HBMC7 IAMHB(1SP)585

HBMC Central Excavation Unit, Crosby on Eden, Cumbria - Soil Report

By Helen C M Keeley.

During the winter of 1980/81 excavations were carried out (directed by Mr J Bennett) of part of Hadrian's Wall between Milecastles 61 and 62, in advance of a gas pipeline (NGR NY 447607). At this point the wall was constructed mainly of turf but has largely been obliterated by a modern road and hedgebank. The associated ditches do survive, however, and formed the main focus of the excavation.

Soils. Crosby lies in the floodplain of the River Eden, approximately four miles north east of Carlisle; soils in the area have not been mapped in detail. To the east, soil parent materials in the Roman Wall district of south west Northumberland have been discussed by Johnson (1966), describing the area on the north side of the South Tyne Valley in the vicinity of Haltwhistle and Hexham, where carboniferous rocks are overlain in many places by boulder clay. Soils of the Hexham district, including a small area around Hadrian's Wall north of Haltwhisle, have been mapped by Jarvis (1977).

To the south, soils of the Penrith area have been mapped (Matthews, 1977) and include typical brown sands of the Newport Series, developed on sandy drift on river terrace deposits, mainly levées, throughout the Eden and Eamont Valleys. These soils are freely drained, reddish brown or brown, with loamy sand or sand texture, and are represented in the Crosby area in addition to the Clifton and Blackwood series.

The nearest area to be mapped in detail is to the north west, around Longtown (Kilgour, 1979), where parent materials are either glaciofluvial sands (and gravels) or (reddish) till (and glaciolacustine drift). The till was laid down in the late Devension and overlain by glaciofluvial deposits. In the vicinity of Carlisle and the Solway coast a second till was deposited, interpreted as a minor re-advance of the Scottish Ice, and again covered by glaciofluvial material. The sequence is:

1) Upper Sands and Gravels.
2) Upper Boulder Clay (till).
3) Middle Sands and Gravels.

4) Lower Boulder Clay (till).

Reddish loamy or clayey, slightly stoney, upper till derived mainly from Triassie rocks occupies much of the district. To the east of Rockcliffe (about 5 miles west of Crosby) is an area of predomia-outly stagrogley soils with patches of raw peat soils, stagnohumic grey soils and argillic brown earths. The main soils and Clifton series (typical stagno-grey soils) with Blackwood-Isleham developed in glaciofluvial deposits. Blackwood series are typical sandy grey soils (medium or coarse sandy) - sandy loam or loamy sand over sand - while Isleham are typical humic-sandy grey soils (medium and coarse sandy) - humose, occasionally peaty, sandy loam or loamy sand over sand.

The recent 1:250,000 soil Map of England and Wales (soil survey, 1983) indicates Clifton series in the excavation area with patches of Blackwood and Newport to the south, closer to the River Eden. Clifton soils are developed on reddish till and consist of slowly permeable seasonally waterlogged reddish fine and coarse loamy soils and similar soils with slight seasonal waterlogging. Some deep coarse loamy soils are seasonally affected by ground water. Blackwood series are deep permeable sandy and coarse loamy soild and groundwater is controlled by ditches.

Agriculture

The main agricultural production in the area is livestock, with dairying predominating, and many of the soils need drainage. Remnants of podzolisation in many soils developed in glaciofluvial sands testify to the comparative recentness of agricultural improvement (Kilgour, 1979). Black surface and podzolic horizons in some soils near Garriestown (NGR NY352644; about 7 miles north west of the excavation area) are relics of former heathlands.

The climate is ruled and fairly dry south of Longtown. Annual rainfall for the Carlisle area and moisture deficit distribution (Hodgson, 1974) is shown in Figure 1. At Kingstown (about 3 miles west of Crosby) average rainfall is 815 mm (32.5 inches) per annum (Figure 2).

Land use capability for the Clifton series is 3sw/1 (kilgour, 1979), ie class 3 with soil and wetness as limiting factors. High yeilds of grass and cereals are possible (These being the most suitable crops) but drainage is needed. Blackwood - Isleham soils are 2sc/2, ie class 2 with soil and climate as limiting factors. The very sandy texture reduces available water capacity to only moderate levels

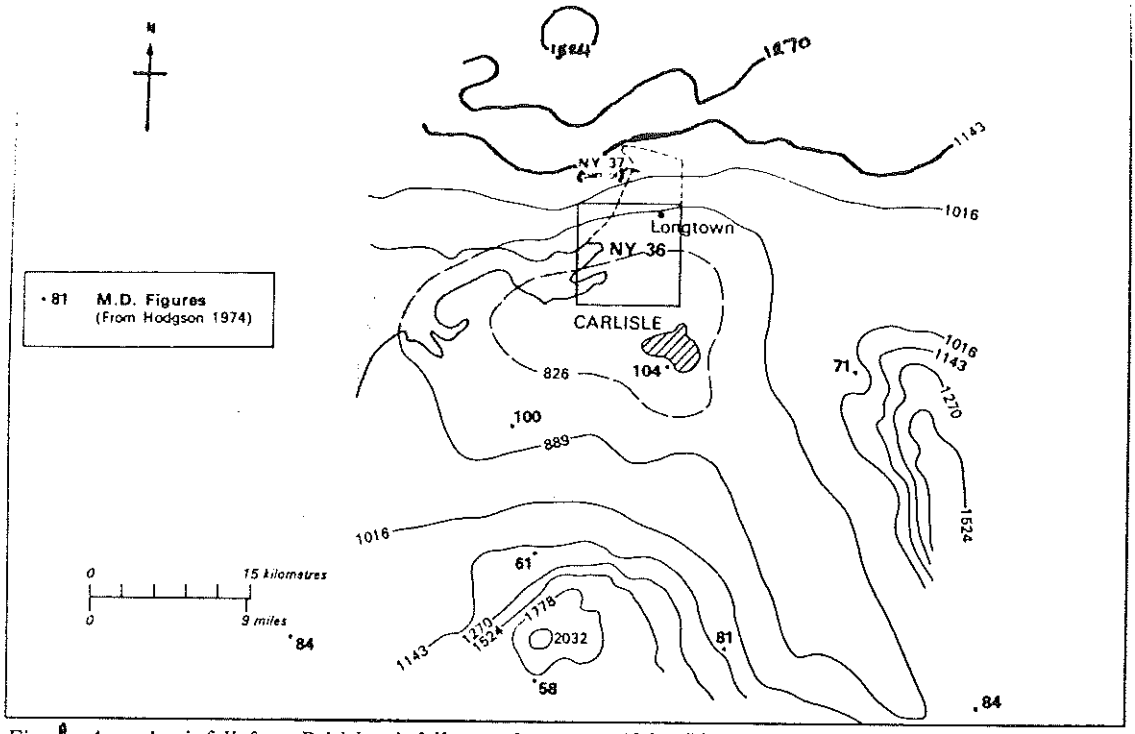
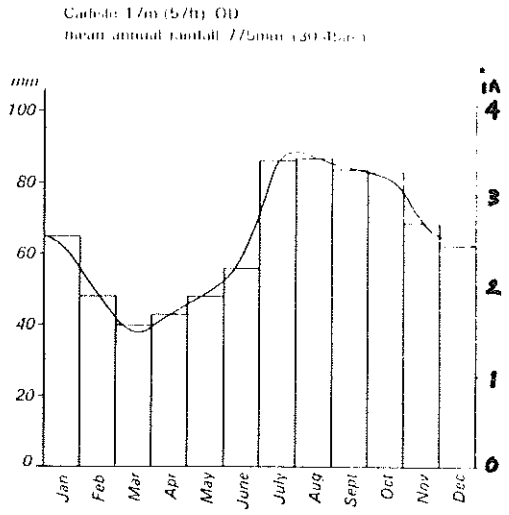


Fig. 1. Annual rainfall from British rainfall annual averages 1916–50 and moisture deficit distribution (Hodgson 1974) in the Carlisle district.



Kingstown 25m (80ft) O.D.
mean annual rainfall 815mm (32·5in)

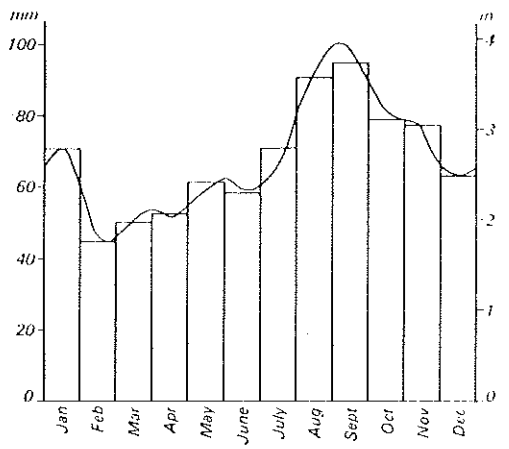


Fig. 2. Mean monthly rainfall at Kingstown (1961–75) and Carlisle (1910–60).

and reduces nutrient retention. A wide range of arable and horticultural crops are possible, including cereals, carrots, parsnips, brassions and potatoes. The Newport series in 2c(3w), ie class 2 with climate and wetness as limiting factors (Matthews, 1977) and is used mainly for grass.

A vegetational sequence for Scaleby Moss (about 2 miles north north-west of the excavation area) has been established by Godwin et al 81975) but this provides no evidence for the Roman period, due to peat cutting and disturbance of the bog surface.

Buried Soils

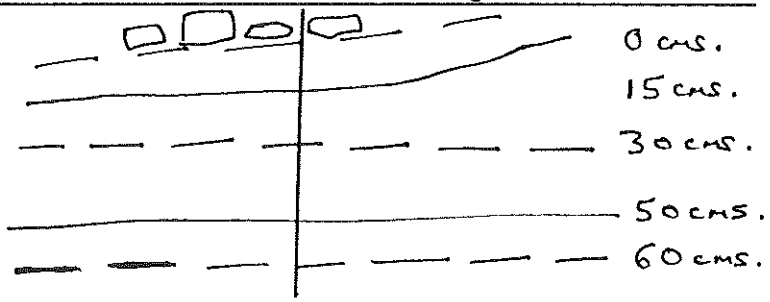
Two soils buried beneath the remains of Hadrian's Wall were examined, section II being somewhat sandier than section I. It was not clear in section I whether the layer immediately underlying stones of the bank consisted of part of the turf wall or a buried topsoil (or a mixture of both) but it showed considerable evidence of disturbance (charcoal fragments, earth worn channels and an animal burrow). Results of particle size andloss on ignition determination are shown in Table 1.

Table 1

Sample No	Loss on ignition	Coarse sand %	Meduim Sand %	Find Sand %	Total Sand %	Coarse Silt %	Medium Silt %	Fine Silt %	Total Silt %	Clay %
IA	3.2	3.13	10.76	45.51	59.40	15.40	3.60	8.40	27.40	13.20
I	4.1	1.44	9.98	47.58	59.00	15.80	3.60	8.40	27.80	13.20
II	10.5	0.67	9.94	52.60	63.20	11.60	3.60	8.40	23.60	13.20
III	4.7	0.51	9.74	56.55	66.80	10.00	6.20	3.80	20.00	13.20
IV	1.5	0.46	8.68	55.86	65.00	13.40	4.60	6.00	24.00	11.00
V	1.7	0.62	12.70	57.48	70.80	5.40	2.20	6.60	14.20	15.00
VI	1.5	0.67	12.51	59.12	72.30	4.90	2.80	6.20	13.90	13.80

Organic matter content (% loss on ignition) with depth is shown in Figure 3 and ignition colours in Figure 4. Soil descriptions for the two sections are as follows:-

Section I, Soil buried beneath the wall adjacent to the road (Plate 1)



0 to 15cms (underlying stones) was very dark greyish brown (10YR3/2) and brown (10YR5/3), ie organic mixed with backed material, in approximately equal proportions, moderately friable coarse sandy loam with moderate medium angular blocky structure. Common medium distinct rusty mottles and charcoal fragments occurred; also worn clannels and an animal burrow were noted. Roots were common, coarse to fine fibrous and woody; stones absent. 15 to 30 cms. Merging boundary to a mottled layer containing some material from above; dark yellowish brown (10YR 4/4), with 50% coarse distinct strong brown mottles, moderately friable coarse loamy sand with moderate medium angular blocky structure. Roots were few, fine fibrous; stones absent.

30 to 50 cms. Merging boundary to mixed yellowish red (5YR4/6) and strong brown (7.5YR 5/8) slightly friable coarse loamy sand with weak medium angular blocky structure. Roots were absent, stones absent and manganese oxide concretions present.

Below 50 cms merging into mixed yellowish brown (10YR 5/8) firm, slightly plastic coarse sand with patches of coarse sandy clay. Structure was moderate, medium angular blocky; stones 10% gravel to medium (rounded pebbles), roots absent, and manganese oxide concretions abundant. At this level (about 60 cms) water enters the profile.

A tiny trace of phosphorus (field test) was found in the layer underlying the stones; PH was 5.9.

Section II (Plates 2 and 3)

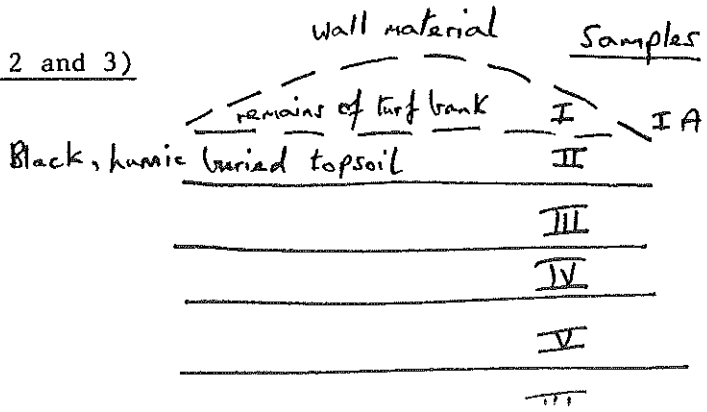


FIGURE 3.

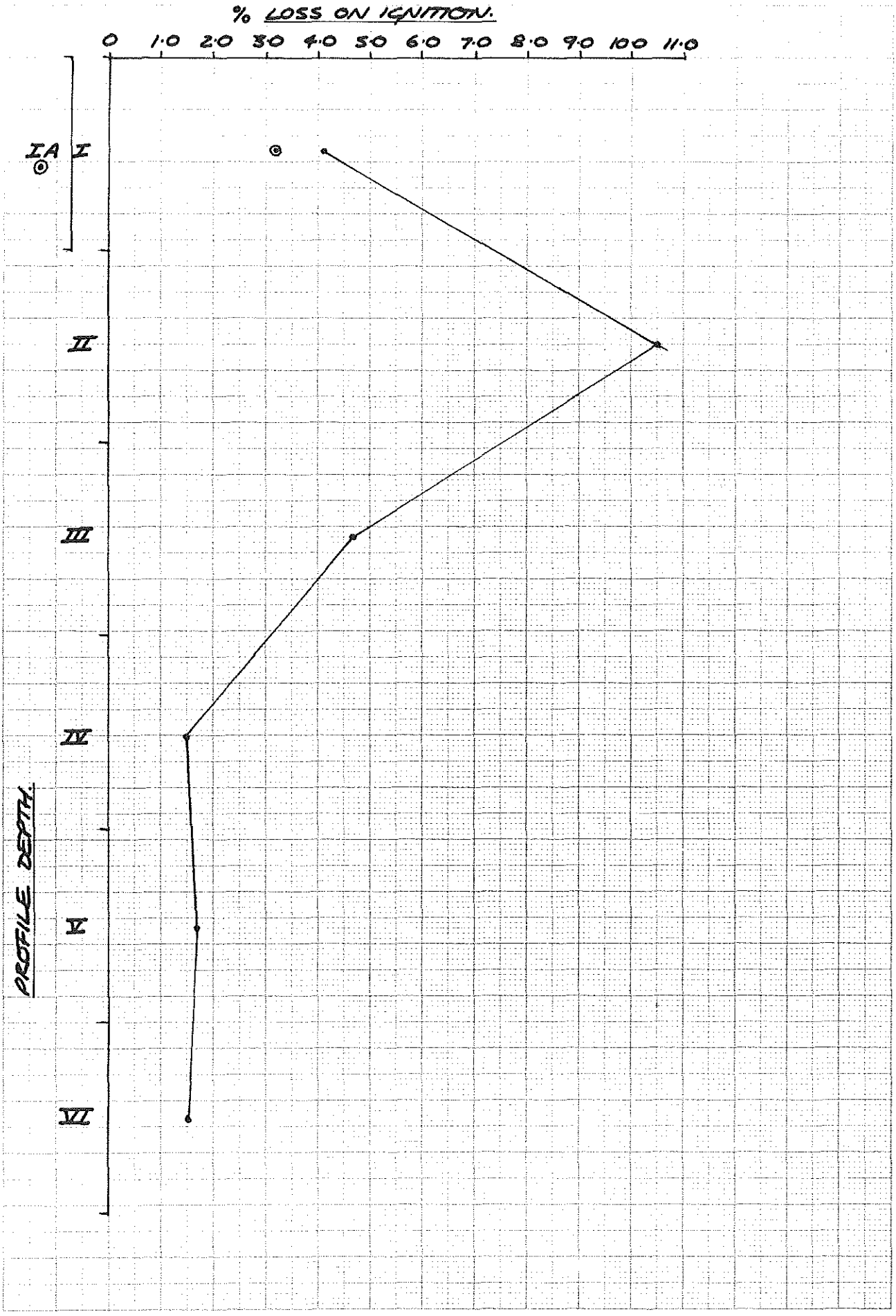
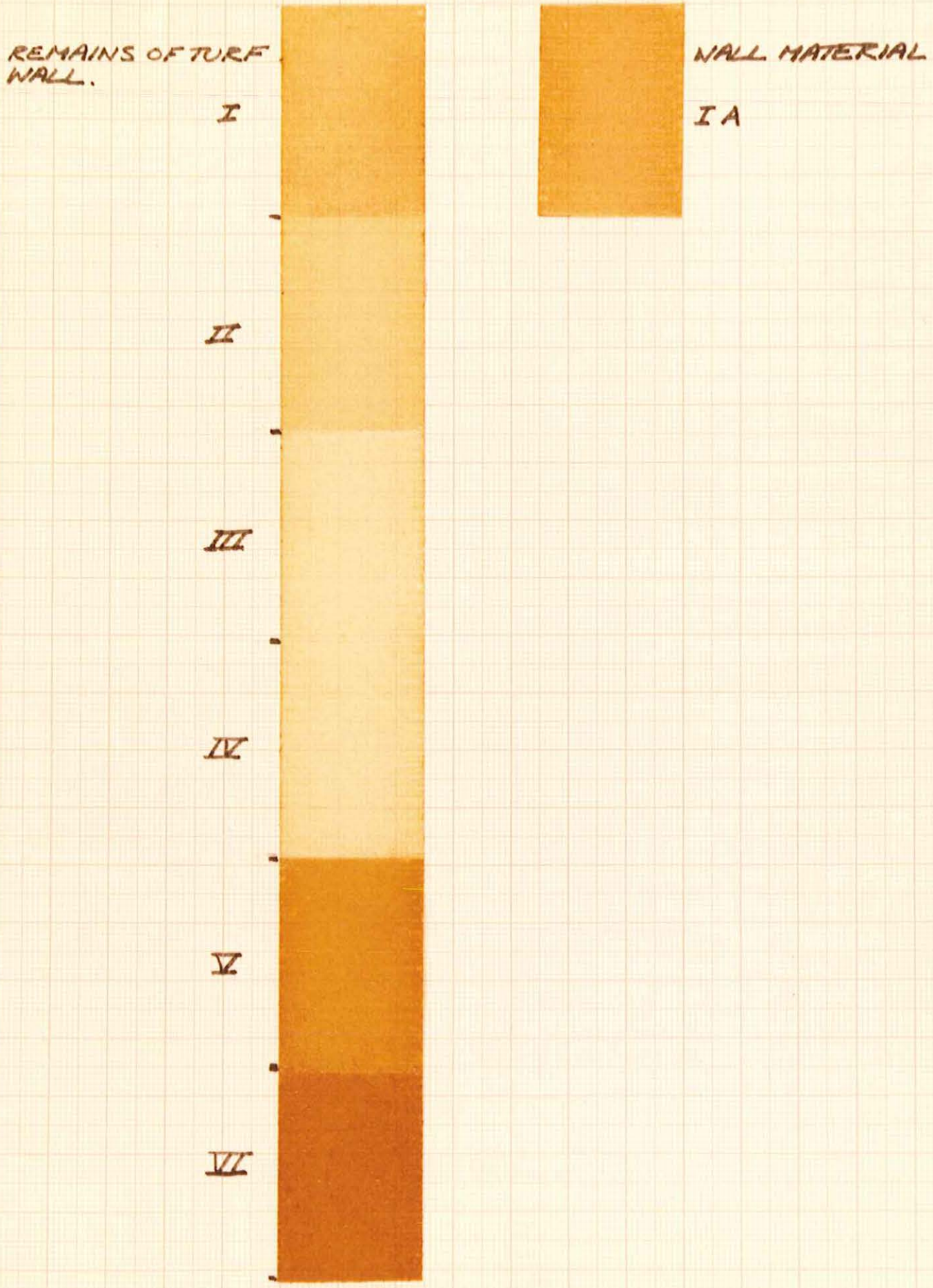

CROSBY: ORGANIC MATTER; % LOSS OF WEIGHT ON IGNITION, 375°C.
% LOSS ON IGNITION.
0
1·0
2·0
3·0
4·0
5·0
6·0
7·0
8·0
9·0
10·0
11·0
IA
I
II
III
IV
V
VI
PROFILE DEPTH.

Figure 4.

CROSBY. IGNITED PROFILE.



This was a particularly sandy profile, representing soils found in a band adjacent to the modern road. Most of the sand was in the fire sand fraction.

IA. Dark brown (7.5YR 3/2) friable sandy loam with weak medium subangular blocky structure containing few gravel size stones and fine, fibrous roots. The material contained red (2.5YR 4/6) indurated iron oxide-rich areas.
I. Very dark greyish brown (10YR 3/2) friable sandy loam with weak medium crumb structure containing few gravel size stones and fine fibrous roots. Rare indistrict red (2.5YR 4/6) mottles occurred.
II. Black (10YR 2.5/1) firm humose sandy loam with moderate medium subangular blocky structure, containing few gravel size stones and common medium to fine fibrous roots. Rare, indistinct brown (10YR 5/3) mottles occurred.
III. Black (5YR 2.5/1) friable stone-free sandy loam with weak medium crumb structure containing rare fine fibrous roots and occasional reddish yellow (7.5YR 6/6) mottles.
IV. Very pale brown (10YR 7/4) friable stone-free sandy loam with weak medium subangular blocky structure, without roots and containing indistrict dark brown (7.5YR4/2) mottles.
V. Yellowish red (5YR5/8) moderately friable stone - free sandy loam with moderate medium blocky structure, without roots and containing abundant industrict iron oxide mottles of various shades of red and yellow.
VI. Red (2.5YR 5/8) moderately friable stone-free sandy loam with moderate medium blocky structure, without roots and containing occasional indistrict grey-brown mottles.

Discussion and Conclusions

The buried soils showed similarities with sections described by Haverfield (1895) at nearby White Moss, underlying the Vallum bank. The Crosby buried soils appeared to be podzolised, having darker layers or concentrations (Bh) below the pale layer and thin brighter areas (Bs) also. However both soils clearly showed evidence of wetness and there has probably been more than one process contributing to the formation of the prominent pale layer. The buried soils thus appeared to be stagnopodzols of Dunsmore series, because of their sandy loam texture (Kilgour, pers. comm., 1983).

There was no evidence to suggest that the soils buried beneath the turf wall had been cultivated, although the surface of section I had clearly been disturbed. It is most likely that the soils supported acid grassland or moorland vegetation prior to construction of the Wall.

References

1. Godwin, H, Walker, D and Ellis, E.H. (1957). Radiocarbon dating and post-glacial vegetational history: Scaleby Moss. Proceedings of the Royal Scoeity (series B), 147, 352-66.

2. Haverfield, F. (1895). Transections of the Cumberland and Westmorland Antiquarian and Archaeological Scoeity. XIII, 453-469. ARticle XXXIX - report of the Cumberland Excavation Committee 1894.

3. Hodgson, J.M. (1974). Ed Soil Survey Technical Monograph No 5, Harpenden, Herts.

4. Jarvis, R.A. (1977). Soils of the Hexham District (sheet 19). Harpenden, Herts.

5. Johnson, G.A.L. (1966). Soil parent materials in the Roman Wall district of south-west Northumberland. Proceedings of the North of England soils Discussion Group. No 2, 26-30.

6. Kilgour, I.N.L (1979). Soild in Cumbria II (Sheet NY 36/37, Longtown). Soil Survey Record No 59, Harpenden.

7. Kilgour, I.N.L (1983). Personal communication.

8. Matthews, B. (1977). Soils in Cumbria I. Sheet NY 53 (Penrith). Soil survey Record No 46, Harpenden.

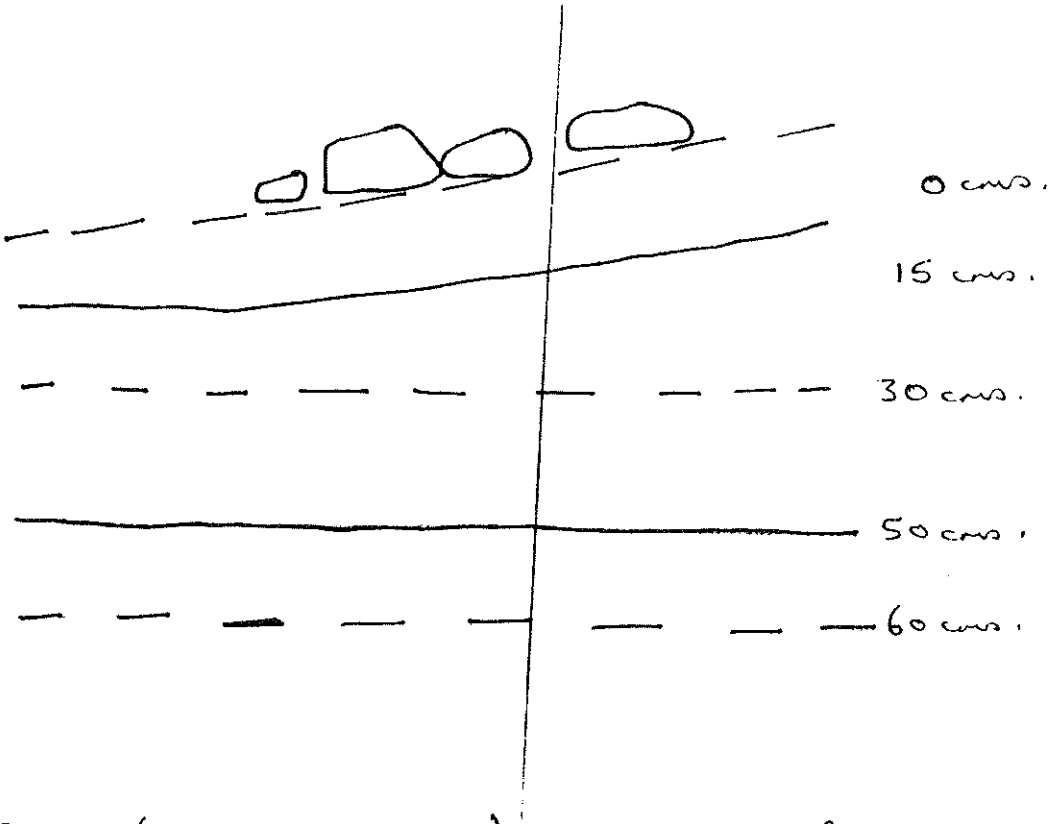
9. Soil survey of England and Wales (1983). Soil Map of England and Wales: Sheet 1, Northern England, Harpenden.

Plate 1.

Plate 2.

Plate 3.

Section I. Soil buried beneath the wall adjacent to the road (Photo



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Below 50 cms. Merging into mixed yellowish brown (10YR5/4), dark yellowish brown (5YR4/6) and strong brown (7.5YR5/8) firm, slightly plastic coarse sand with patches of coarse sandy clay. Structure was moderate, medium angular blocky; stones 10% gravel to medium (rounded pebbles), roots absent, and manganese oxide concretions abundant. At this level (about 60 cms.) water enters the profile.

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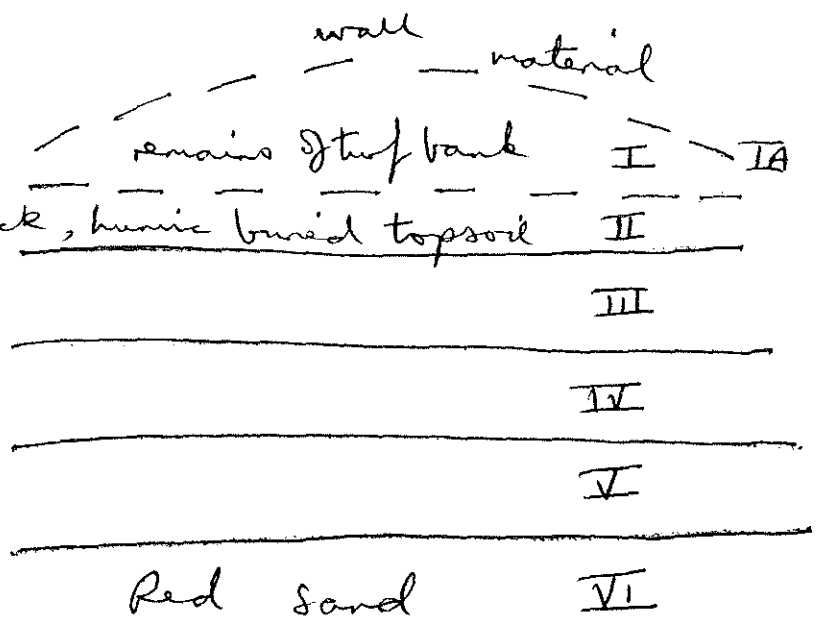
Samples.



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I Very dark greyish brown (10YR 3/2) friable sandy loam with weak medium crumb structure containing few gravel size stones and fine fibrous roots. Rare indistinct red (2.5YR 4/6) mottles occurred.

II Black (10YR 2.5/1) firm humose sandy loam with moderate medium subangular blocky structure, containing few gravel size stones and common

medium to fine fibrous roots. Rare, indistinct brown (10YR 5/3) mottles occurred.

III Black (5YR 2.5/1) friable stone-free sandy loam with weak medium crumb structure containing rare fine fibrous roots and occasional reddish yellow (7.5YR 6/6) mottle

IV Very pale brown (10YR 7/4) friable stone-free sandy loam wit weak medium subangular blocky structure, without roots and containing indistinct dark brown (7.5YR 4/2) mottles.

V. Yellowish red (5YR 5/8) moderately friable stone-free sandy loam with moderate medium blocky structure, without roots and containing abundant indistinct iron oxide mottles of various shades of red and yellow.

VI Red (2.5YR 5/8) moderately friable stone-free sandy loam with moderate medium blocky structure, without roots and containing occasional indistinct grey-brown mottles.

PARTICLE SIZE ANALYSIS AND ORGANIC MATTER CONTENT: RESULTS.

SAMPLE : (21) CROSBY I A.

PARTICLE SIZE.

Coarse Sand	3·13%
Medium Sand	10·76
Fine Sand	45·51
TOTAL SAND	59·40%
Coarse Silt	15·40
Medium Silt	3·60
Fine Silt	8·40
TOTAL SILT	27·40%
CLAY	13·20%

TEXTURE: SANDY LOAM.

ORGANIC MATTER CONTENT (375°C) : 3·2%

SAMPLE : (22) CROSBY I

PARTICLE SIZE.

Coarse Sand	1·44%
Medium Sand	9·98
Fine Sand	47·58
TOTAL SAND	59·00%
Coarse Silt	15·80
Medium Silt	3·60
Fine Silt	8·40
TOTAL SILT	27·80%
CLAY	13·20%

TEXTURE: SANDY LOAM.

ORGANIC MATTER CONTENT (375°C) : 4·1%

C

PARTICLE SIZE ANALYSIS AND ORGANIC MATTER CONTENT: RESULTS.

SAMPLE : (23) CROSBY II

PARTICLE SIZE.

Coarse Sand	0·67%
Medium Sand	9·94
Fine Sand	52·60
TOTAL SAND	63·20%
Coarse Silt	11·60
Medium Silt	3·60
Fine Silt	8·40
TOTAL SILT	23·60%
CLAY	13·20%

TEXTURE: SANDY LOAM.

ORGANIC MATTER CONTENT (375°C) : 10·5%

SAMPLE : (24) CROSBY III

PARTICLE SIZE.

Coarse Sand	0·51%
Medium Sand	9·74
Fine Sand	56·55
TOTAL SAND	66·80%
Coarse Silt	10·0
Medium Silt	6·20
Fine Silt	3·80
TOTAL SILT	20·00%
CLAY	13·20%

TEXTURE: SANDY LOAM

ORGANIC MATTER CONTENT (375°C) : 4·7%

PARTICLE SIZE ANALYSIS AND ORGANIC MATTER CONTENT: RESULTS.

SAMPLE : (25) CROSBY IV

PARTICLE SIZE.

Coarse Sand	0·46%
Medium Sand	8·68
Fine Sand	55·86
TOTAL SAND	65·00%
Coarse Silt	13·40
Medium Silt	4·60
Fine Silt	6·00
TOTAL SILT	24·00%
CLAY	11·00%

TEXTURE: SANDY LOAM

ORGANIC MATTER CONTENT (375°C) : 1·5%

SAMPLE : (26) CROSBY V

PARTICLE SIZE.

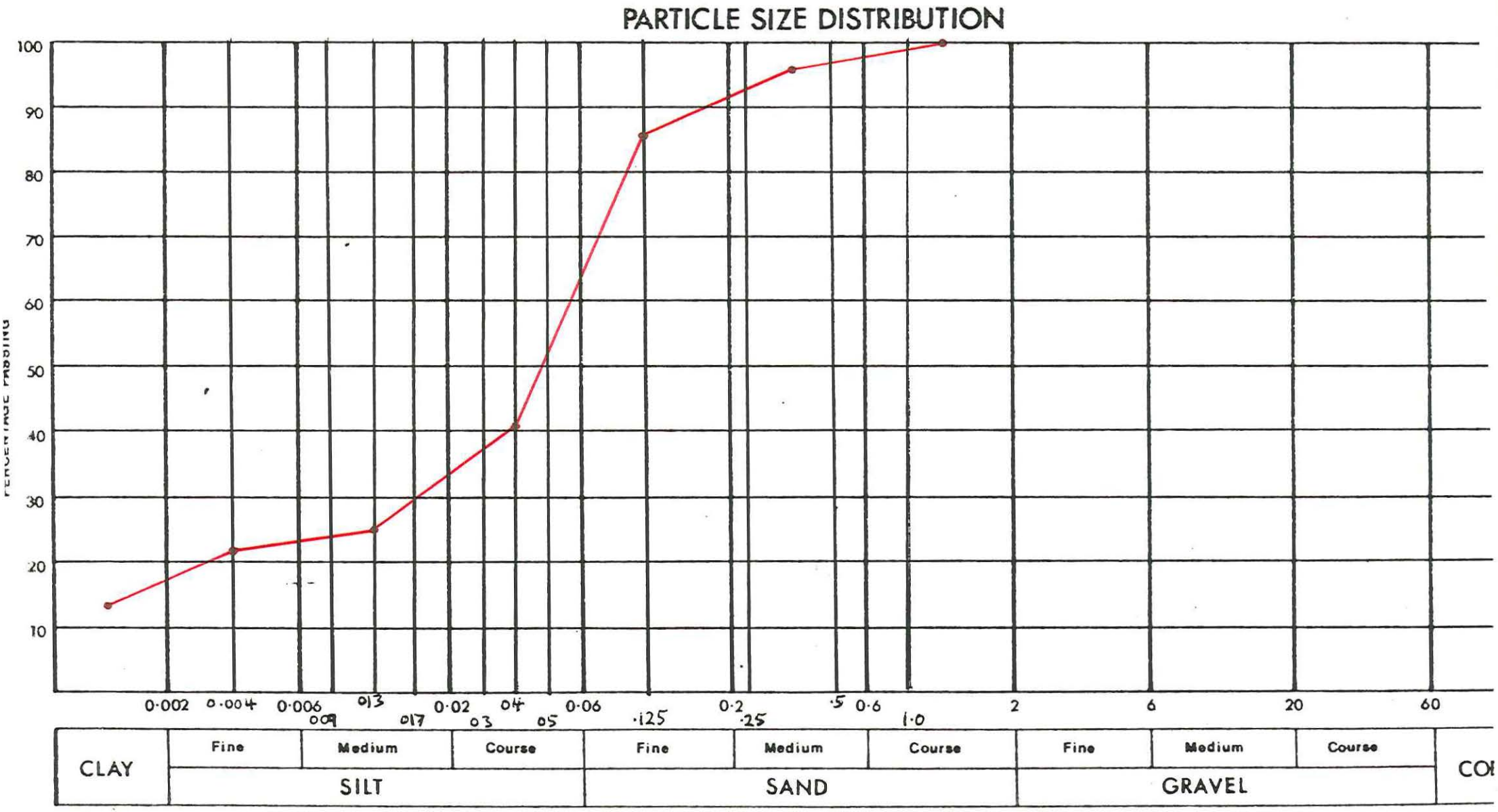
Coarse Sand	0·62%
Medium Sand	12·70
Fine Sand	57·48
TOTAL SAND	70·80%
Coarse Silt	5·40
Medium Silt	2·20
Fine Silt	6·60
TOTAL SILT	14·20%
CLAY	15·00%

TEXTURE: SANDY LOAM

ORGANIC MATTER CONTENT (375°C) : 1·7%

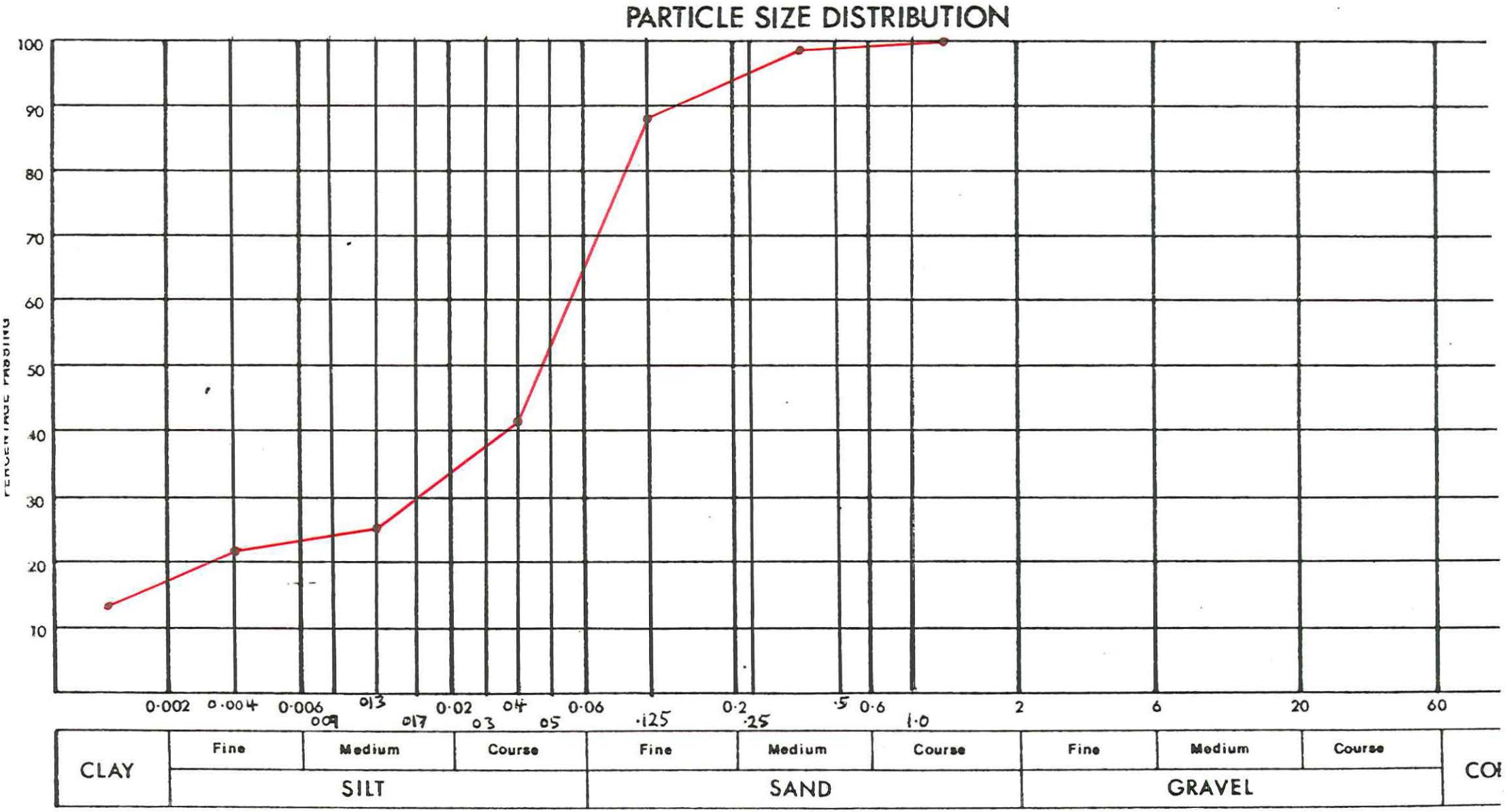
C

(21) CROSBY I A.



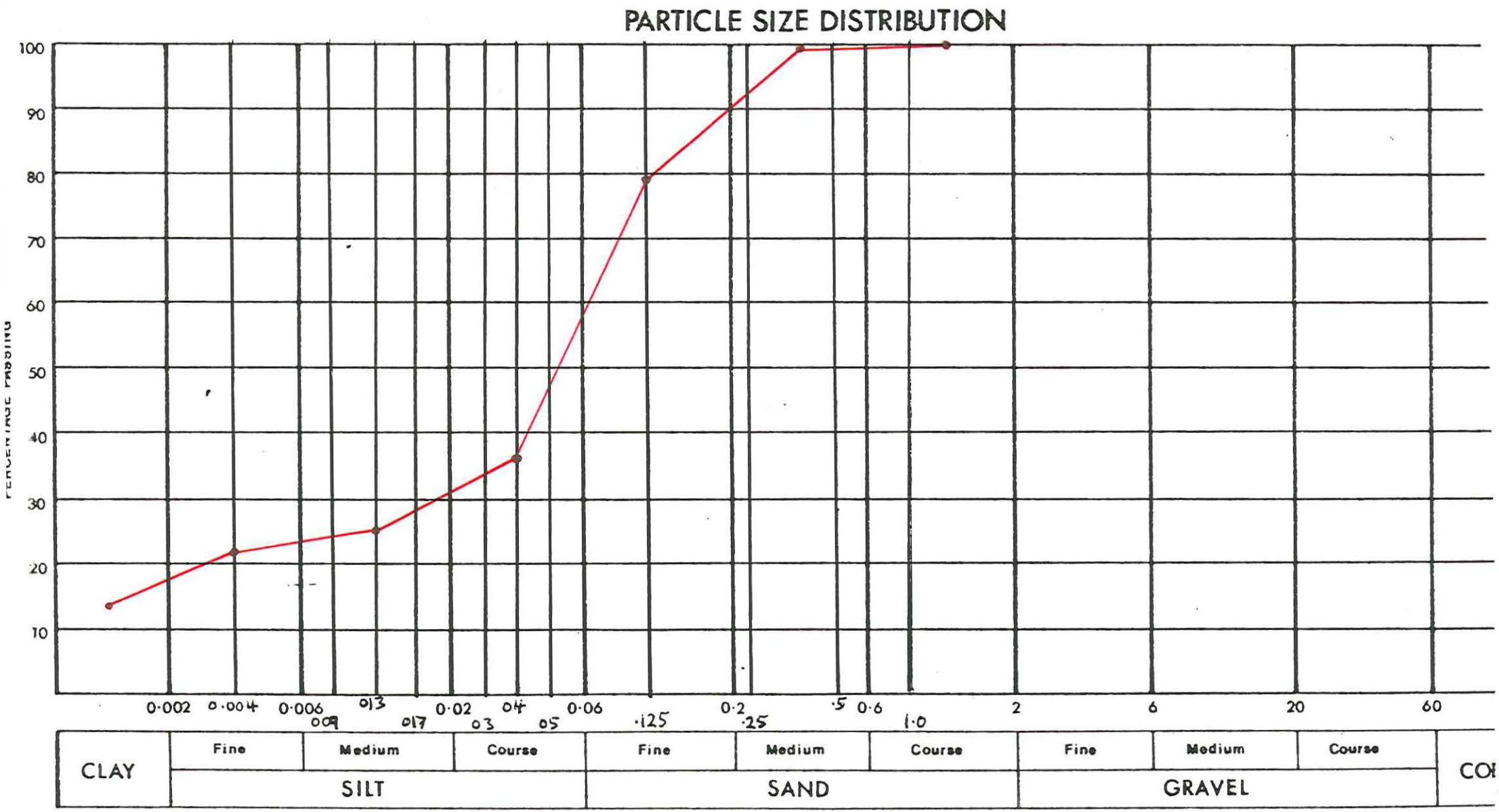
SANDY LOAM.

(22) CROSBY I



SANDY LOAM.

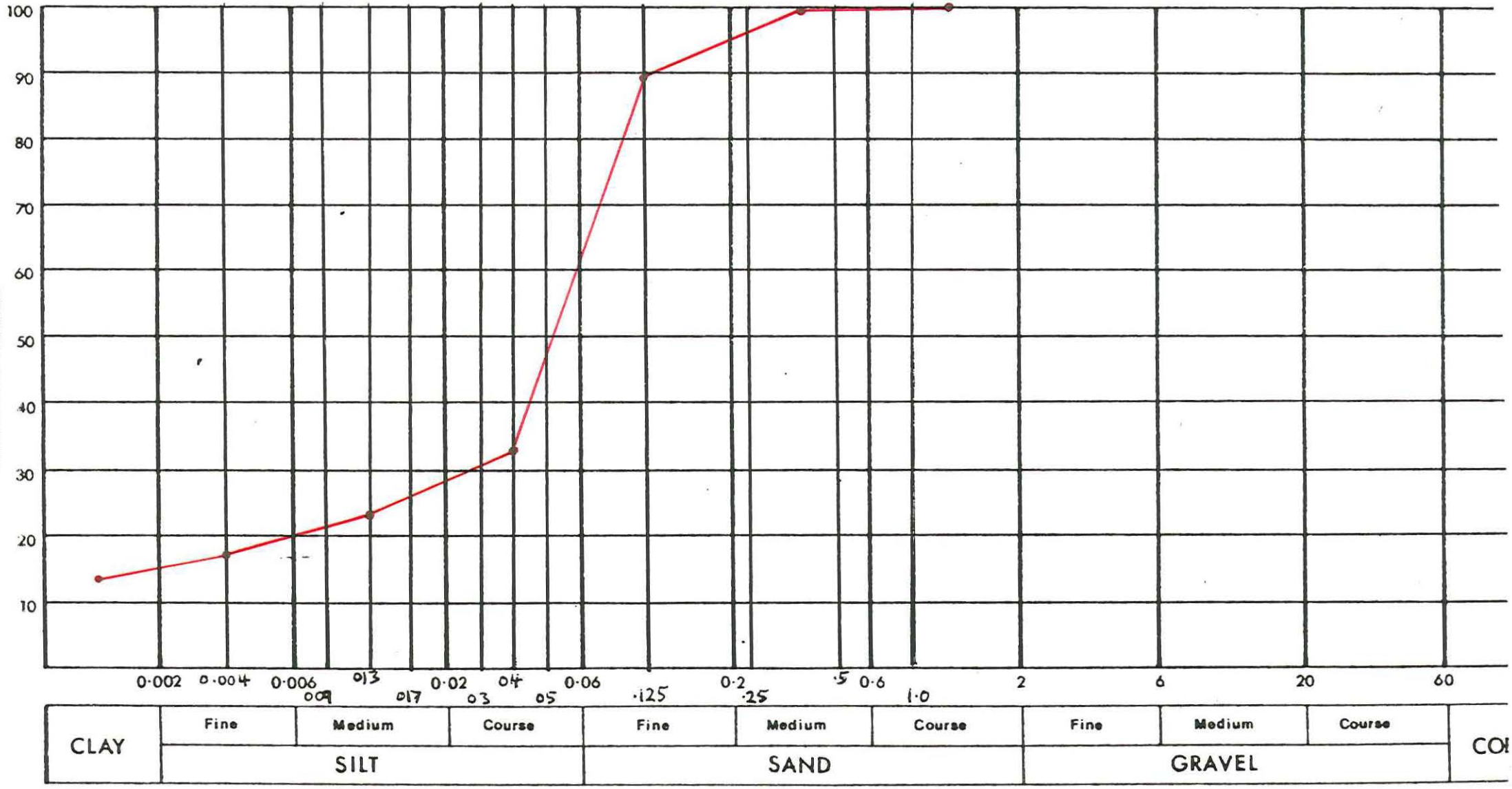
(23) CROSBY II.



SANDY LOAM.

(24) CROSBY III

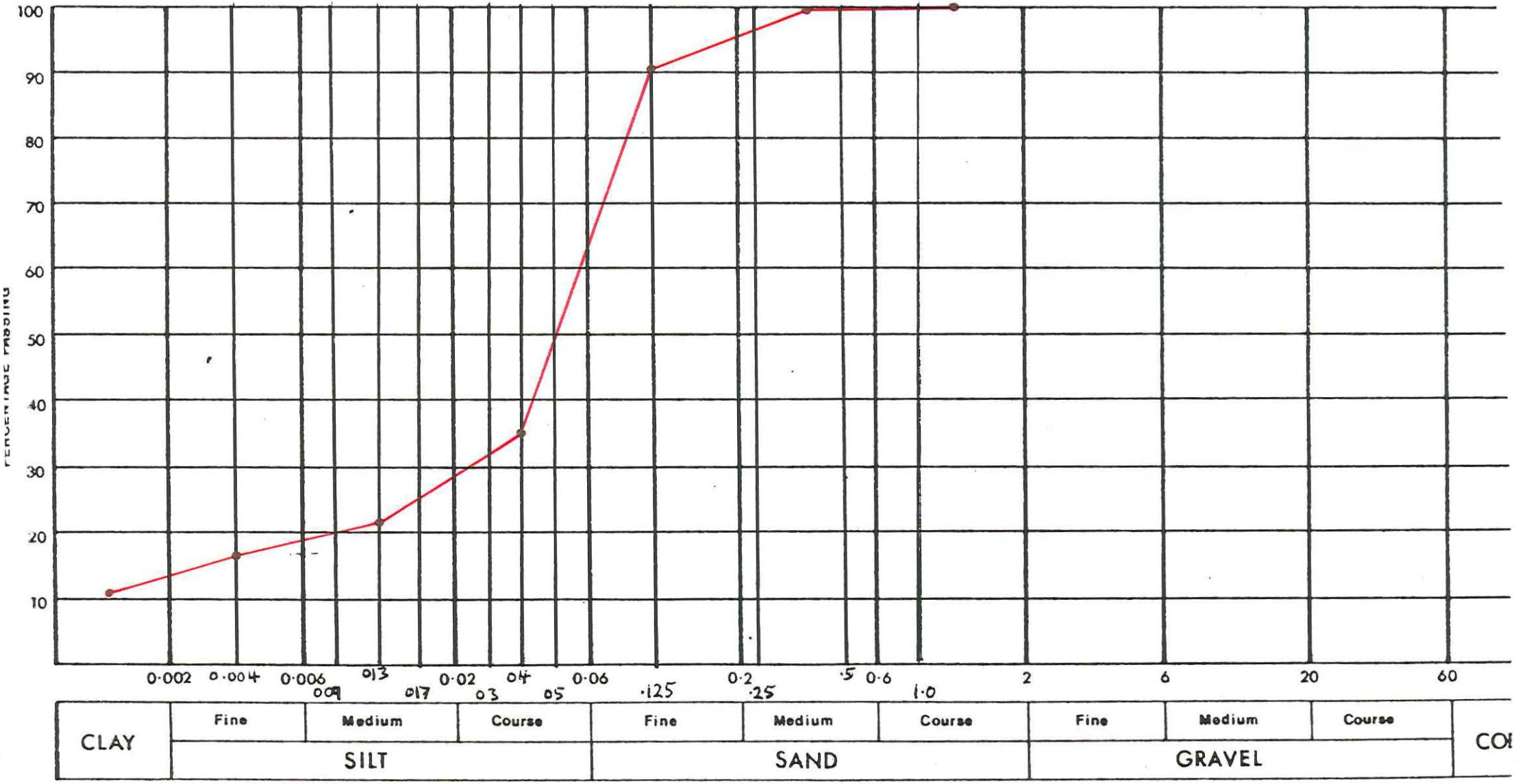
PARTICLE SIZE DISTRIBUTION



SANDY LOAM.

(25) CROSBY IV

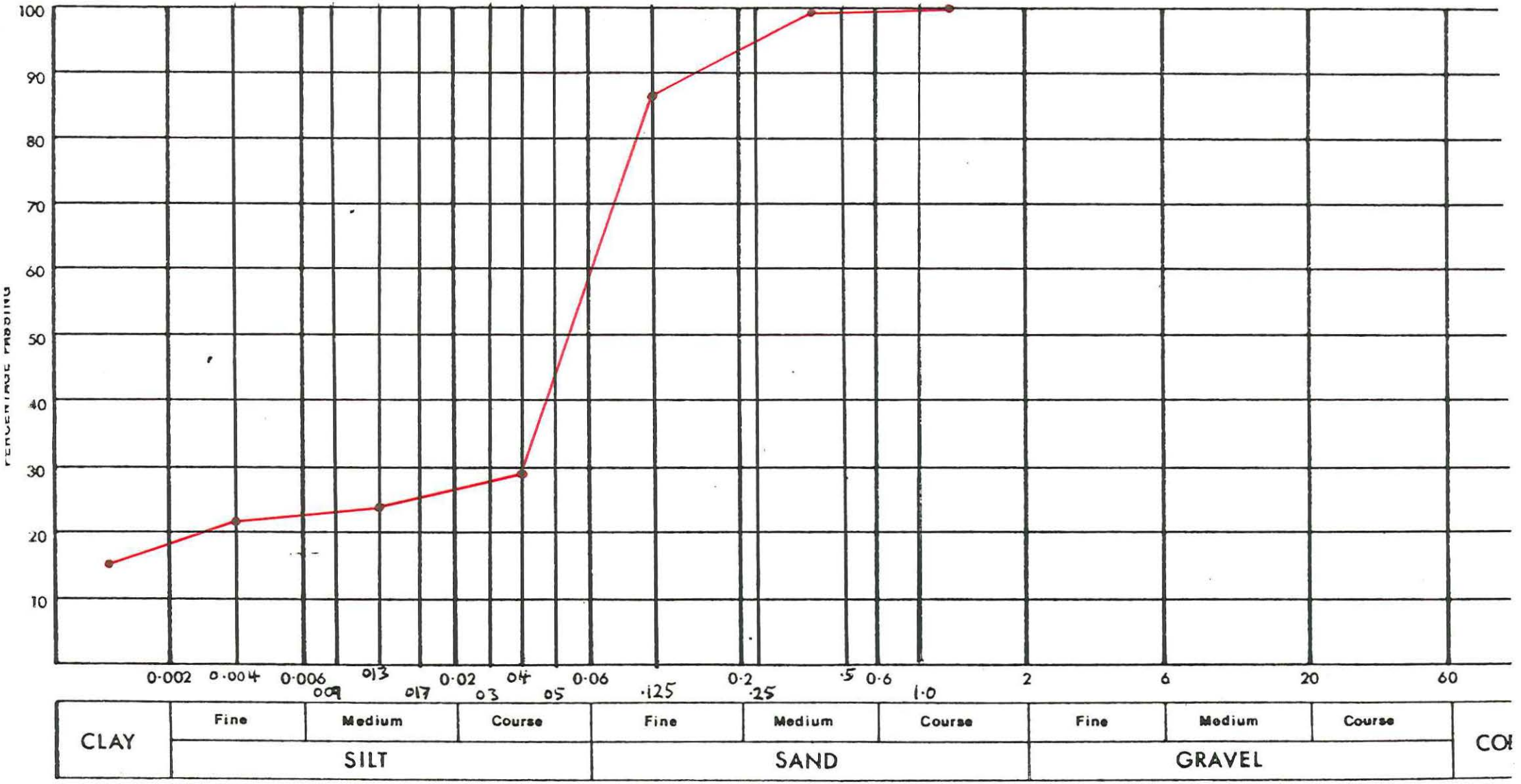
PARTICLE SIZE DISTRIBUTION



SANDY LOAM.

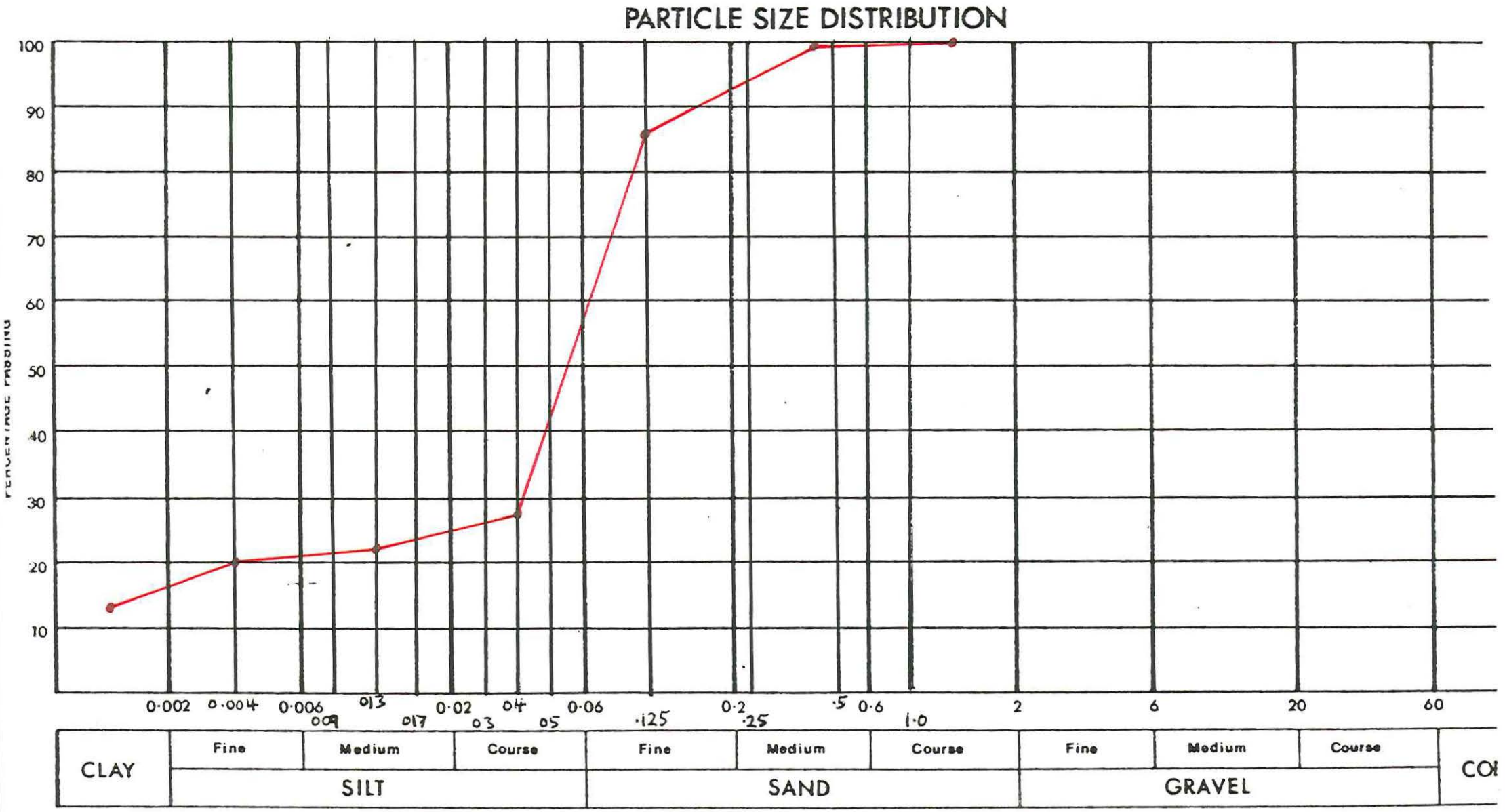
(26) CROSBY IV.

PARTICLE SIZE DISTRIBUTION



SANDY LOAM.

(27) CROSBY VI



SANDY LOAM.