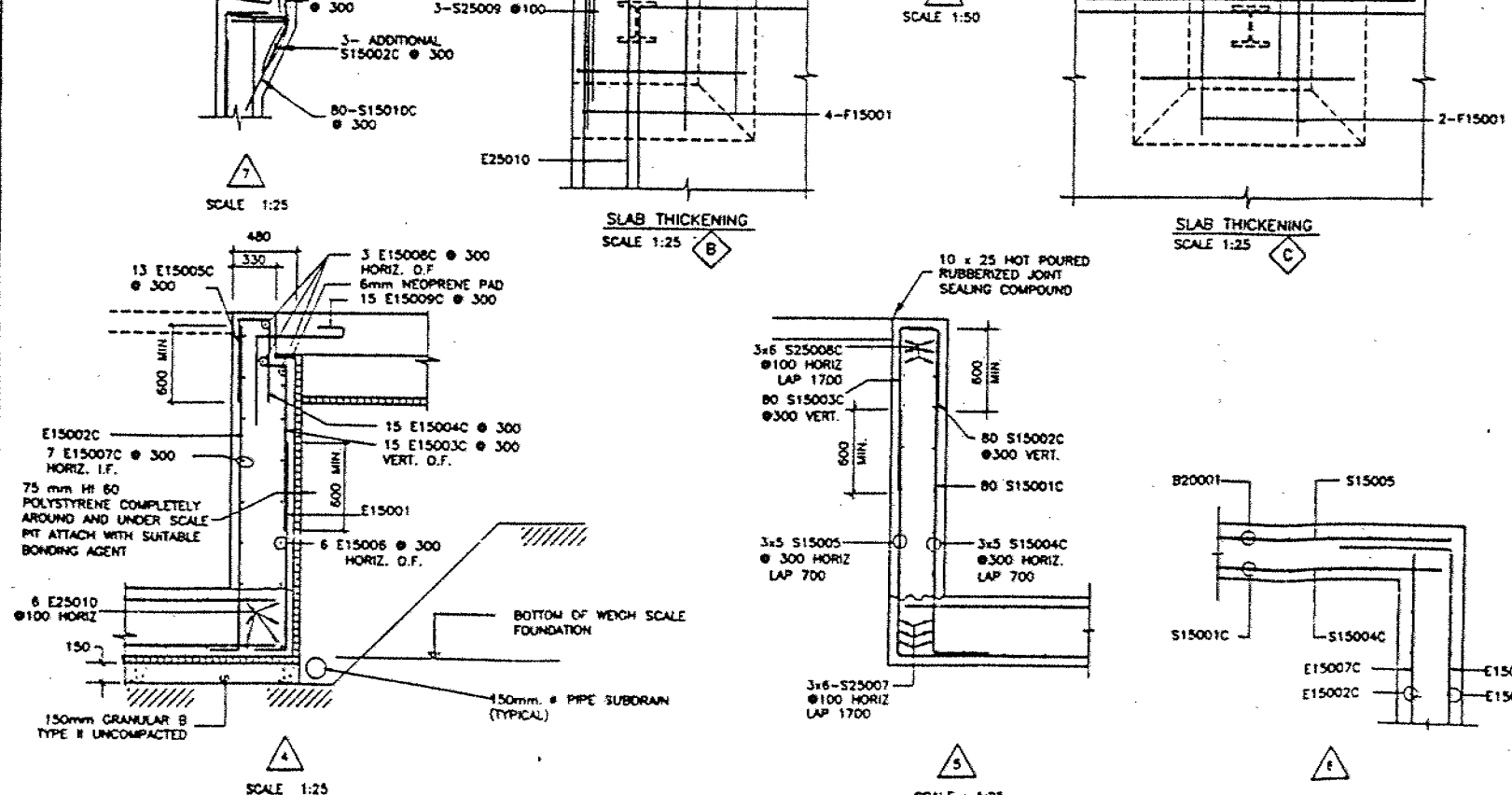
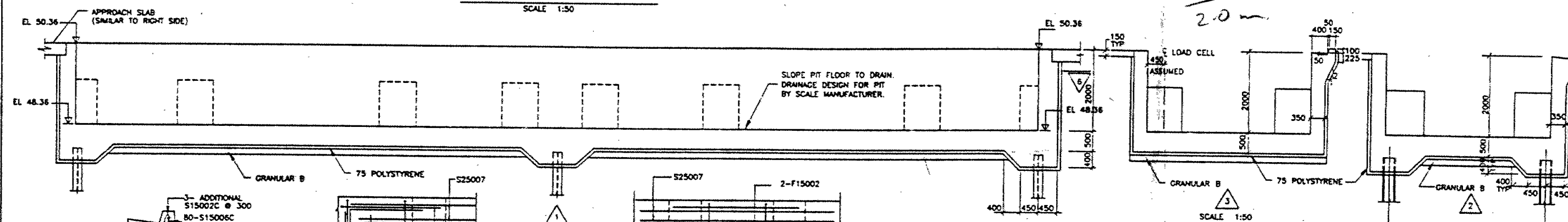
NOTES:

- 1) FOR GENERAL NOTES SEE DWG. S01.
- 2) LOAD CELL NOT TO BE FARTHER FROM WALL THAN SHOWN IN SECTION THREE UNLESS APPROVED BY THE ENGINEER.

PILE DATA HP 310x110			
#	APPROX. LENGTH	CUT OFF ELEV.	BATTER
6	12.4	47.4	NONE



PLAN - SCALE PIT REINFORCEMENT  
SCALE 1:50



REINFORCING BAR SCHEDULE

MARK	#	LENGTH	TYPE	A	B	C	D	J	K	R
B20001	166	8000	17		1850	4300	1850			
B20002C	125	4250	STR							
B15003	33	8700	STR							
B15004C	33	8700	STR							
S15001C	160	2440	2	210	2230					
S15002C	160	910	2	210	700					
S15003C	160	1410	2	210	1200					
S15004C	30	8700	STR							
S15005	30	8700	STR							
S15006C	80	700	2	250	450					
S25007	36	9400	STR							
S25008C	36	9400	STR							
S25009	12	1800	2	900	900					
S15010C	80	1440	13		400		900		190	65
E15001	30	1150	2	250	900					
E15002C	28	2580	2	250	2330					
E15003C	30	1450	2	250	1200					
E15004C	30	790	2	190	600					
E15005C	26	790	2	190	600					
E15006	12	5200	17		450	4300	450			
E15007C	14	4200	STR							
E15008C	8	5200	17		450	4300	450			
E15009C	30	1560	18	300	500	600			180	
E25010	12	4200	STR							
F15001	20	2280	16		700	780	800			
F15002	4	2410	14		800	810	800			

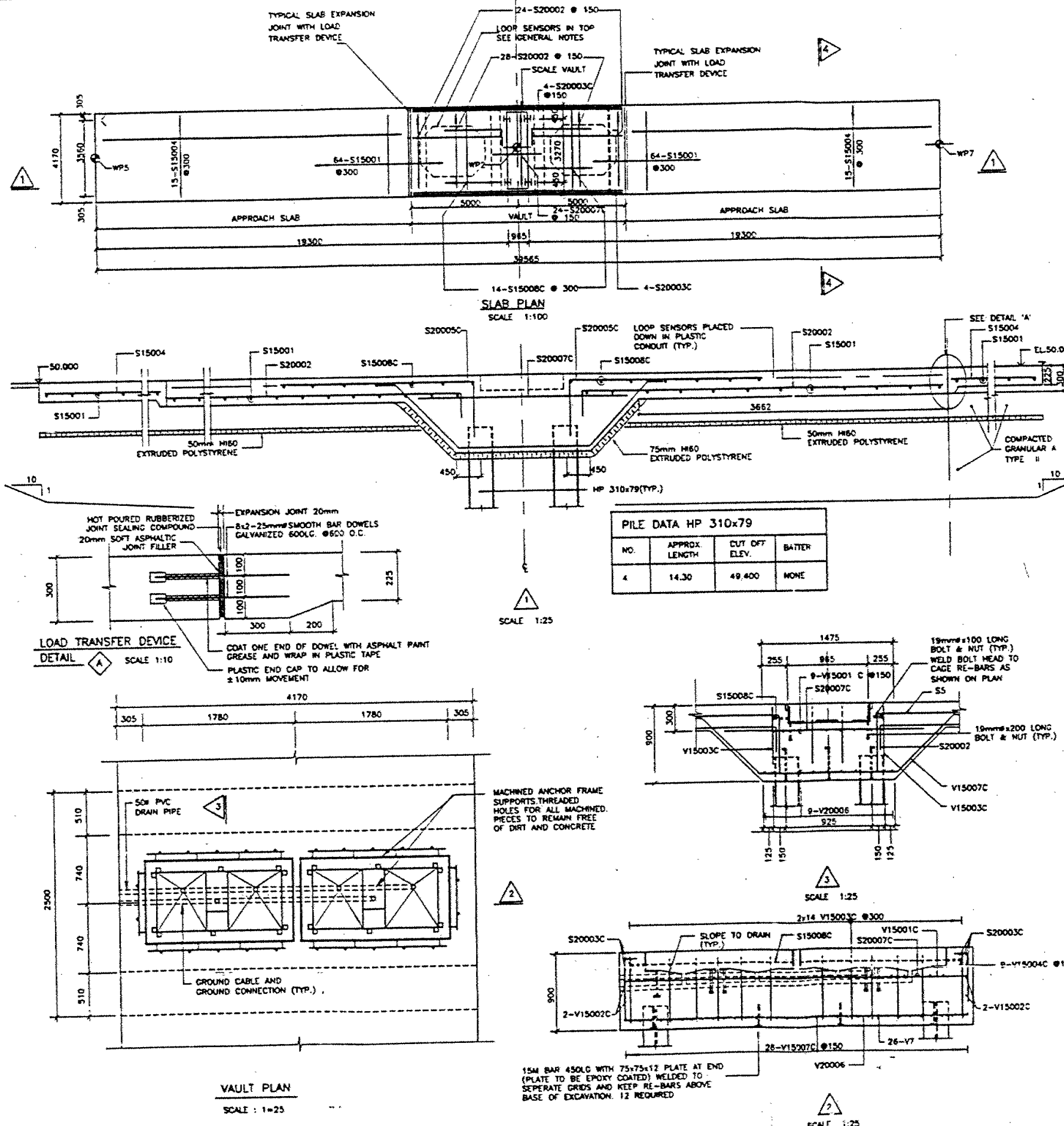
METRIC  
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AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

PLAN No.  
CONT No.  
WP No. 2501-86-00

SORTER SCALE PIT

131

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REINFORCING BAR SCHEDULE											
VAULT BAR SCHEDULE											
MARK	SIZE	NO.	TYPE	LENGTH	A	B	C	D	H	K	MASS
V15004C	15	9	STR	4090							58
V15002C	15	4	STR	1220							8
V15003C	15	28	STR	775							34
V15004	15	4	STR	1800		210	730	700			10
V20006	20	9	STR	4090							87
V15007C	15	26	4	3956	1018	1320	300		720	720	161
SLAB BAR SCHEDULE											
S15001	15	128	STR	4090							822
S20002	20	26	2	4800	310	4850					188
S20003C	20	8	STR	9850							124
S15004	15	30	STR	14800							688
S20005C	20	56	2	1675	1525	150					221
S20007C	20	24	STR	2300							130
S15008C	15	28	STR	4090							180
TOTAL (KG)											2711

#### GENERAL NOTES

CHECK ALL DIMENSIONS AND REPORT ANY DISCREPANCIES BEFORE PROCEEDING WITH WORK. DRAWING NOT TO BE SCALED.  
REFER TO MECHANICAL AND ELECTRICAL DRAWINGS FOR SIZE AND LOCATION OF FLOOR, WALL AND OPENINGS.  
COORDINATE OPENINGS AS REQUIRED BY MANUFACTURER OF SCALE EQUIPMENT.  
ALL STANDARDS REFERRED TO ARE LATEST EDITIONS THEREOF.  
REFER TO SITE PLAN FOR LOCATION, ELEVATION & ALIGNMENT OF WEIGH-IN-MOTION SCALE.  
ANCHOR FRAME AND GROUND RODS TO BE SUPPLIED BY SCALE MANUFACTURER.

#### FOUNDATION

VAULT AND APPROACH SLABS TO REST ON GRANULAR 'A' TYPE # COMPACTED TO 100% STD. PROCTOR MAX. DRY DENSITY.

#### CONCRETE AND REINFORCING STEEL

CLASS OF CONCRETE 30 MPa IN 28 DAYS. ALL CONCRETE EXPOSED TO WEATHER TO HAVE 4 TO 6% AIR ENTRAINMENT. CONCRETE PROTECTION FOR REINFORCING STEEL (UNLESS OTHERWISE NOTED ON DRAWINGS OR IN SPECIFICATIONS):

1. EXPOSED SURFACES IN CONTACT WITH EARTH: 75mm.
2. FORMED SURFACES EXPOSED TO WEATHER OR IN CONTACT WITH EARTH: 50mm.
3. FOR BARS 20mm AND LARGER FOR BARS 13mm, 16mm WIRE AND SMALLER FOR BARS 13mm, 16mm WIRE AND SMALLER IN SLABS, WALLS AND JOISTS.

38mm FOR ALL OTHER REINFORCING REINFORCING STEEL TO BE DEFORMED BARS CONFORMING TO THE REQUIREMENTS OF C.S.A. G30 SERIES. DETAILING, FABRICATION AND PLACING OF REINFORCEMENT TO CONFORM TO CAN3-A23.1. CONCRETE MATERIALS AND METHODS OF CONCRETE CONSTRUCTION.

REINFORCING STEEL: YIELD STRENGTH 400 MPa PROVIDED SLEEVES FOR DUCTS, PIPING AND CONDUITS THROUGH WALLS AND SLABS AS INDICATED ON THE MECHANICAL DRAWINGS OR AS REQUIRED BY OTHER TRADES. LOCATIONS AND DETAILS OF CONSTRUCTION JOINTS TO BE ESTABLISHED WITH THE ENGINEER WELL IN ADVANCE OF CONSTRUCTION.  
OPENINGS TO BE FORMED AS SHOWN ON THE DRAWINGS PRIOR TO STEEL PLACEMENT. FOR ADDITIONAL OPENINGS NOT SHOWN ON THE STRUCTURAL DRAWINGS, CONSULT WITH THE ENGINEER BEFORE PLACING CONCRETE. DO NOT CUT OPENINGS OR HOLES AFTER CONCRETING UNLESS SPECIFICALLY REVIEWED BY THE ENGINEER.  
WELD VAULT REINFORCING BARS TOGETHER TO FORM CAGE AS DETAILED.

#### LOOP SENSORS

LOOP SENSORS CONSISTING OF 3 TURNS 14 WIRE IN PLASTIC RIGID CONDUIT TO BE PLACED DURING CONCRETING. CHAIRS SUPPORTING THE LOOPS TO BE OF NON-MAGNETIC MATERIAL. THE FINISHED SURFACE OF THE SLAB SHALL NOT VARY MORE THAN 3mm UNDER A 3.000m LONG STRAIGHT EDGE.

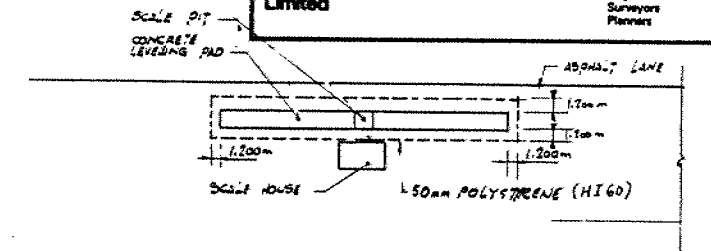
#### COORDINATES

	STA	N	E
WP5	10+735.218	5001038.090	227465.000
WP6	10+750.000	5001047.326	227476.541
WP7	10+769.782	5001059.688	227491.886

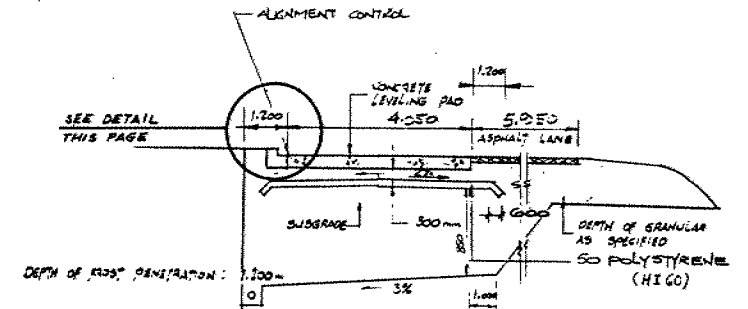
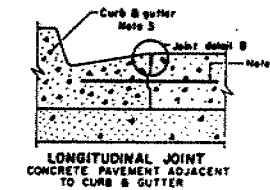
CONFIDENTIAL No 85-400  
WFO No 2505-79-02

SHEET  
20

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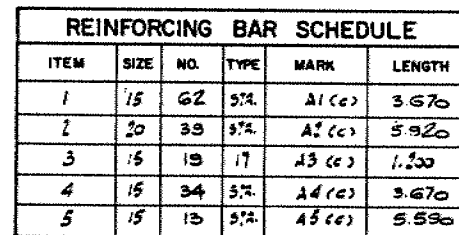
## SITE PLAN



**SECTION** 2

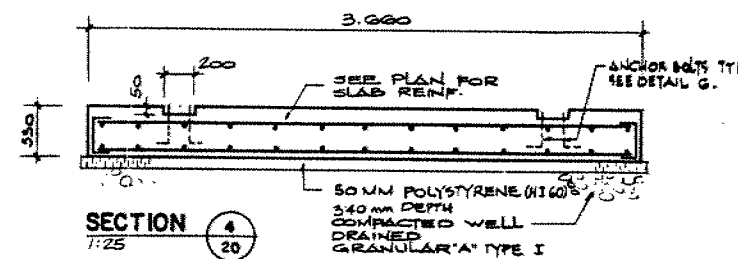
NOTES:

1. FOR APPROPRIATE TRANSITION REFER TO THE POLYSTYRENE STANDARD OF REQUIRED POLYSTYRENE THICKNESS SEE DO-472.
2. 9x19mm SAW CUT SEALED WITH HOT RUBBERIZED WAX SEALING COMPOUND.

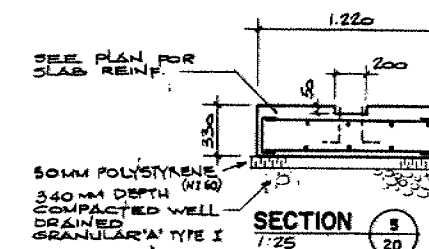


530  
140   
TYPE 17

1. SLAB TO HAVE ZERO CROSS-SECTION.
2. CLASS OF CONCRETE IS TO BE 25 MPa.
3. (C) DENOTES EPOXY COATED BARS.



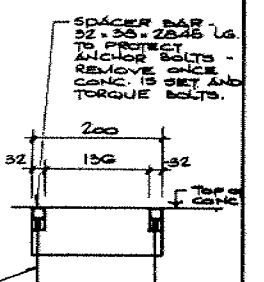
SECTION 4  
1:25 20



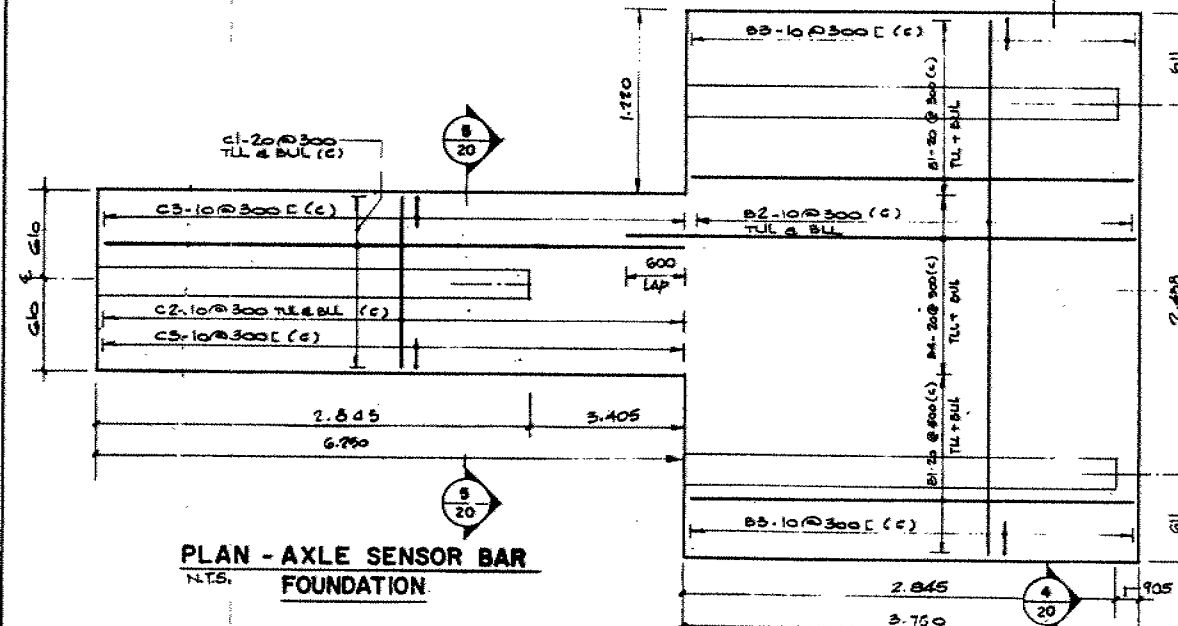
SECTION 5

MARK	SIZE	No.	TYPE	LENGTH
B1(1)	20	20	STR.	3.600
B2(1)	10	20	STR.	3.510
B3(1)	10	20	17	560
B4(1)	20	10	STR.	4.275
C1(1)	20	10	STR.	5.500
C2(1)	10	40	STR.	1.070
C3(1)	10	40	17	560

TYPE 17:



**PLACEMENT OF  
AXLE SENSOR  
BAR IN CONCRETE**  
N.T.S.  
**DETAIL 6**



# METRIC

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AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

PLAN No

CONT No 85-400

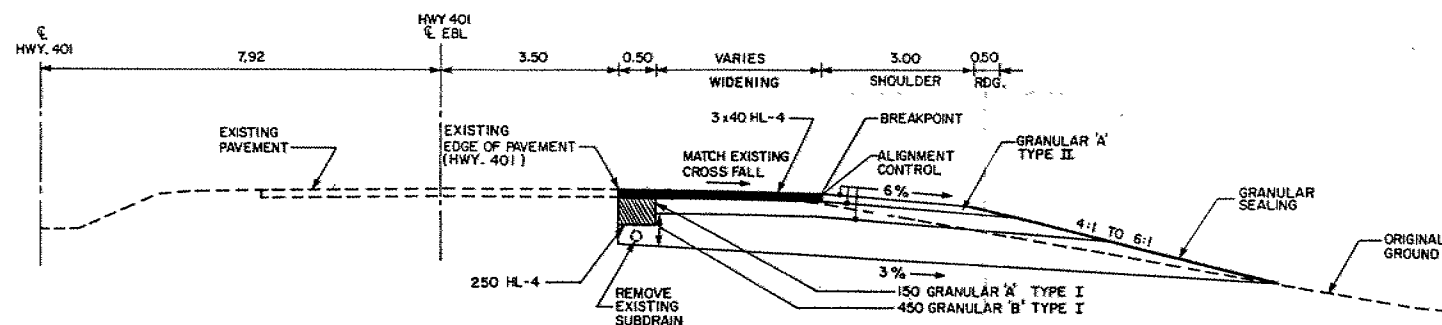
WP No 2505-79-02

TYPICAL SECTIONS

SHEET  
21

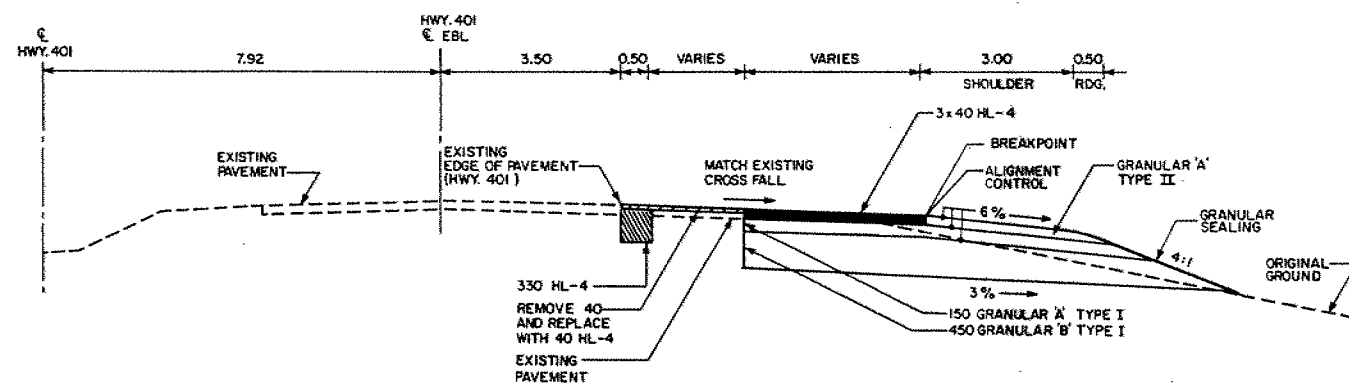
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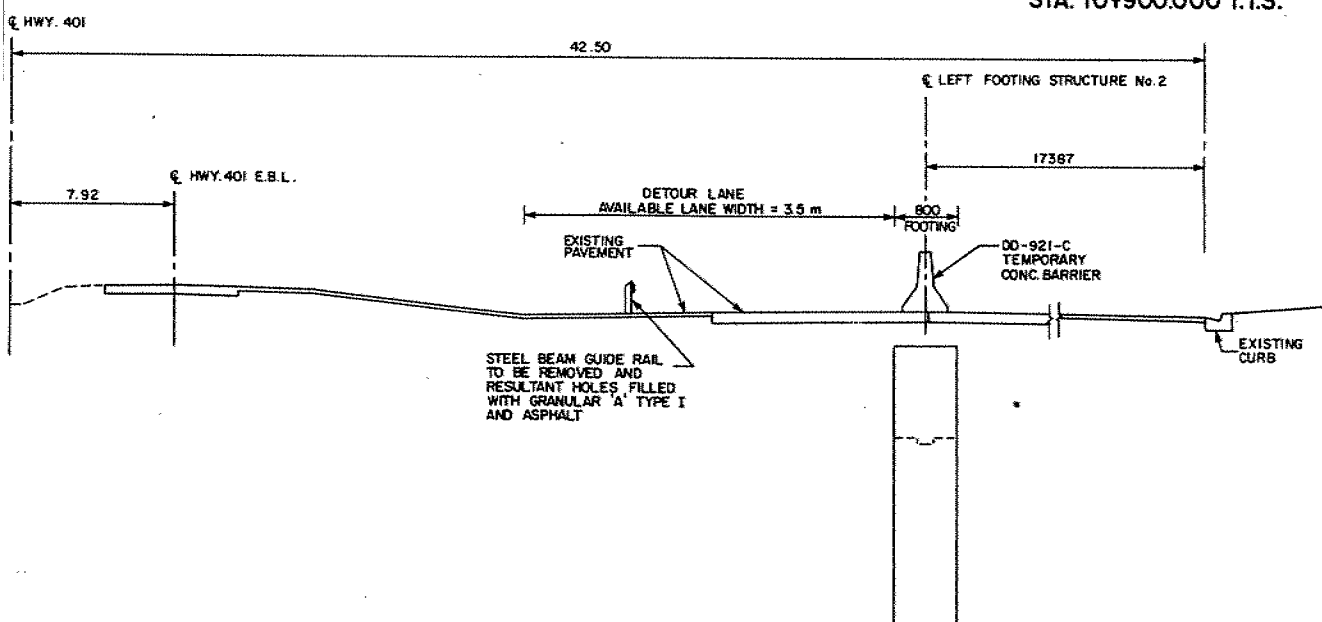
## TYPICAL SECTION

STA. 9+800.000 T.I.S.  
STA. 11+000.000 T.I.S.



## TYPICAL SECTION

STA. 9+950.000 T.I.S.  
STA. 10+900.000 T.I.S.



## DETOUR

STA. 10+430 T.I.S.

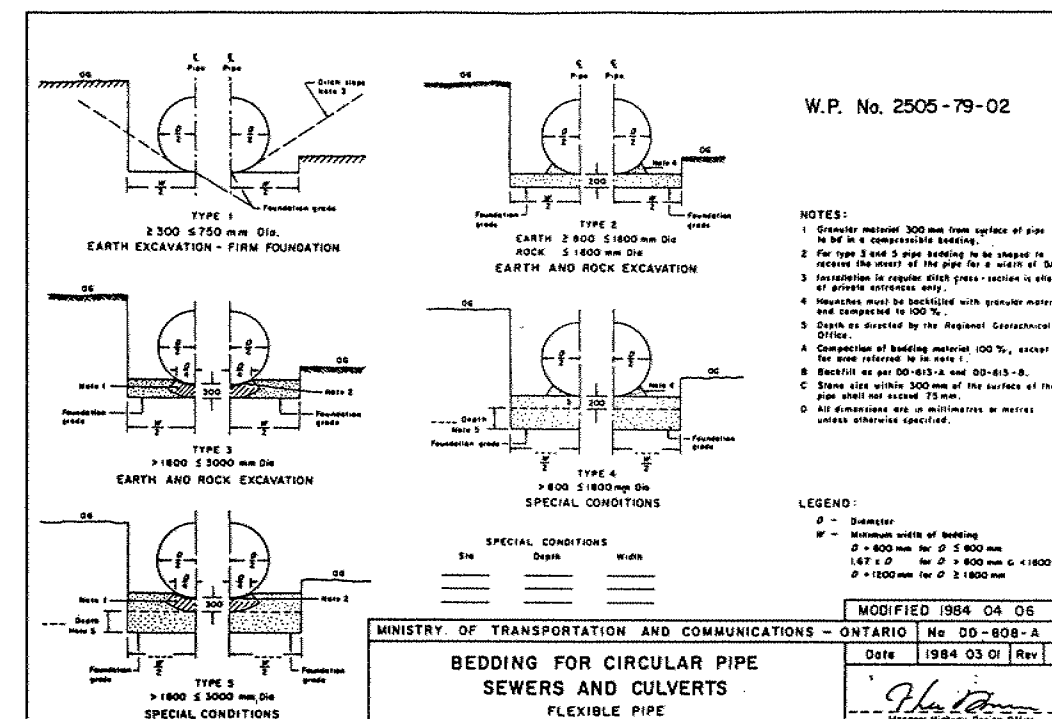


TABLE OF PAVEMENT AND BASE THICKNESS (mm)

Road	Surface Course		Upper Binder Course		Middle Binder Course		Lower Binder Course		Total Depth Of Hot Mix	Granular 'A' Type I	Granular 'B' Type I
	No. of Lifts	Total Depth	No. of Lifts	Total Depth	No. of Lifts	Total Depth	No. of Lifts	Total Depth			
401 Pavement Widening	1	* 40 HL-4	2	80 HL-4	2	110 HL-4	1	140 HL-4	370	--	Required only where existing sub-drains removed
401 Shoulder Widening	1	* 40 HL-4	--	--	--	--	1	50 HL-4	90	--	--
Tapers and Ramps	1	* 40 HL-4	--	--	--	--	2	80 HL-4	120	150	450
Parking Area and Overnight Storage Area	1	* 40 HL-4	--	--	--	--	2	80 HL-4	120	150	450

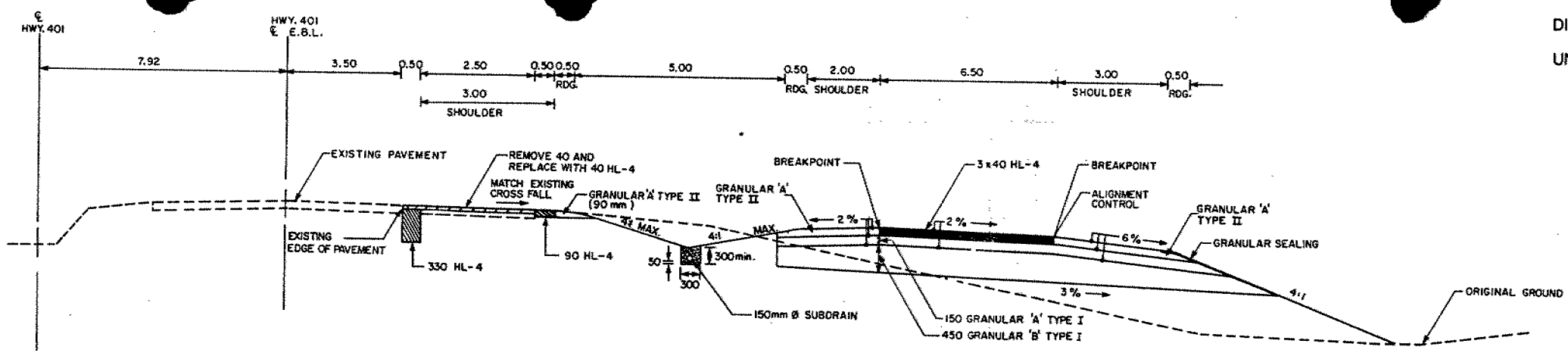
\* 40mm HL-4 Average, 30mm Minimum HL-4

NOT TO SCALE

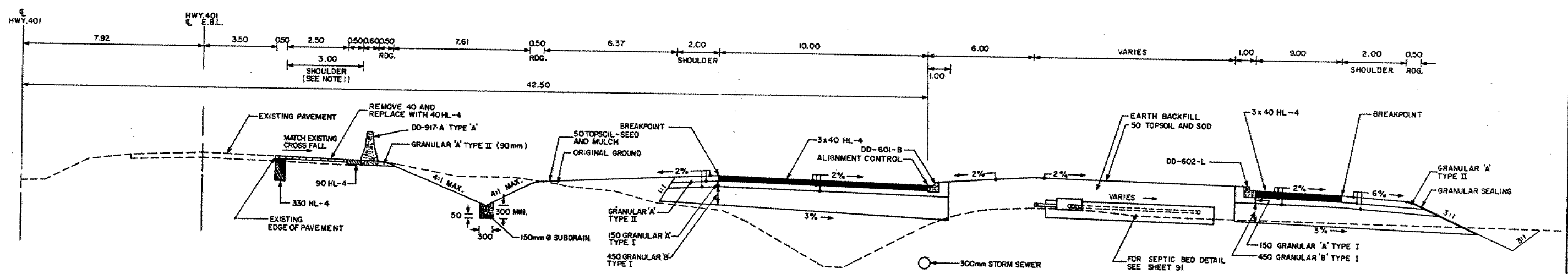
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CONT No 85-400  
WP No 2505-79-02

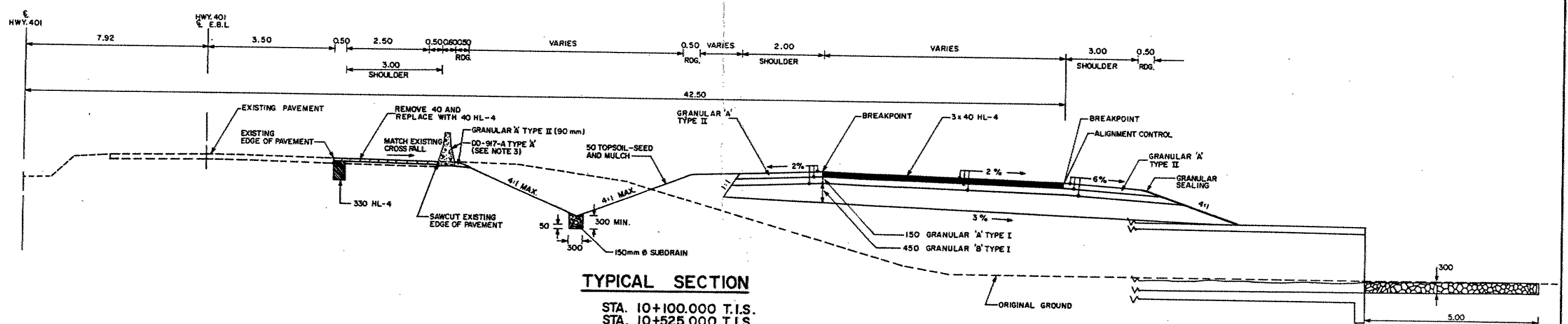
TYPICAL SECTIONS  
SHEET 22  
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TYPICAL SECTION  
STA. 10+600.000 T.I.S.



TYPICAL SECTION  
STA. 10+287.000 T.I.S.



TYPICAL SECTION  
STA. 10+100.000 T.I.S.  
STA. 10+525.000 T.I.S.

CULVERT EXTENSION  
STA. 10+224.000 T.I.S.

NOT TO SCALE