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55-F-221C

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Hwy 401 & 4

WESTMINISTER

Twp.

BA-402

RACEY, MACCALLUM AND ASSOCIATES
LIMITED

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THE VIBRATION ENGINEERING COMPANY

REPORT NO. S-500-509/54/T-46-1

January 28th, 1955.

M. M. Dillon & Co., Limited,
974 Eglinton Street, West,
TORONTO, Ontario.

Attention: Mr. R. A. Chrysler

RE: FOUNDATION INVESTIGATION, BRIDGE SITE NO. 19,
HIGHWAY NO. 401, OVERHEAD CROSSING,
HIGHWAY NO. 4, WESTMINSTER TOWNSHIP

Dear Sirs:

Following your instructions we have carried out the drilling of four (4) soil test borings at the site and have analysed the samples in the laboratory. We have now completed our study of the field and laboratory data and are pleased to report as follows:

LOCATION AND NUMBER OF BOREHOLES

Four boreholes were put down, as shown on the attached plan, and numbered 1, 3, 7 and 9 respectively. These numbers conform to those indicated on plans of a previous exploration program to facilitate correlation. The boreholes were located generally at the ends of the abutments of the overpass.

DRILLING WORK

The equipment was brought to the site on Tuesday January 4th, 1955, but, due to the holes having not been spotted and to rain, operations were not begun in earnest until January 6th at borehole Number 1. This hole being limited to a depth of 35 feet, operations were suspended on January 8th. Borehole 9 was then drilled to a depth of 69.5 feet which operation was completed on the 12th.

On account of different values of the penetration resistance gained in the first two boreholes (Boreholes No. 1 and No. 9) and due to the fact that the bridge site is located in a creek area where possible soft spots in the sub-soil must be taken into consideration, it was proposed to the client and approved to extend the investigation by two more boreholes (Boreholes No. 3 and No. 7).

Due to some mechanical difficulties, drilling was not resumed until January 17th when two drills were utilized at the site to make up for lost time. Operations were concluded on January 19th.

REPORT NO. S-500-509/54/T-46-1 Cont'dLABORATORY TESTS

To obtain an accurate representation of the soil profile, samples were secured generally at every 2.5 feet in boreholes No. 1 and No. 9 down to a depth of 20 feet. Sampling was carried out at a lower frequency in the other two holes in order to expedite the work.

As will be shown on the attached Engineering Data Sheets, the samples were generally subjected to plasticity tests and water content measurements. It was not found necessary to carry out compression or consolidation tests.

ANALYSIS OF THE DATA

The penetration index, as shown on the penetration diagrams of the Engineering Data Sheets, rises from a low value near the surface to a maximum between Elevations 810 and 816, information from boreholes 3 and 7 showing this to be at Elevation 813. A slight reduction in stiffness is then noted. It will be seen that the increase in stiffness in the upper layers is greatest in the holes away from the creek, smallest in borehole 6 which is nearest this creek, indicating that this extra strength is possibly due to consolidation by dessication which will of course be less effective at borehole 7 where capillary action will combat evaporation.

The plasticity tests are very uniform: above El 793, the liquid limit values are all between 30 and 36 while the plastic limits range between 13 and 19; at greater depth, the soil is somewhat less plastic.

The water content of the samples taken above El 793 range between 19 and 22% with the exception of one sample which was found to contain 18% and one 27%. As a rule, the water content of the soil in question is appreciably closer to the plastic than to the liquid limit. As it may be assumed that the shrinkage limit of a soil is quite close to the plastic limit and that the liquid limit, in moderately active clays, is close to the maximum potential water content of stable clay soils, the indication is that little consolidation, if any, need be expected.

For bearing capacity purposes, penetration indices have been tabulated as follows:

Borehole:	<u>1</u>	<u>3</u>	<u>7</u>	<u>5</u>	
El 820	24	nil	nil	nil	(nil = 5 or less)
818	45	5	nil	8	
816	56	14	10	15	
814	40	28	24	26	
812	22	32	25	28	

From the above it would appear that, at Elevation 816, the bearing capacity of the material would be high in the vicinity of borehole 1 but somewhat low in the others. At Elevation 814, the penetration resistance in the vicinity of borehole 1 is still higher than that of the others but falling rapidly with increasing depth. On the other hand, the penetration resistance indicated in the other holes is quite adequate.

REPORT NO. S-500-509/54/T-46-1 Cont'dCONCLUSIONS

The penetration index is a correlative value and as such necessitates a higher factor of safety than a laboratory compression test to account for possible variations from the norm. The securing of undisturbed samples and their testing is, however, beyond the scope of this program for economic reasons. As a consequence, we would suggest designing the footings of the present structure on the basis of the above tabulation. Assuming that the potential arc of failure of such a footing will descend to a depth equal to one-half the minimum dimension of the bearing area, we would suggest that for a structure of this size, where the footings should be approximately 8 feet wide, a design value of 2.5 tons per square foot could be utilized at Elevation 815. The necessity of seating the structure higher, say at Elevation 816, would reduce this value to about 2 tons per square foot because of the softer soil encountered between the footing and the good soil in the vicinity of boreholes 3, 7 and 9. Conversely, the lowering of the footing to Elevation 814 or less would also necessitate a small reduction because of the slightly weaker soil encountered at depth especially in borehole No. 1.

The above values being correlative, certain assumptions have been made in particular with regards to the depth of confinement of the footing which is normally assumed at approximately 1/2 foot below grade. A reduction in strength would result in the location of the footing directly at the surface and conversely a slight increase would be in order if the footing were set at a greater depth than provided for. It is felt, however, that the accuracy of the evaluation of the strength of the soil is not sufficient to warrant refining the analysis to this point.

It shall be noted that the water table in all cases was between 2 and 3 feet from the surface. The soil encountered being quite impervious, it is felt that surface runoff into the borehole and the necessary use of wash water when drilling will cause an excessive water table reading. The imperviousness already mentioned, however, renders this point somewhat academic as it is felt that the rate of percolation into the excavation, during construction, will be too low to develop into any sort of contracting problem provided this excavation is not carried out during a rainy period at which time surface runoff may have to be pumped out of the working area.

Yours very truly,

RACEY, MACCALLUM AND ASSOCIATES LIMITED


Robert Quintal

RHQ/PW

Original and

Two Copies: M. M. Dillon & Co. Ltd., Toronto, Ont. Attention: Mr. R.A. Chrysler
c.c.'s: 2 - Messrs. Racey, MacCallum and Associates Limited, Montreal, P. Q.
2 - Soils Engineers

~~Placey, MacCallum and Associates Limited~~

Proposed Westminster Twp. Bridge #19
Plan showing location of Boreholes

Order No. S-500-549/54/T-46Dated 31/12/54Day Month YearHole Began 18/1/55Hole Ended 19/1/55

RACEY, MACCULLUM AND ASSOCIATES

Limited

Foundation Engineering Division

Engineering Data Sheet for Borehole: 3

F. Lusk

Driller

Helper

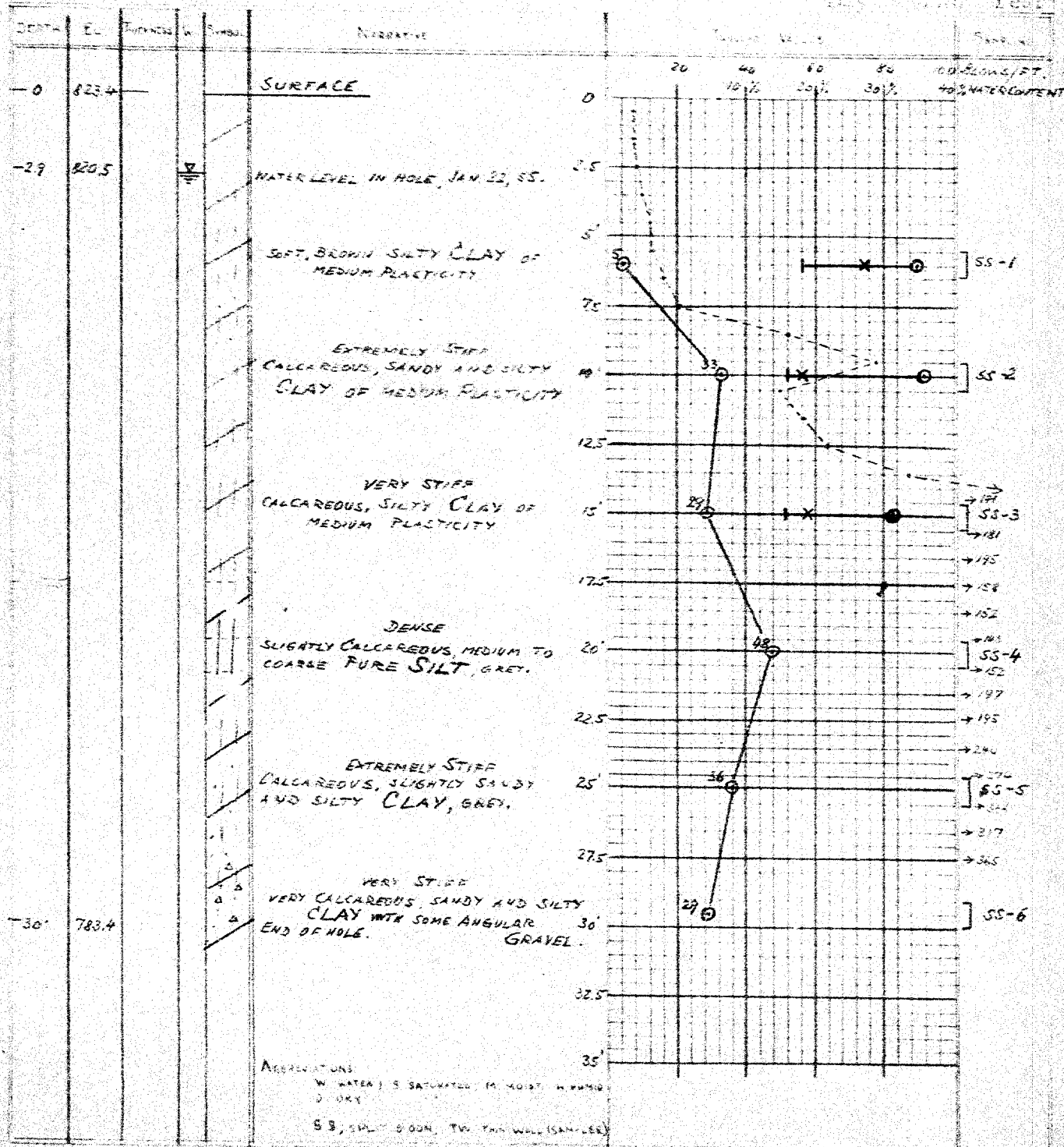
Job Name: SOIL INVESTIGATIONS, PROP. WESTMINSTER TWR. BRIDGE #19Job Located: OVERHEAD CROSSING AT JUNCTION HIGHWAYS NO. 4 AND NO. 401Hole Located: SEE ATTACHED PORTION OF OH.D. PLANHole Elevation: 823.4 Datum: M.S.L.

K. TUBBESING

Checked by

22/1/55

Day Month Year



Order No.: S-500-509/54, T-46

Dated 3/12/54

Day Month Year

Hole began 17/1/55

Hole ended 19/1/55

RACEY, MacGILLIVRAY AND ASSOCIATES

Limited

Foundation Engineering Division

Engineering Data Sheet for Borehole: 7

A. McLADDEN

Driller

M. CHEVRIER

Helper

Job Name: SOIL INVESTIGATIONS, PROP. WESTMINSTER TRD. BRIDGE #19

Job Located: OVERHEAD CROSSING AT JUNCTION HIGHWAYS NO. 4 AND NO. 401

Hole Located: NEAR EDGE OF CREEK (SEE ATTACHED O.D.R. - PLAN)

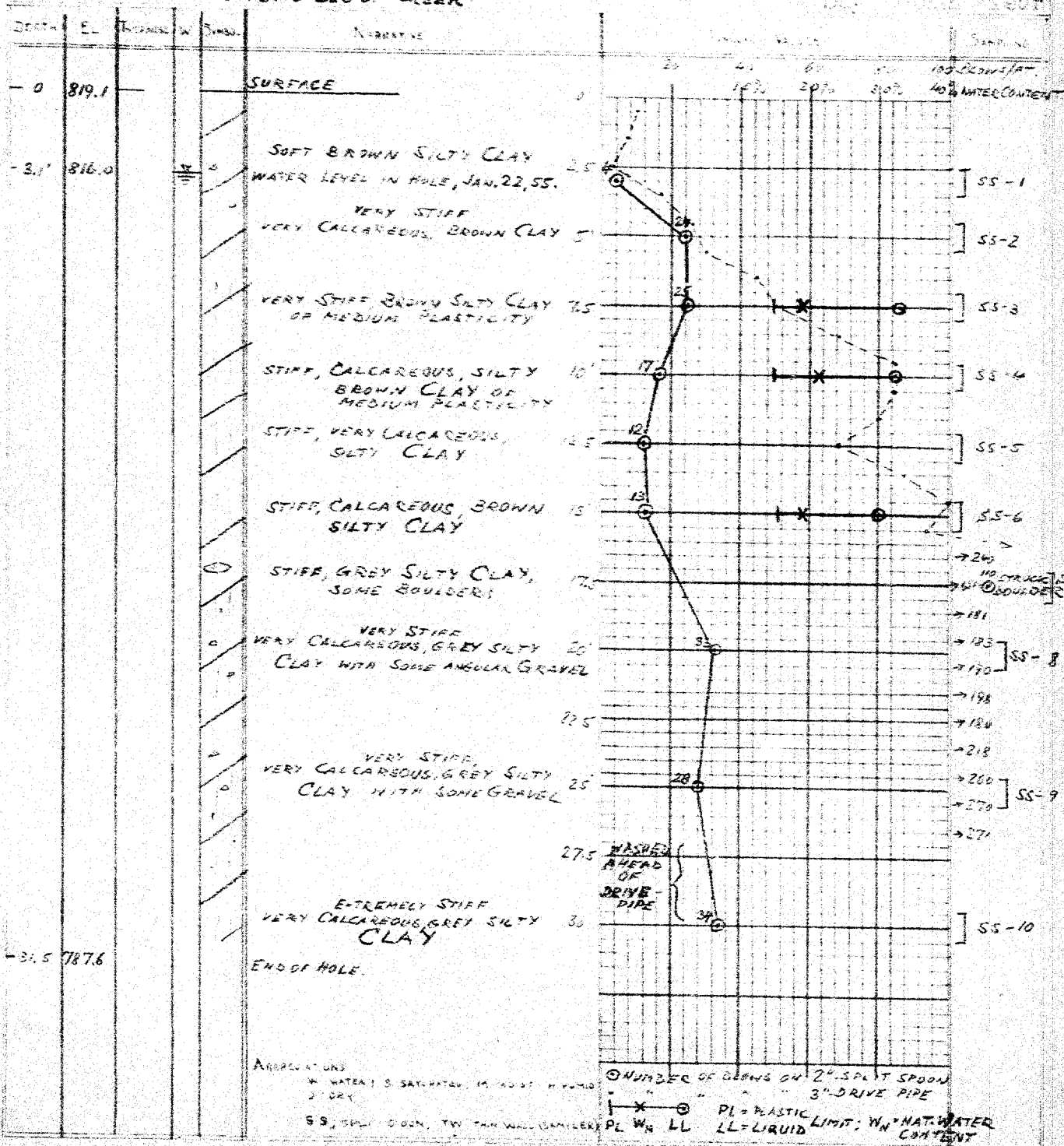
Hole Elevation: 819.1' Datum: M.S.L.

K. TISSENG

Checked by

24/1/55

~ 2.5' ABOVE BED OF CREEK



Order No.: S-500-509/54/T-46

RACEY, MacCULLUM AND ASSOCIATES

F. LUSK

Dated 3/12/54

Limited

Driller

Day Month Year

Foundation Engineering Division

Hole Began 6/1/55

Hole Ended 8/1/55

Engineering Data Sheet for Borehole: 1

Helper

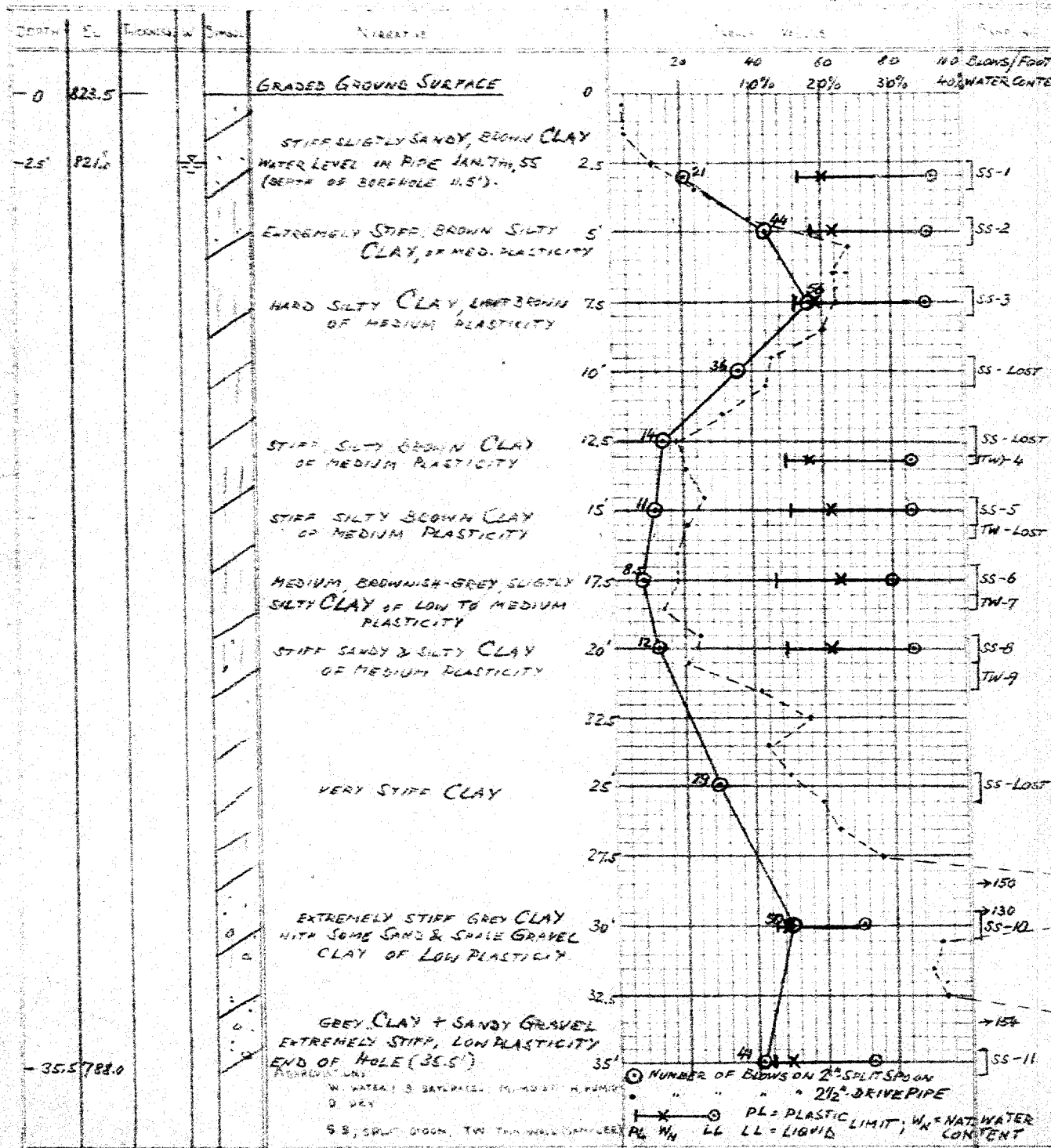
Job Name: SOIL INVESTIGATIONS, PROP. WESTMINSTER TOWNSHIP BRIDGE #19 K. TUBBESING

Job Located: OVERHEAD CROSSING AT JUNCTION OF HIGHWAYS NO. 4 AND NO. 401

Hole Located: SEE ATTACHED PORTION OF GND-PLAN

Hole Elevation: 823.5' Datum: M.S.L.

8/1/55



Dated 31/12/54

F. LUCK

Day 31/12/54

Found 101 10101, 101 10101, 101 10101

Rate 101 10101

Engl. 101 10101, 101 10101, 101 10101

101 10101

Job No. 101 10101, SOIL INVESTIGATIONS, PAIN WESTMINSTER TPA BRIDGE #19
Job Description: CROSSING AT JUNCTION HIGHWAY NO. 4 AND NO. 401
Notes: SEE ATTACHED POSITION OF OND - PLAN
Hole No. 101 10101, 822' PAIN M.S.L.

K. T. 101 10101

15/1/55

