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DEPARTMENT OF
MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1973/179

SEARCH FOR GRAVEL DEPOSITS FOR PADDYS RIVER ROAD, A.C.T., 1972

by

R.J. Hansen

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CONTENTS

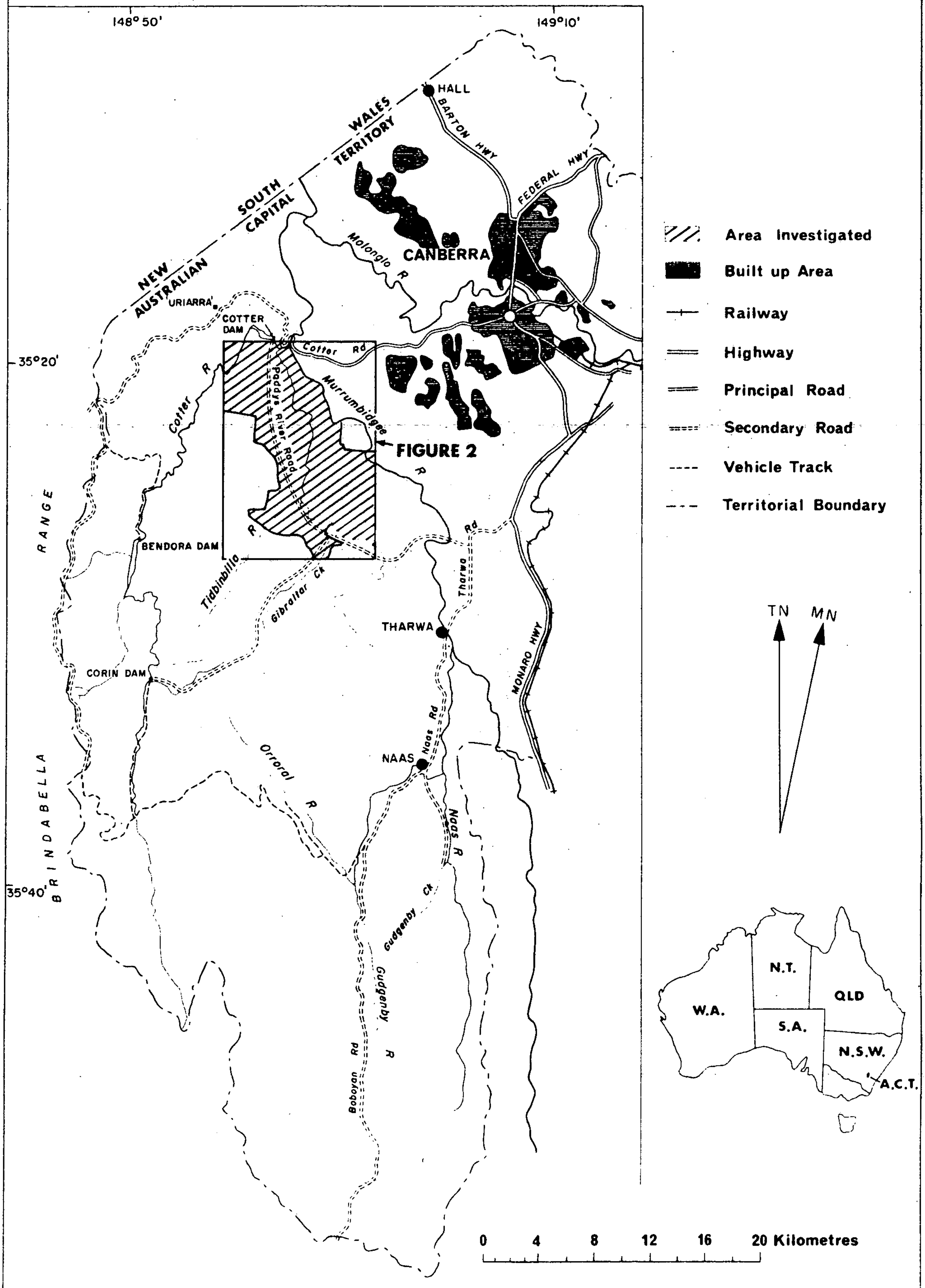
SUMMARY

Plastic and non-plastic gravel is required for use as base course material and for the shoulders of the Paddys River Road, and a search of the surrounding area was undertaken to find suitable material. Weathered material from the Shannons Flat Granodiorite was found to be unsuitable in most areas owing to the abundance of biotite and the high plasticity indices; however, a promising area was found on 'Riverlea' where a deposit of at least 10 metres thick would probably be suitable for use as plastic gravel. Material directly usable as non-plastic gravel could not be located. However, some creek bed sediments in Pierces Creek have a very low silt content which is too low for non-plastic gravel, but it is considered that a suitable material could be formed by mixing the Pierces Creek gravel with plastic gravel derived from the granodiorite.

FIGURE 1

SEARCH FOR GRAVEL DEPOSITS FOR PADDYS RIVER ROAD, A.C.T. 1972

LOCALITY MAP



To accompany Record 1973 /179

155/A16/1072 P.B.

INTRODUCTION

In June 1970, the Bureau of Mineral Resources (BMR) was requested by the Department of the Interior (D.I.) to locate deposits of plastic and non-plastic gravel* within a 4 km radius of 'Riverlea' homestead on Paddys River Road. The area of investigation was later extended to a radius of about 8 km from 'Riverlea' homestead (Fig. 2), and access was gained to Pierces Creek Forest and to Blocks 1, 10, 18, 24, 29, 33, 34, 35, 41, 47 and 76, Paddys River District.

Constraints imposed by the Department of the Interior on the location of gravel pits were as follows:

1) pits should be less than 8 km from the roadworks
2) they should be accessible from existing roads
3) they should not be located on freehold or resumed freehold land
4) they should not be readily visible from existing roads

GEOLOGY

General

The area was mapped by Snelling (1960), and is covered by the Canberra 1:250,000 Geological Sheet, SE/55-16 (Strusz, 1971). The rocks are, in decreasing order of abundance, the Shannons Flat Granodiorite, sedimentary rocks of probable Ordovician age, Silurian Volcanics, Tharwa Adamellite and minor amounts of aplite, microgranite, and prophyritic leucogranite.

Weathering and gravel

The suitability of material for use as plastic gravel depends on the chemistry of the parent rock, the development of completely weathered rock, and the extent to which the weathered profile has survived the present cycle of erosion. Completely weathered material derived from a biotite-rich parent rock, such as the Shannons Flat Granodiorite or some of the volcanic rocks, invariably contains a red plastic clay, which renders it unsuitable for use as non-plastic gravel; however, areas of slopewash derived from completely weathered volcanic or granitic rocks may provide suitable material because much of the clay would have been washed from the material during transport. The weathered argillaceous sedimentary rocks are generally too clayey for use as gravel.

FIELD INVESTIGATIONS

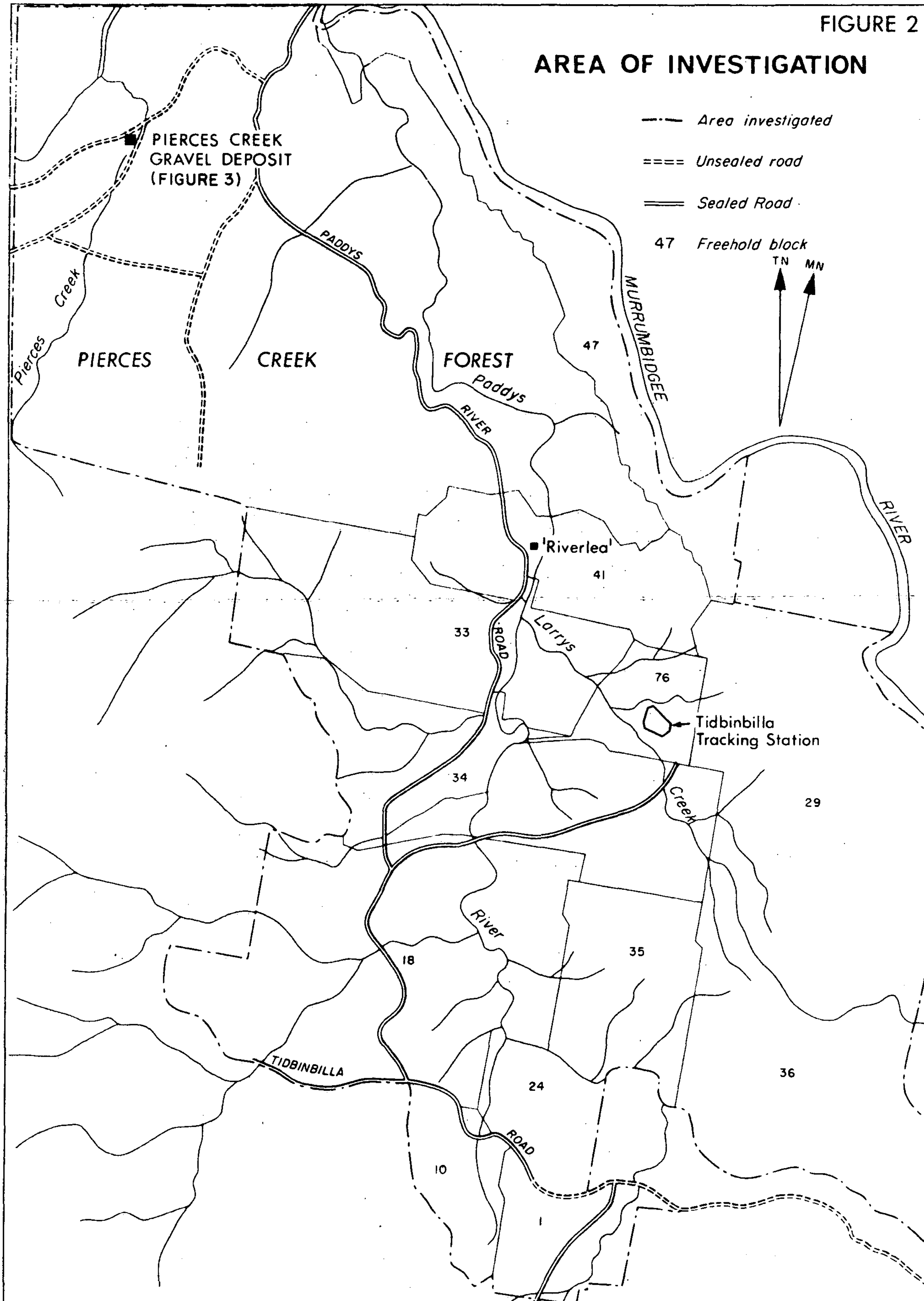
Granodiorite and adamellite

The acid igneous rocks of the A.C.T. provide both plastic and non-plastic gravel and many thousands of cubic metres have been won in the past. Commonly occurring undesirable materials in such gravels are organic matter and flakey or platy minerals such as biotite, and to a lesser extent muscovite and chlorite. Unfortunately, biotite is present to varying amounts in most parts of the batholith and this generally renders in situ weathered material unsuitable as a source for gravel.

More than 150 hand auger holes (logs of these are available at BMR) were drilled to check depth of weathering, degrees of leaching, and development of red clay. Favourable sites were chosen for examination with a power auger.

The most suitable material for use as plastic gravel was found on

* (i) Minimum reserves of about 7000 cu m are generally considered to constitute a viable deposit.
(ii) See Appendix 1 for definitions of terms 'Plastic' and 'Non-Plastic Gravel'.



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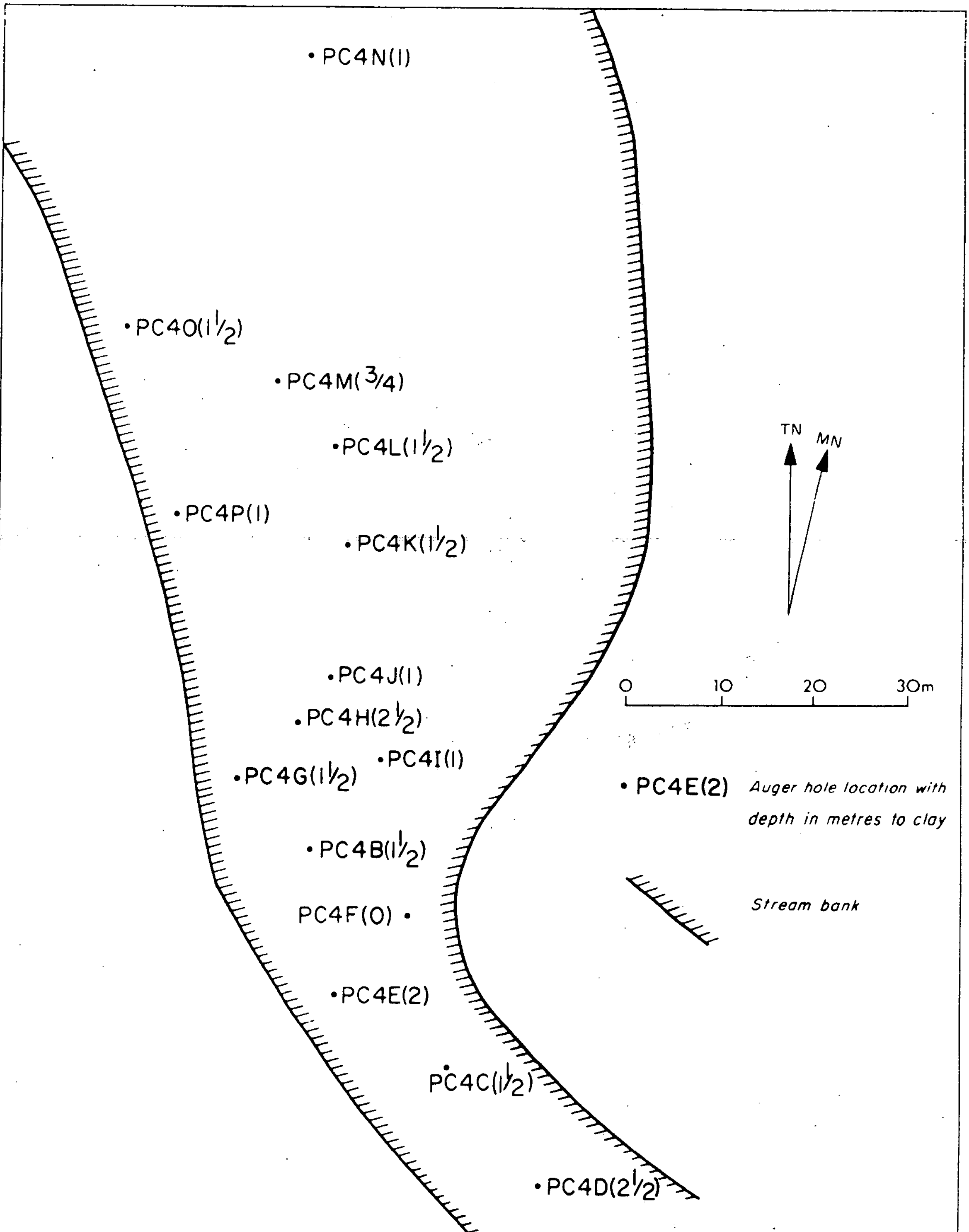
No.	Description	Author	Checked	Base map/survey ACT LAND TENURE	TITLE AREA OF INVESTIGATION
A1				Geology by R.J. HANSEN	
A2				Compiled and checked Project geologist	Checked and approved A.T. LAWS Senior geologist
A3					PROJECT Search for gravel deposits Paddys River Road, A.C.T, 1972
A4				E.G. WILSON Supervising geologist	To accompany Record 1973/179
A5					Drawn by P.BLYTHE
					Drawing No. I55/A16/1073

LOCATION OF AUGER HOLES IN PIERCES CREEK DEPOSIT **FIGURE 3**



AMENDMENTS				SCALE	COMMONWEALTH OF AUSTRALIA BUREAU OF MINERAL RESOURCES CANBERRA, A.CT.
No.	Description	Author	Checked	1:600	
A1				Base map/survey	TITLE LOCATION OF AUGER HOLES IN PIERCES CREEK DEPOSIT
A2				Geology by R.J. HANSEN	
A3				Compiled and checked — Project geologist	Checked and approved A.T. LAWS — Senior geologist
A4					PROJECT Search for gravel deposits Paddys River Road, A.C.T. 1972
A5				E.G. WILSON Supervising geologist	To accompany Record 1973/179 — Drawn by P.BLYTHE — Drawing No 155/A16/1074

Block 41, 'Riverlea' station (Hole No. P.R. PR03), where seismic investigations indicated that granite at this locality was highly weathered to a depth of at least 10 m. No other potential deposits of plastic or non-plastic gravel were found on granite.

Sedimentary rocks and volcanics

The sedimentary rocks consist mostly of shale and impure quartzite. Although a suitable gravel deposit could possibly form in reworked slopewash from these parent materials, no suitable material was found in the Paddys River area. The Paddys River Volcanics are of intermediate composition, giving rise to clayey weathered profiles of shallow depths, generally about 0.5 to 1.5 m.

Creek deposits

Creek sections were examined to determine suitability of the creek-bed sediments. The only occurrence which did not show an excess of organic matter or clay was at Pierces Creek (Fig. 2). Sixteen power auger holes were drilled (Fig. 3), but the material is poorly graded: it has a low silt and clay content (Appendix 2). The deposit is unsuitable for plastic or non-plastic gravel, but could probably be mixed with a more plastic material to obtain a gravel with a satisfactory range of Plasticity Index. Reserves of about 5000 cu m were proved.

RESULTS AND CONCLUSIONS

With the exceptions of the plastic gravel deposit found on Block 41, and the small reserves of material with poor grading characteristics at Pierces Creek, no other suitable plastic or non-plastic gravel deposits were found.

RECOMMENDATIONS

The area south of 'Riverlea' may be served by the Gibraltar Creek gravel pit (Vandenbroek & Hansen, 1973), and the search for suitable material should be extended to the Uriarra area, which could serve the Paddys River Road north of 'Riverlea'.

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APPENDIX 1

DEFINITIONS OF GRAVEL, PLASTIC AND NON-PLASTIC

'Gravel' is used in this report in an engineering rather than geological sense. It is defined as an unconsolidated, well-graded mixture of gravel-sized rock fragments and/or mineral grains such as quartz and feldspars, together with sand and silt, in a feebly plastic soil binder. It should be stressed that the terms gravel, sand, and silt refer only to particle size according to the Unified Soil Classification System, and not to their mode of origin.

'Gravel' derives its strength from mechanical interlock owing to high internal friction of its sub-angular components and specifications have been designed by the Commonwealth Department of Works (CDW) for quality control (see Appendix 2). These specifications are based on the assumption that the performance of 'gravel' is influenced by two characteristics, particle size distribution and plasticity. The latter is determined by an empirical test which indicates the affinity of the material for water and thereby the potential volume change of the clay binder. Particle size limits are flexible, but the grading curve should be smooth and parabolic.

'Plastic' and 'non-plastic gravel'

There are two types of gravel required for rural roads. In engineering terminology they are known as 'plastic gravel' and 'non-plastic gravel'. The former is used for surfacing unsealed roads and for shoulders on sealed roads. Its plasticity index (PI) should not exceed 8 and its maximum particle size should not exceed 3.8 cm in diameter. 'Non-plastic gravel' is used as a surface course underneath a seal and its PI must not exceed 6 and its maximum particle size should not exceed 3.8 cm.

In general, the 'plastic' variety should have a higher percentage of fine-grained material than the 'non-plastic' type because vehicle traffic tends to remove a considerable portion of the finer grained material.

APPENDIX 2

PARTICLE SIZE DISTRIBUTION OF PIERCES CREEK GRAVEL DEPOSIT SAMPLES

The following charts show the relationships between the sample particle size, the Commonwealth Department of Works (CDW) grading specifications and the theoretical ideal grading derived from Talbot's formula. Talbot's formula gives the range of particle sizes, from the smallest to the largest, which will result in minimum pore space after compaction.

The formula is $p = \left(\frac{d}{D}\right)^x \times 100$,

where p = percentage by weight smaller than any particle size d.

d = particle size

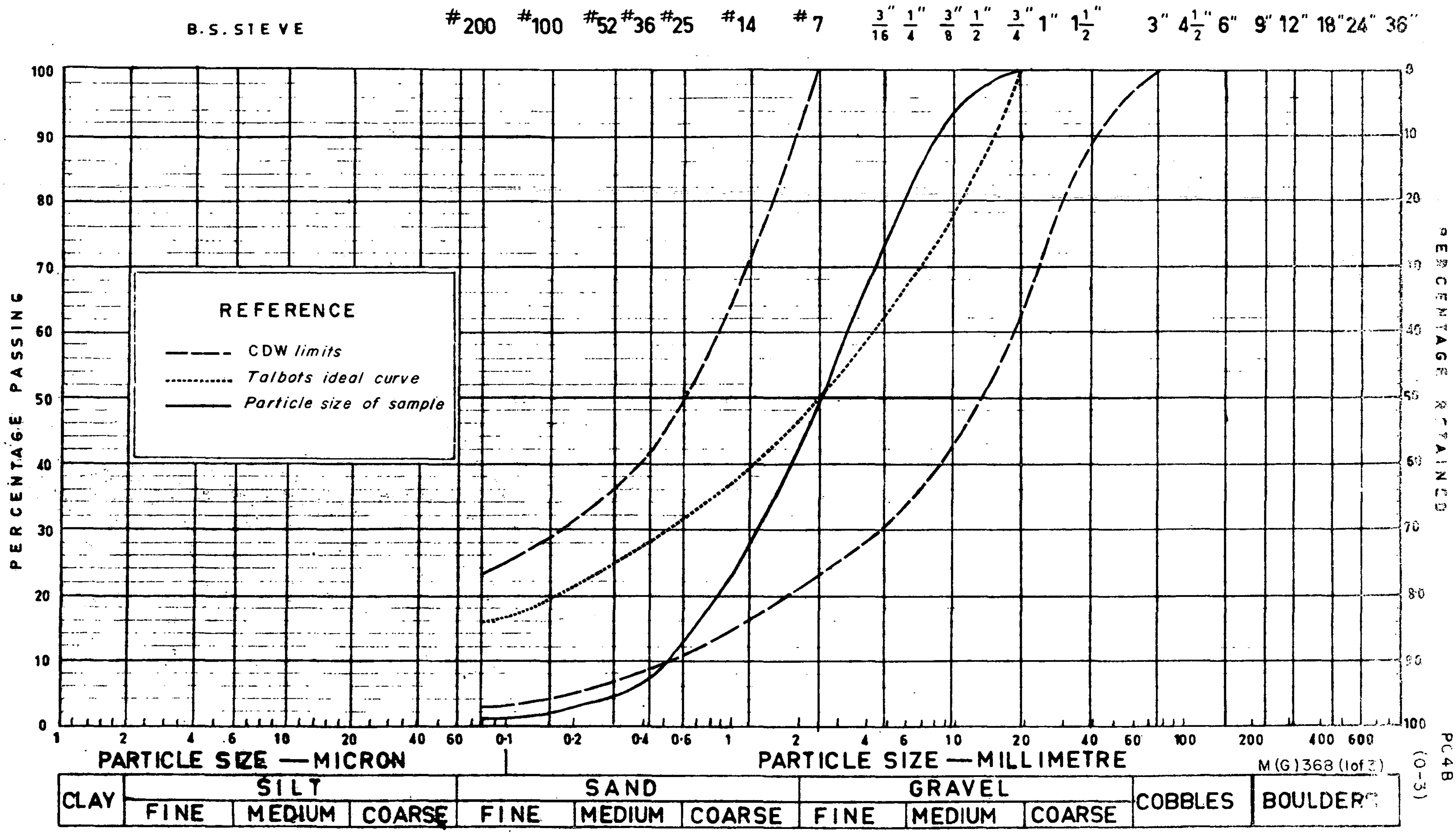
D = maximum particle size

x is a function of the particle shape; it is usually taken between 0.25 and 0.40. In this case the exponent was taken to be 0.33.

NOTE: THE PARTICLE SIZE DISTRIBUTION CURVES SHOULD BE TREATED WITH CAUTION, AS THEY REPRESENT SAMPLES OBTAINED BY CONTINUOUS DISTURBED AUGERING.

The particle size distribution charts indicate the limits of the CDW grading specifications as dashed lines, the Talbot curve as a dotted line, and the sample curve as a solid line.

PARTICLE SIZE DISTRIBUTION CHART



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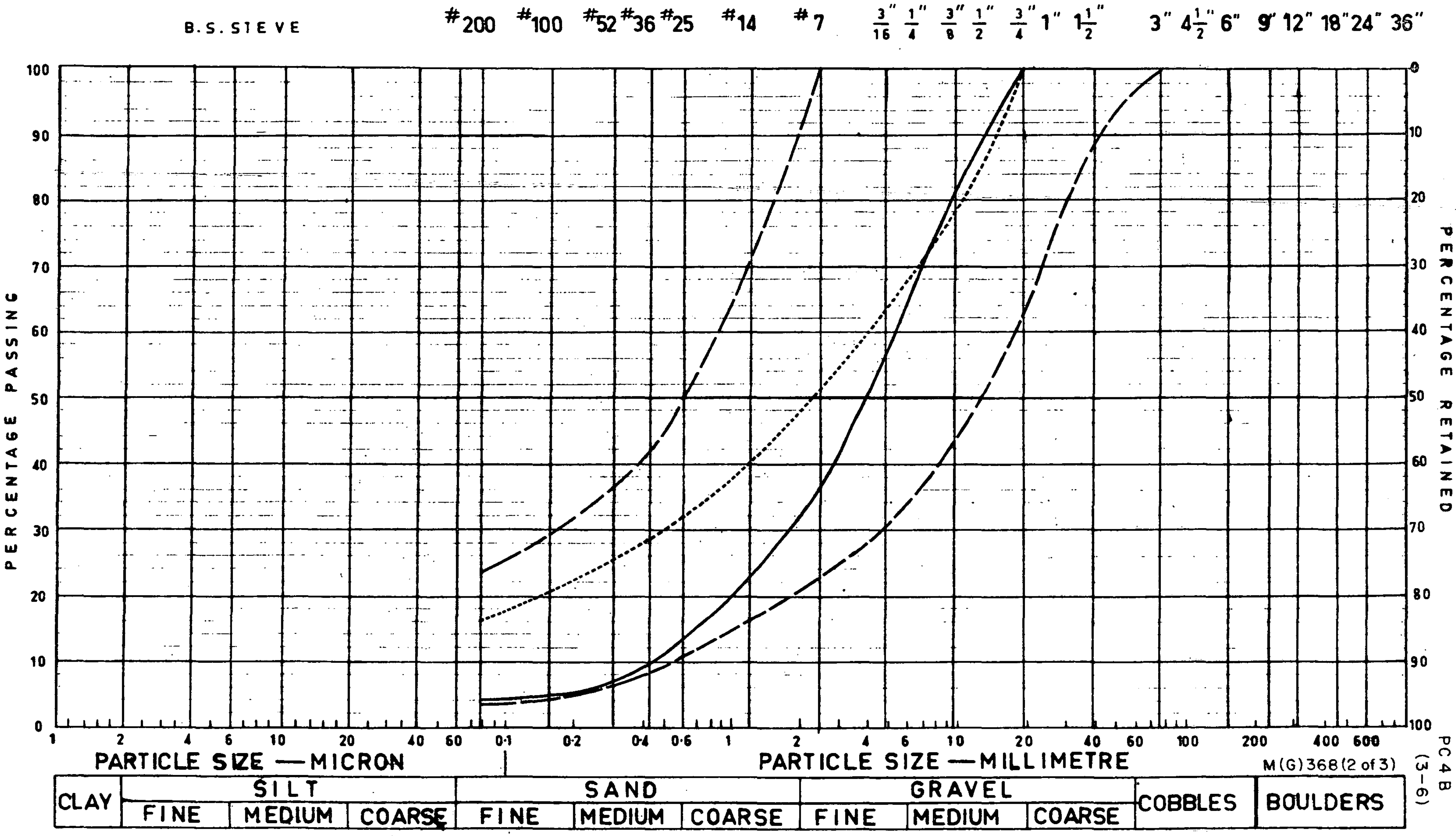

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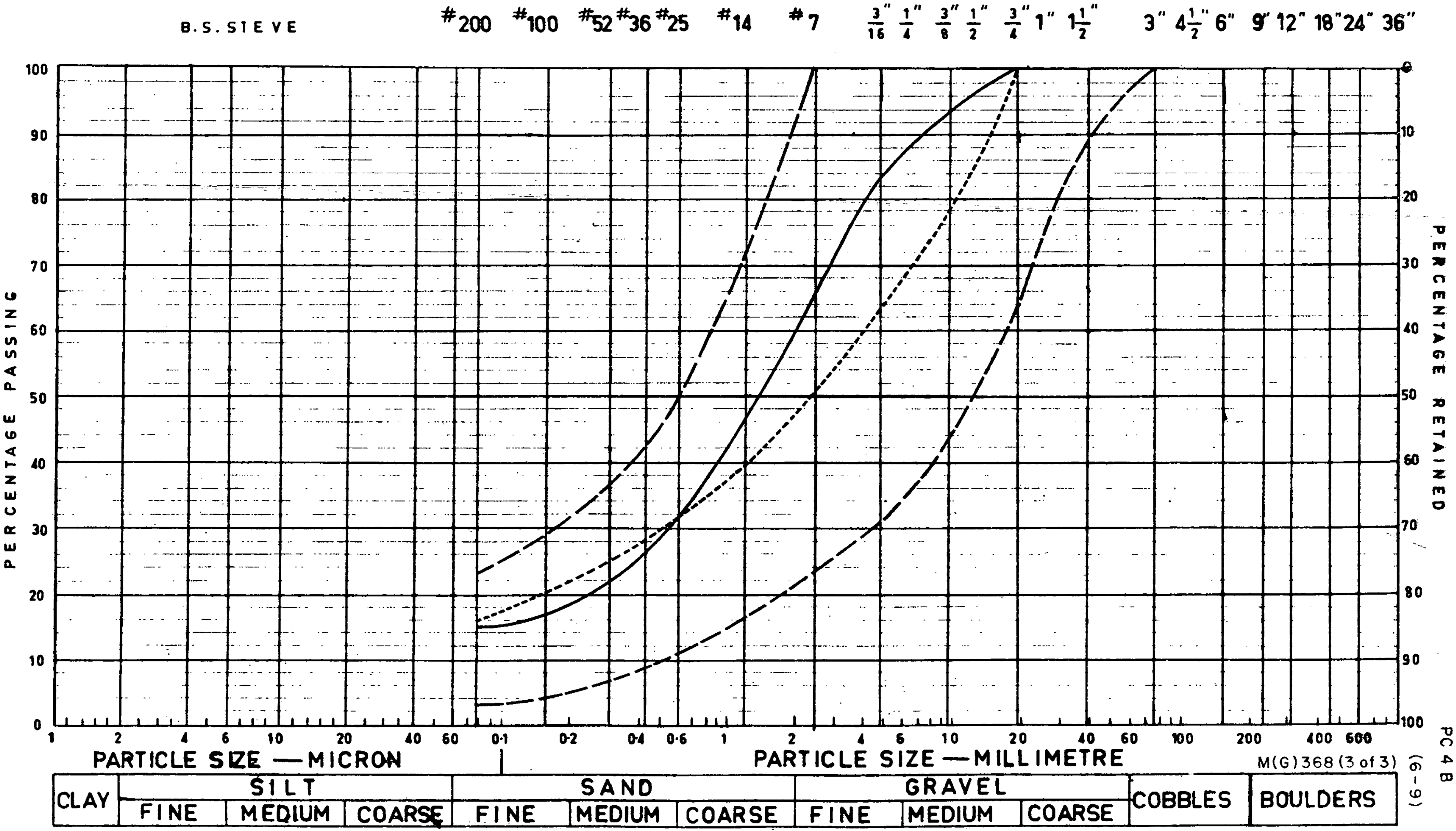

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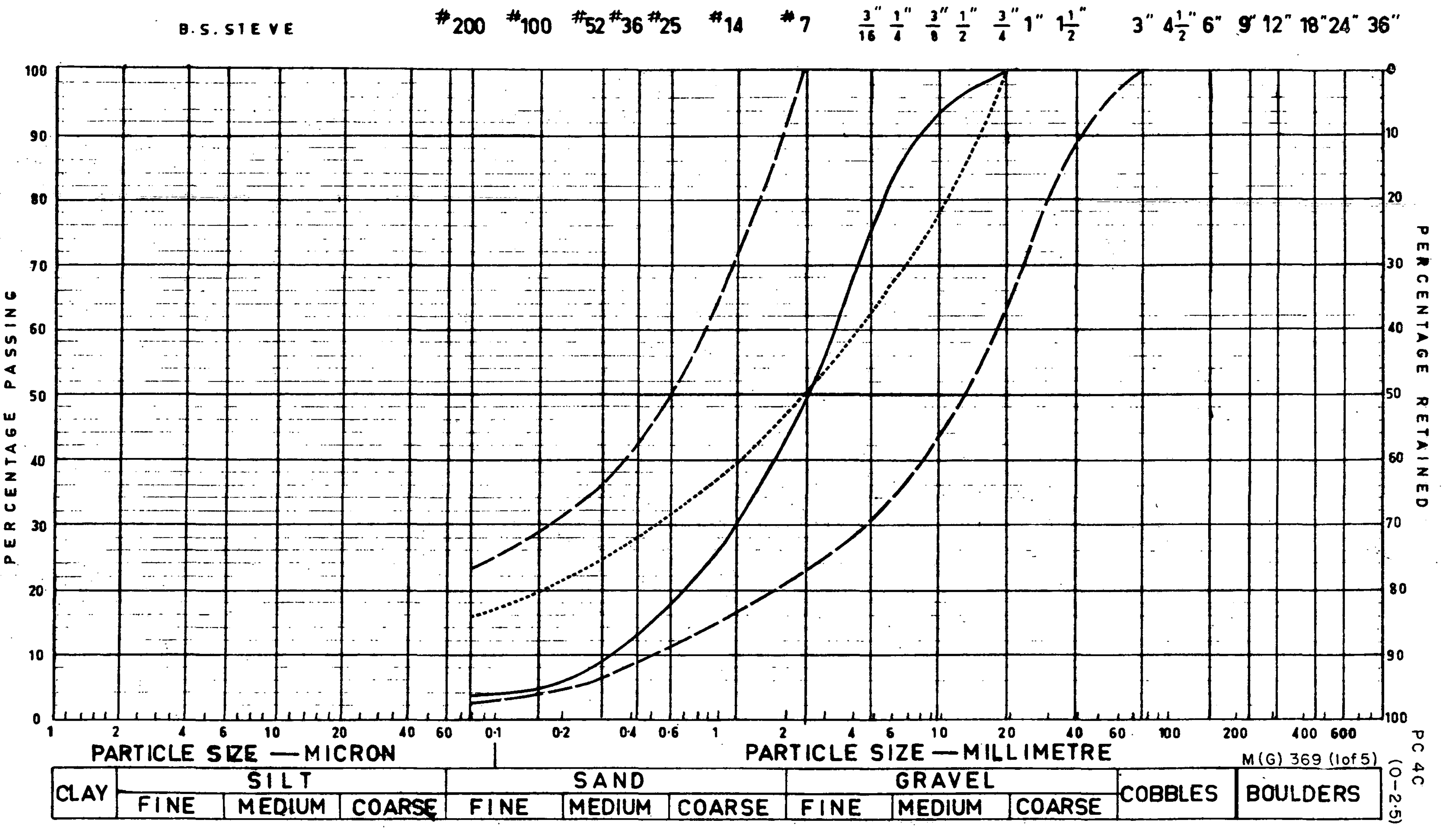

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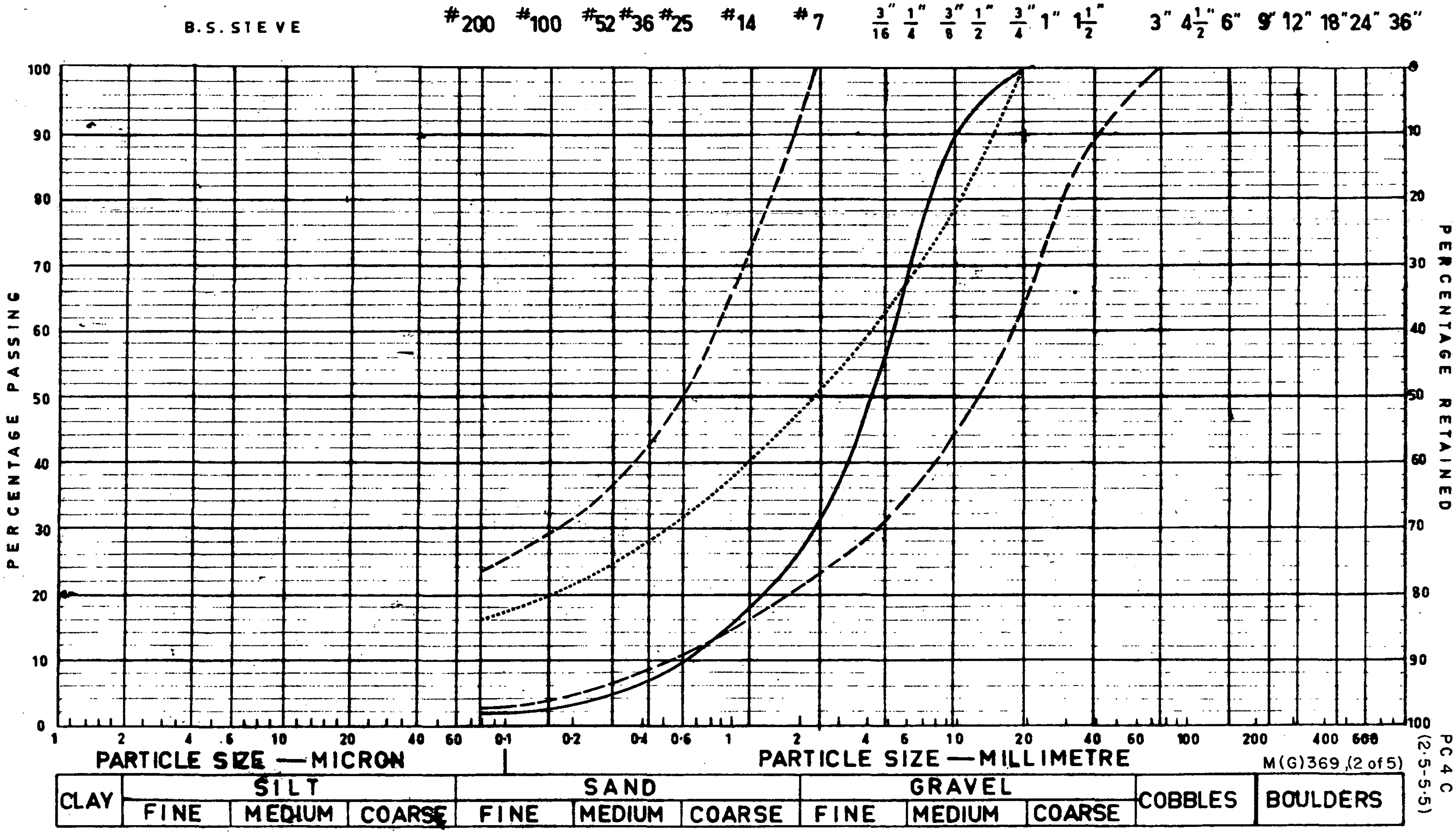

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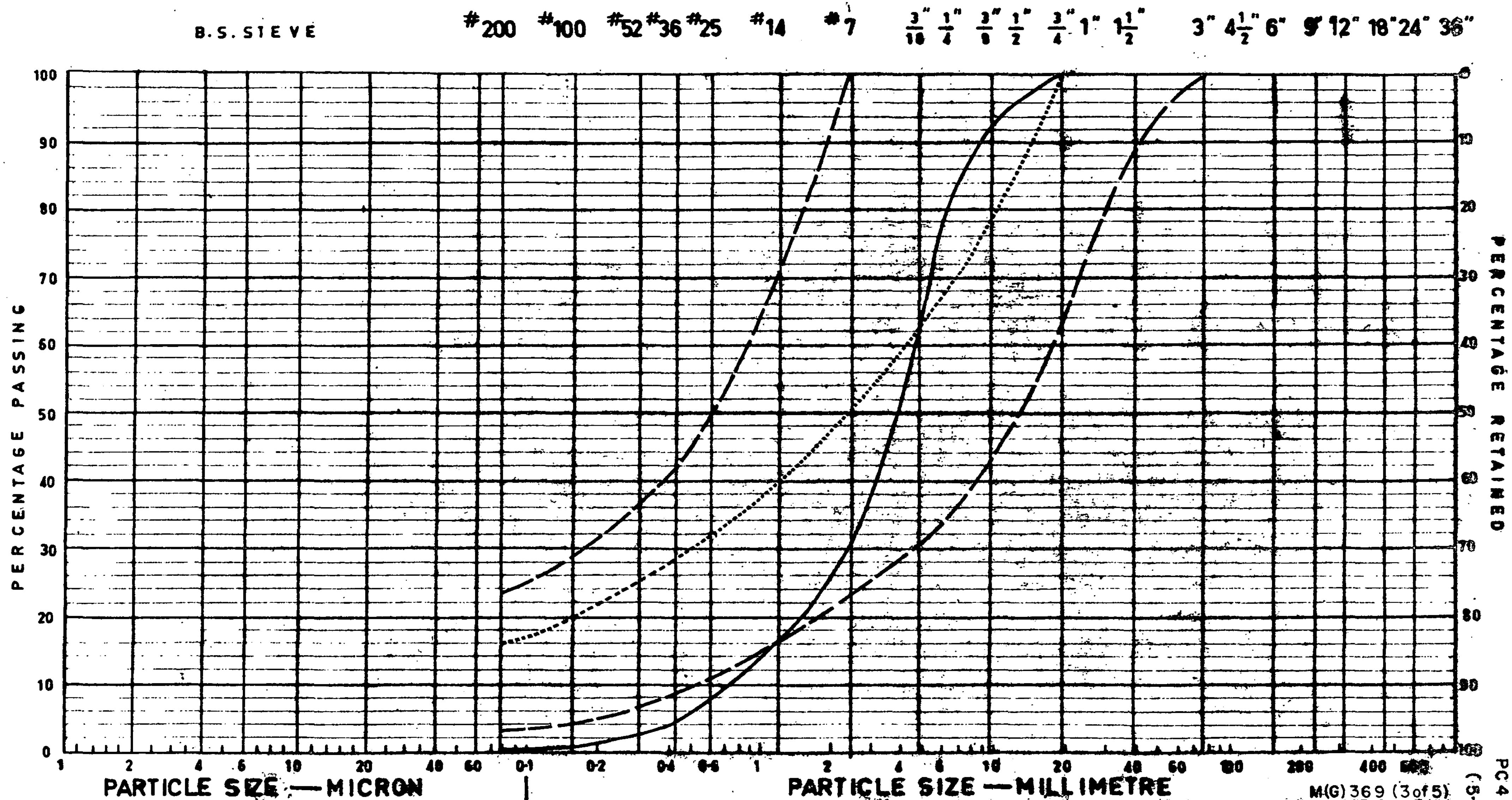
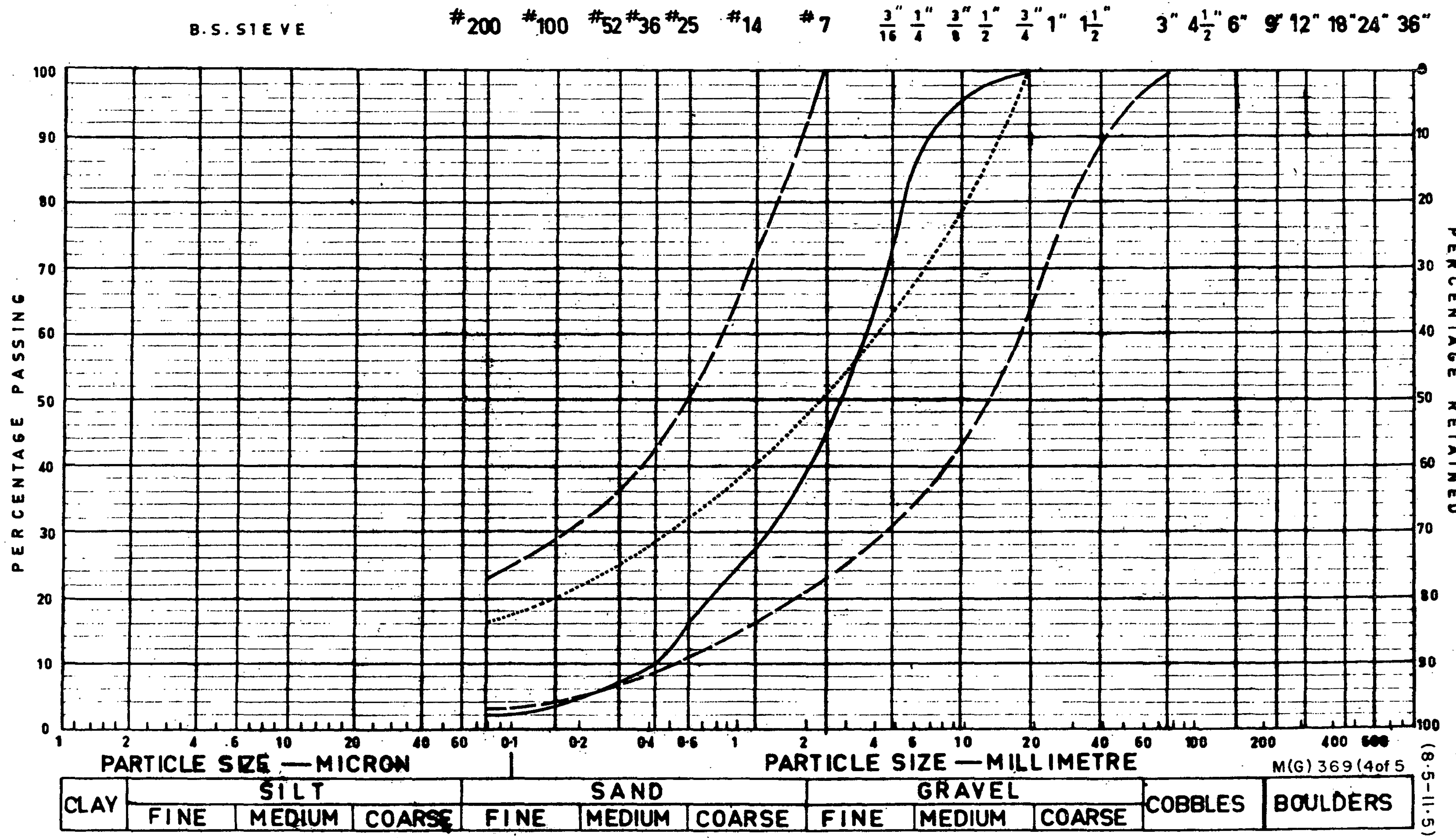


CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

PARTICLE SIZE DISTRIBUTION CHART



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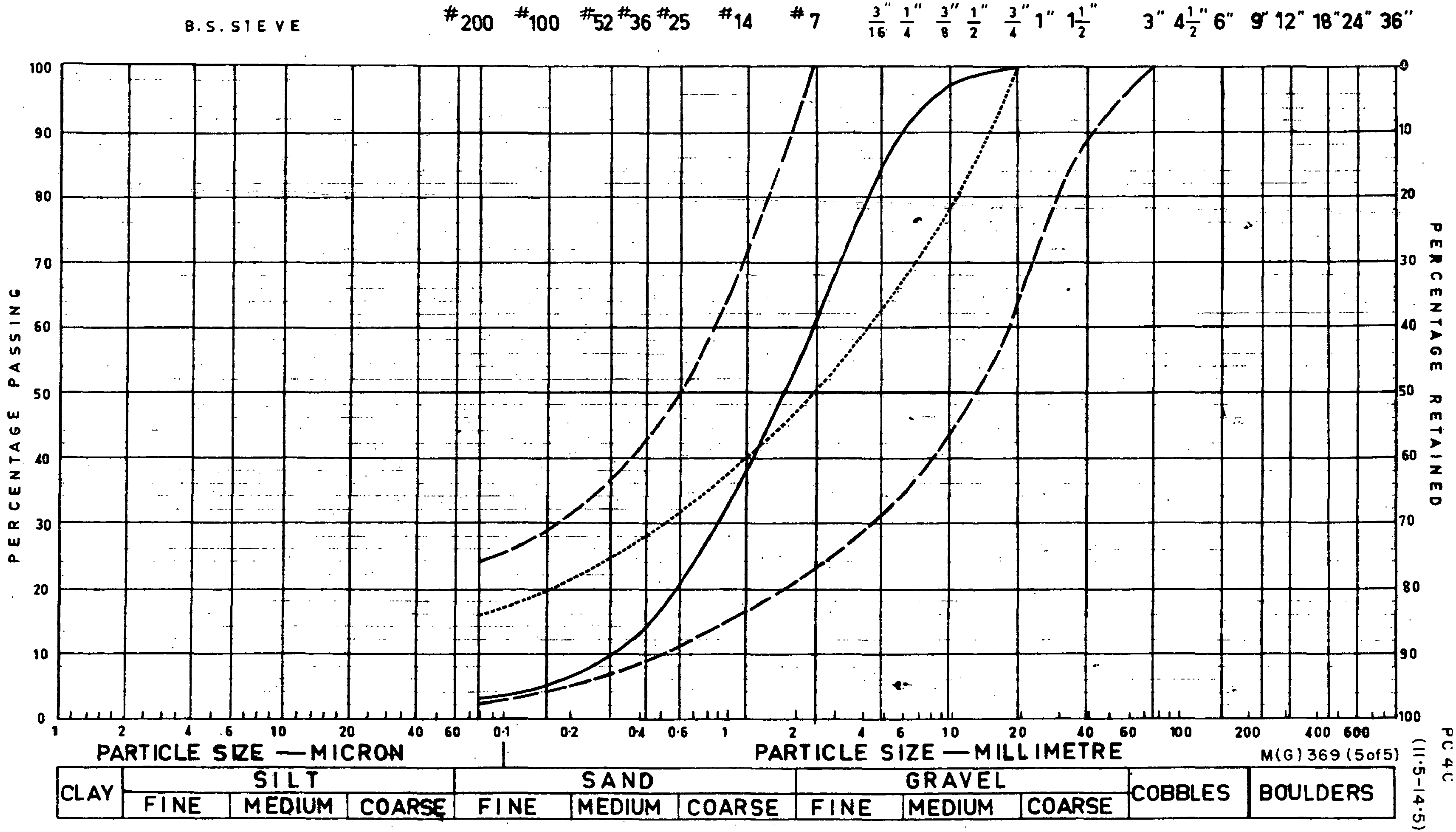

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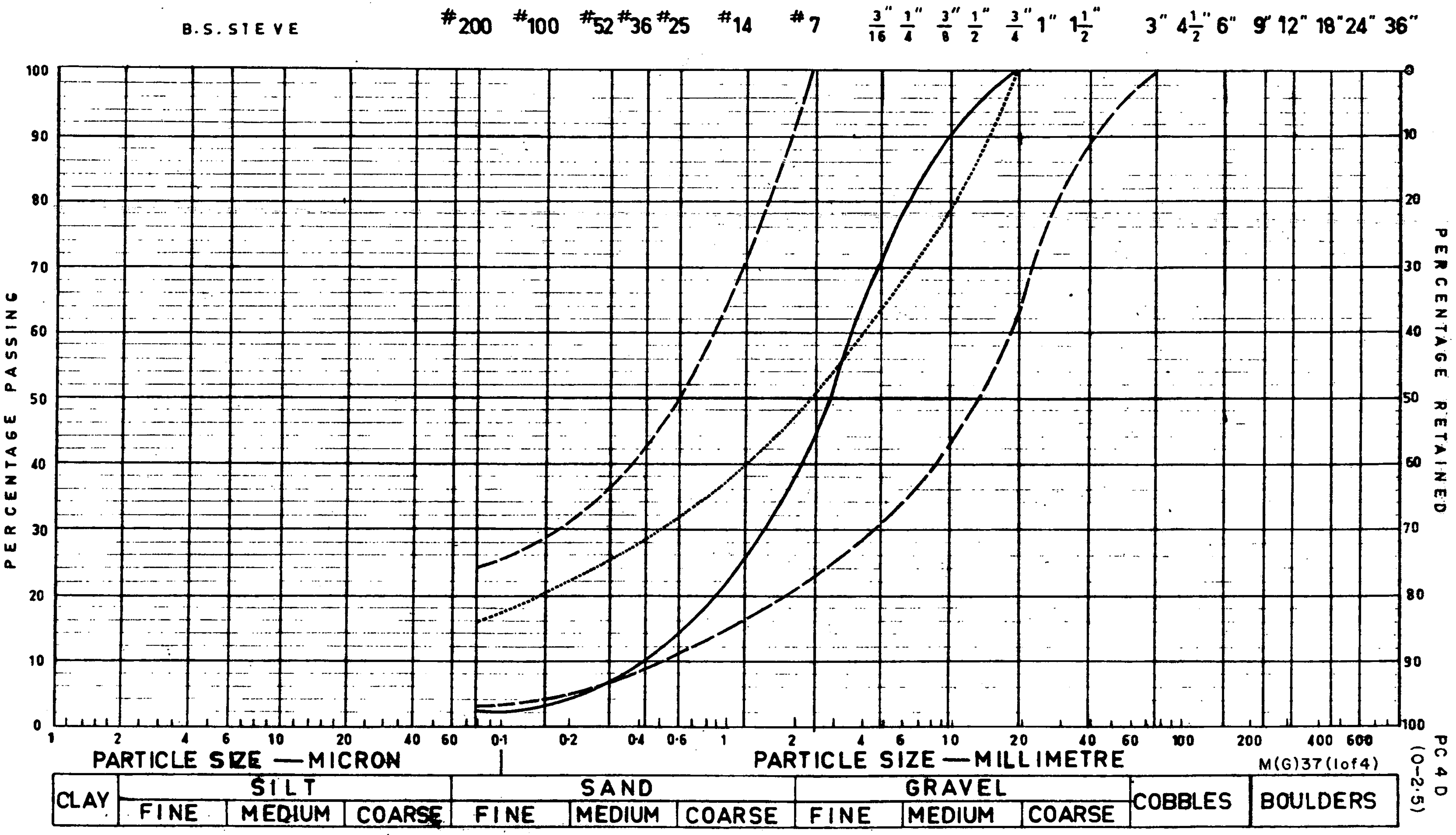

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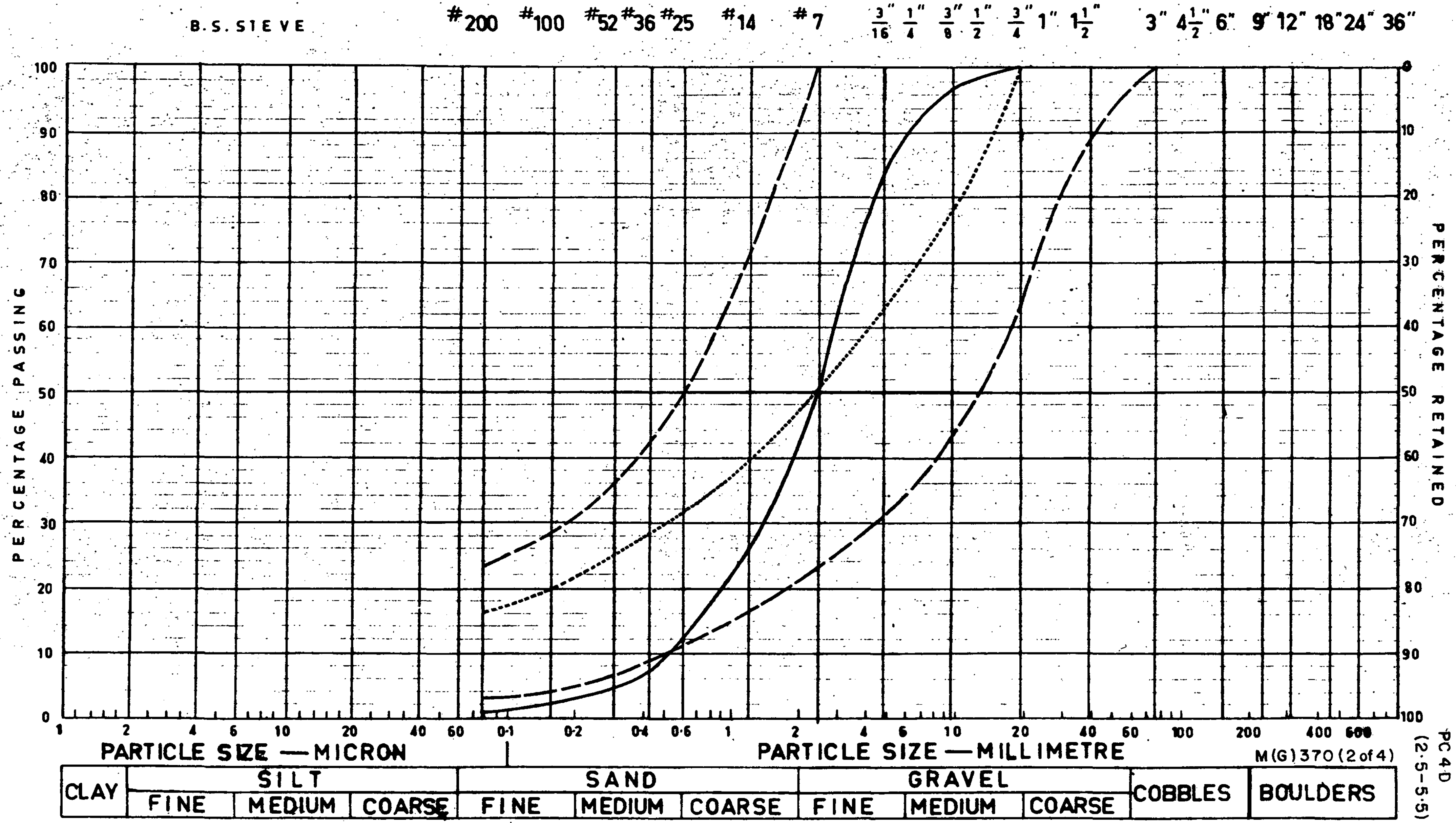

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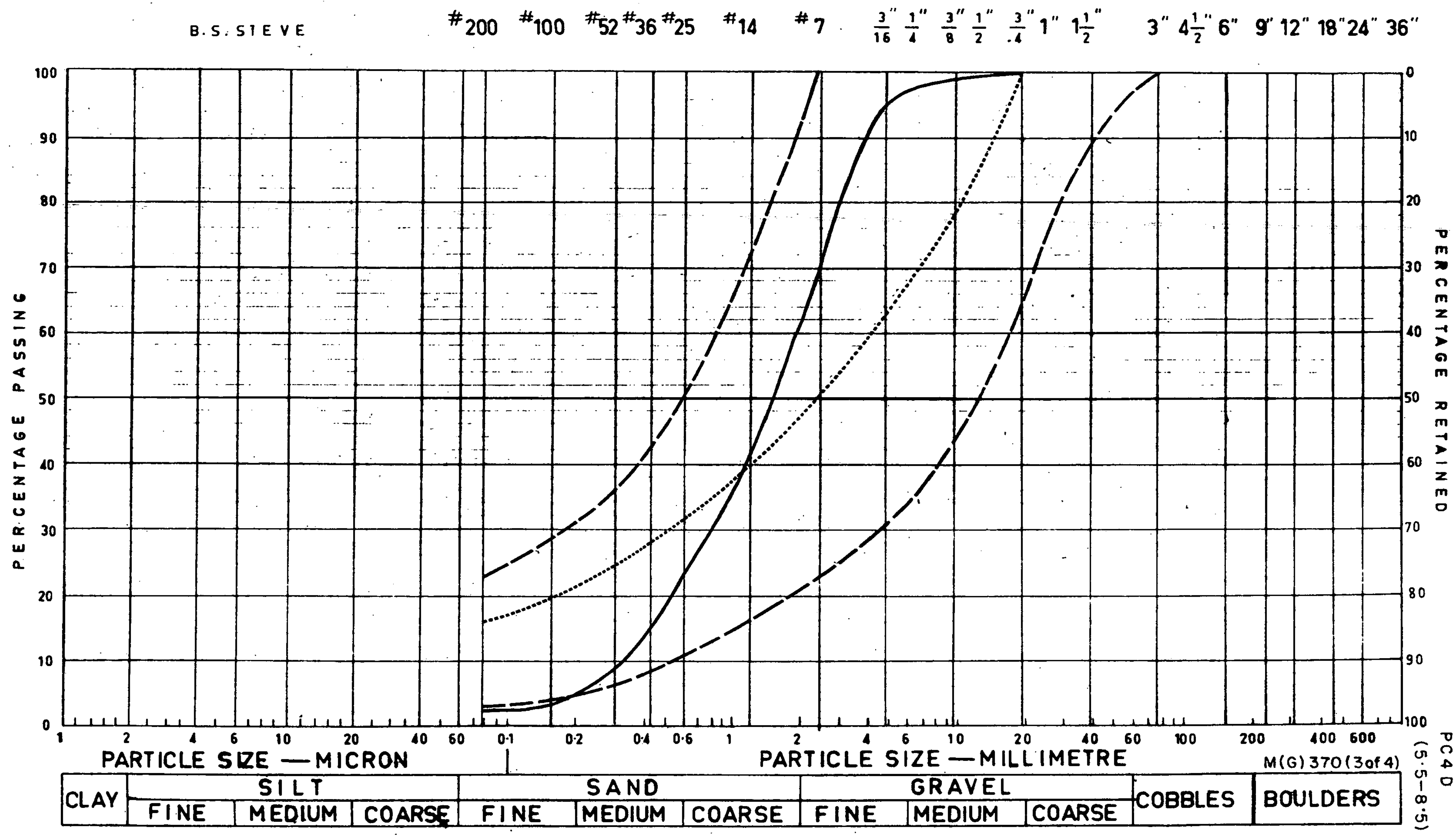

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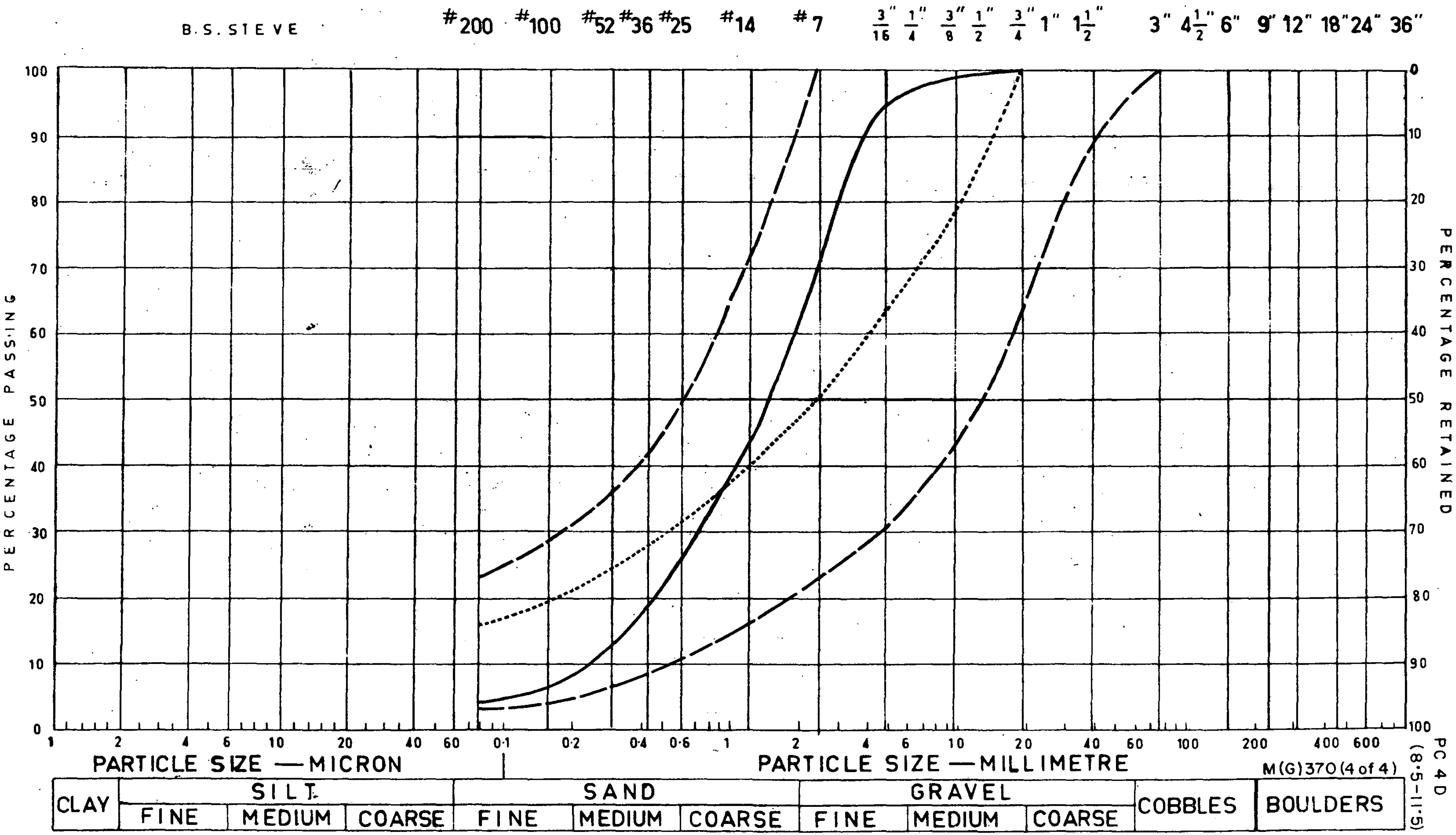

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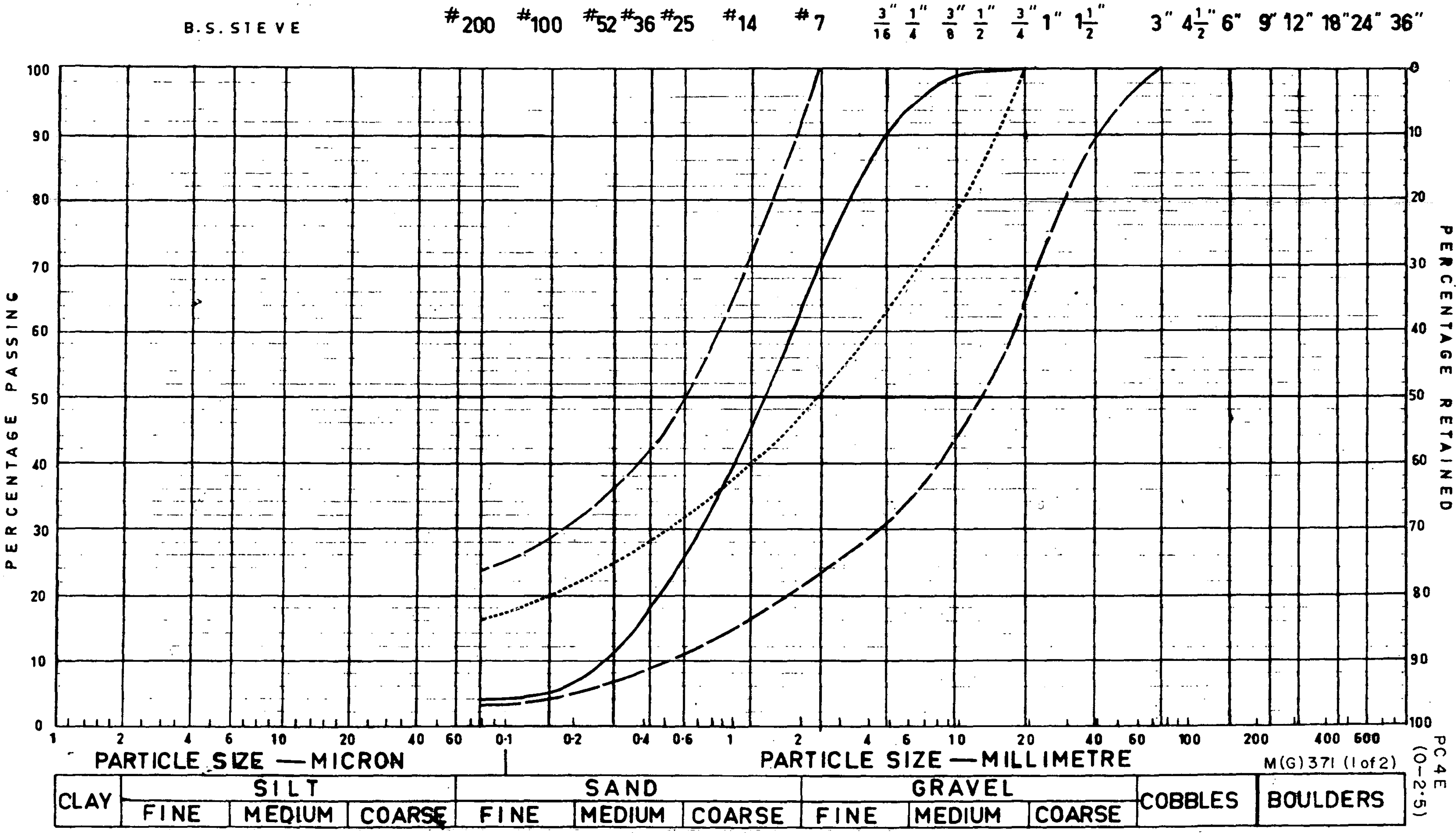

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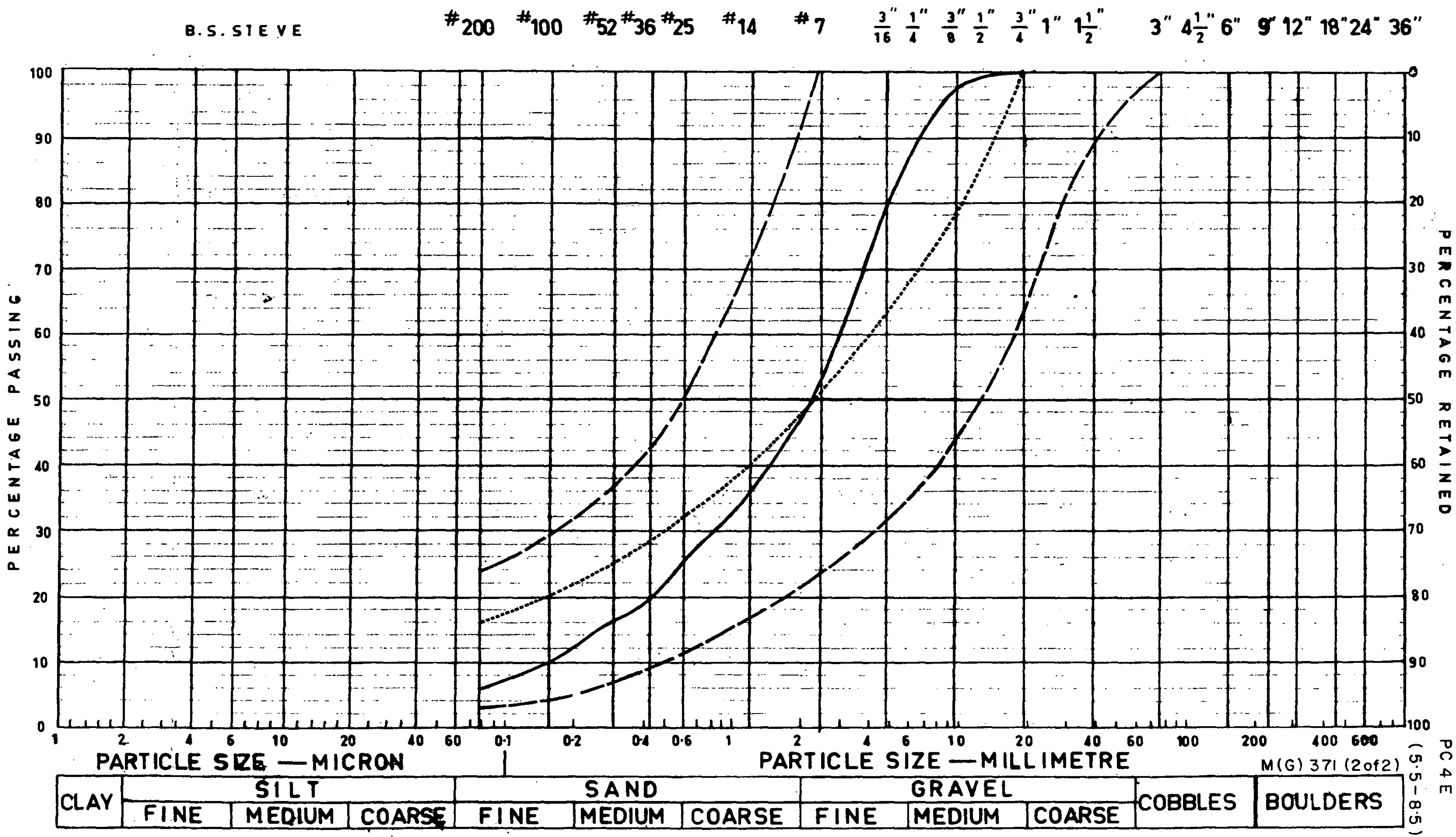

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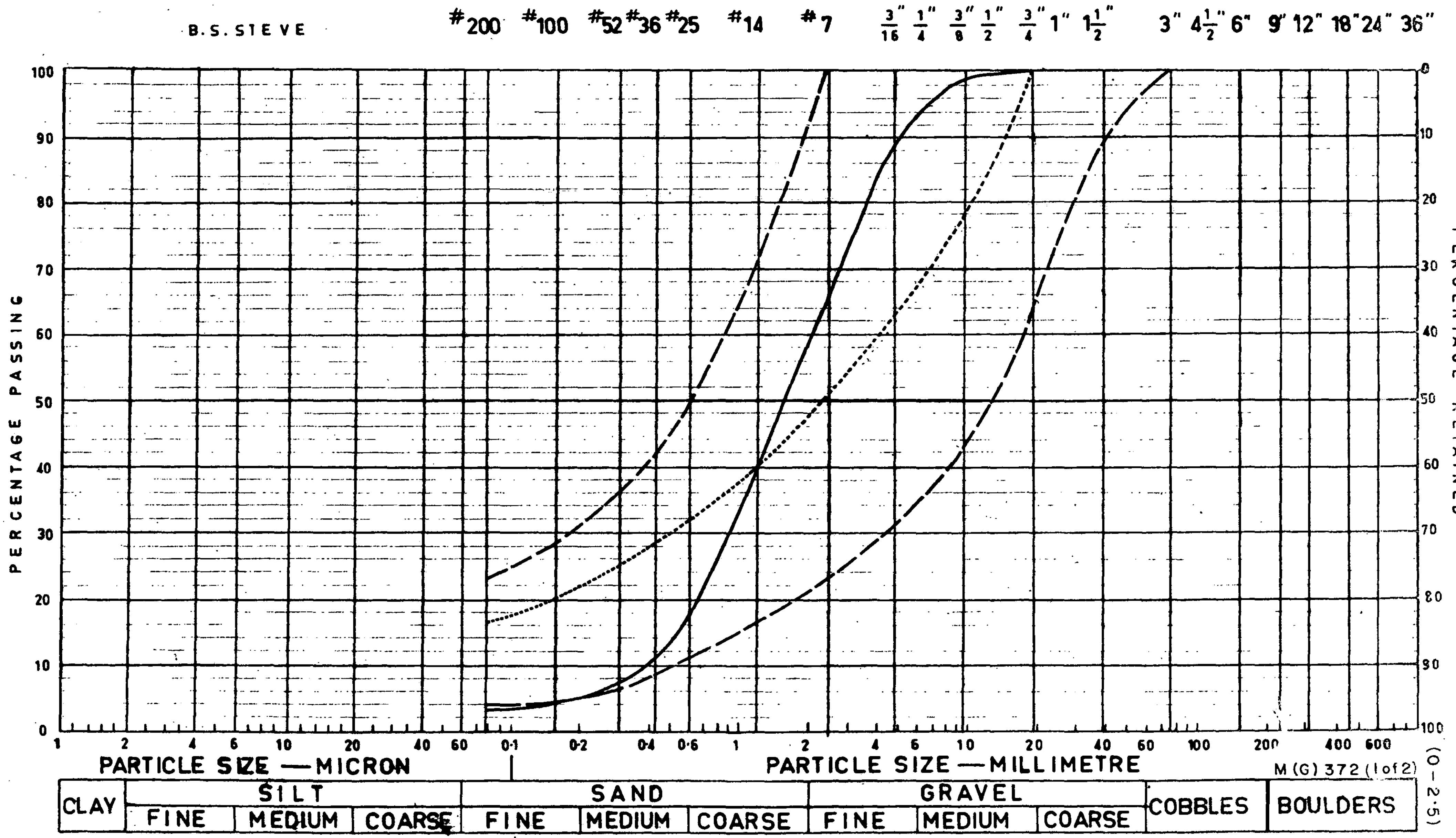

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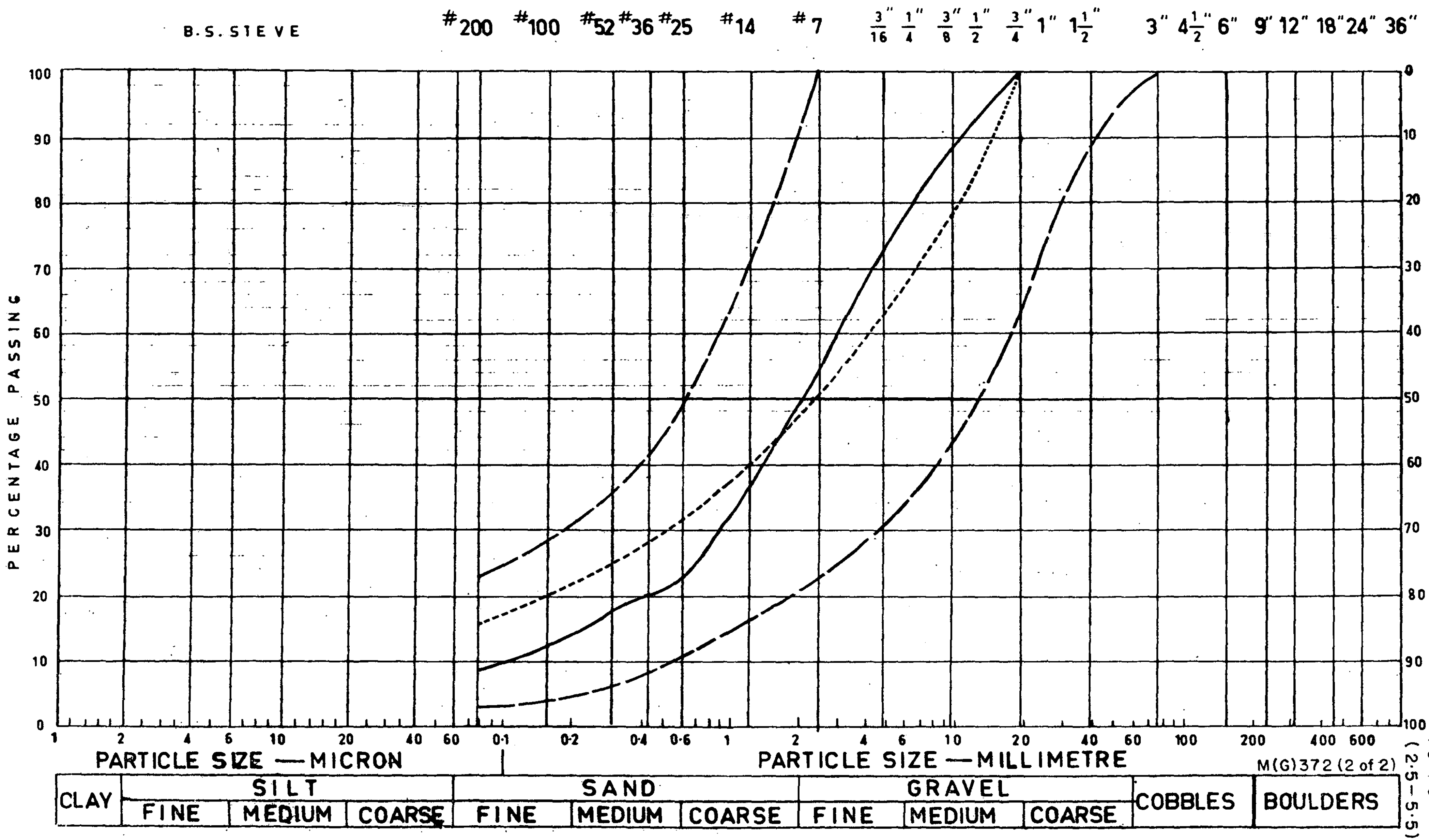

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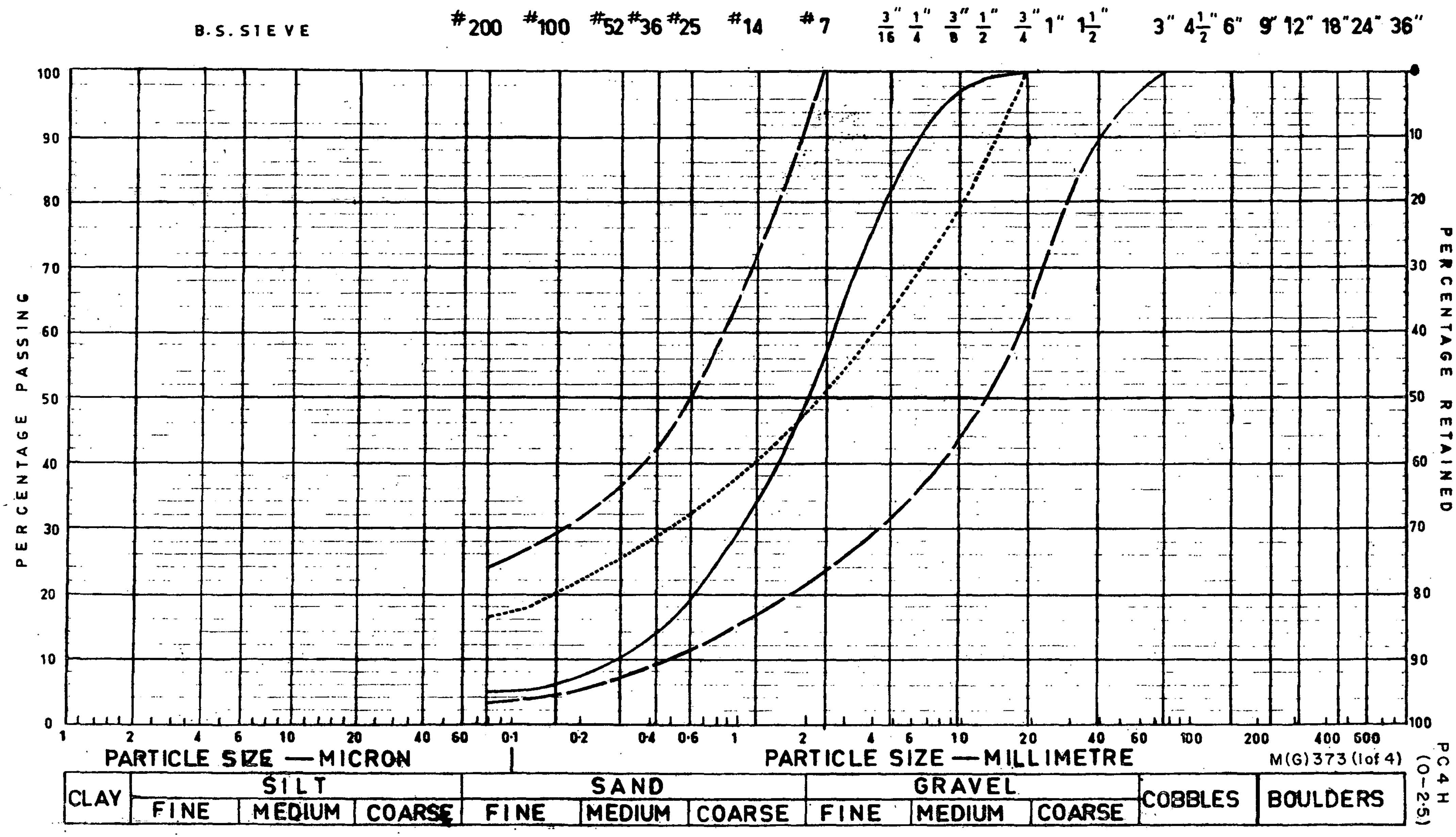

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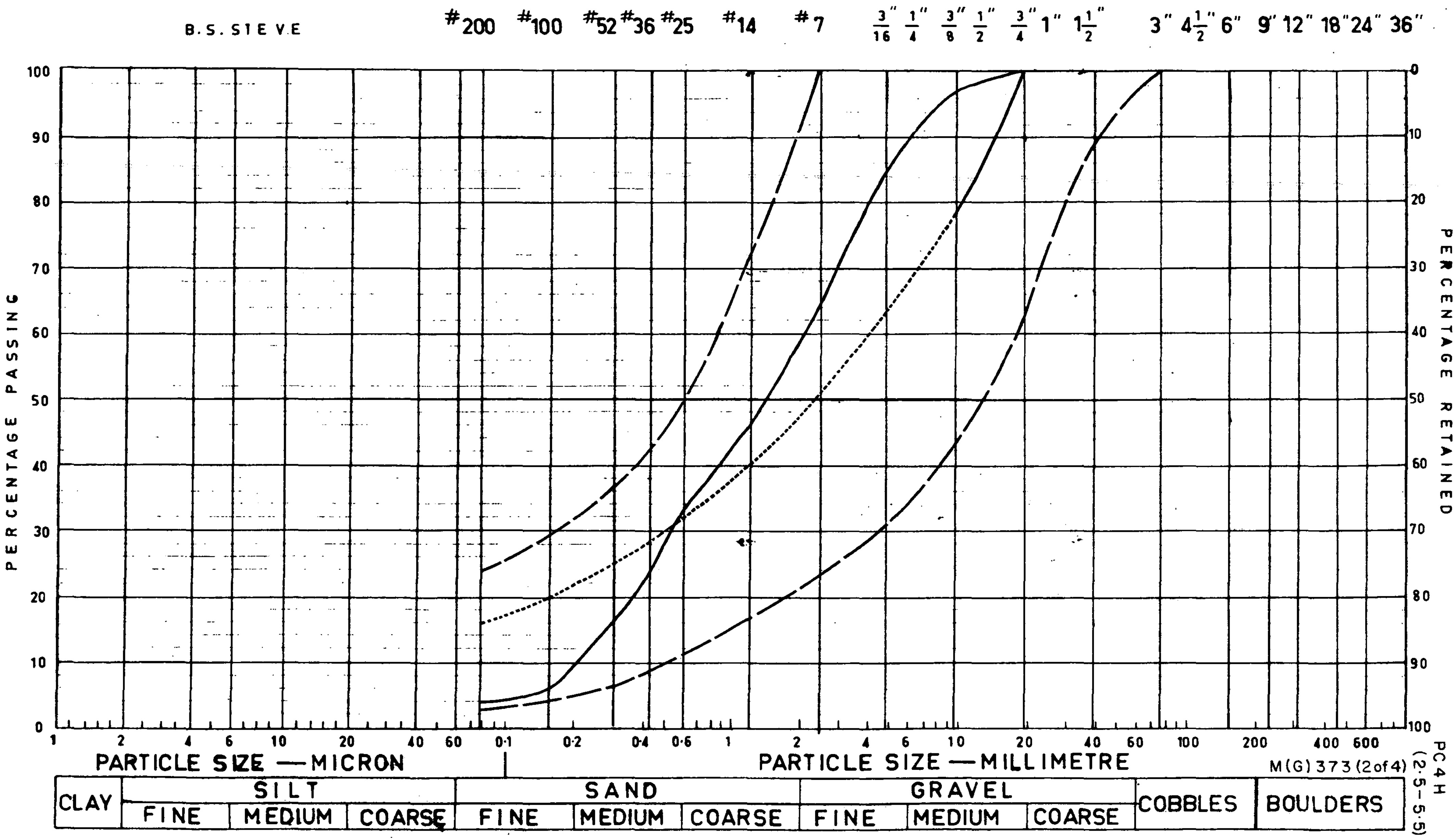

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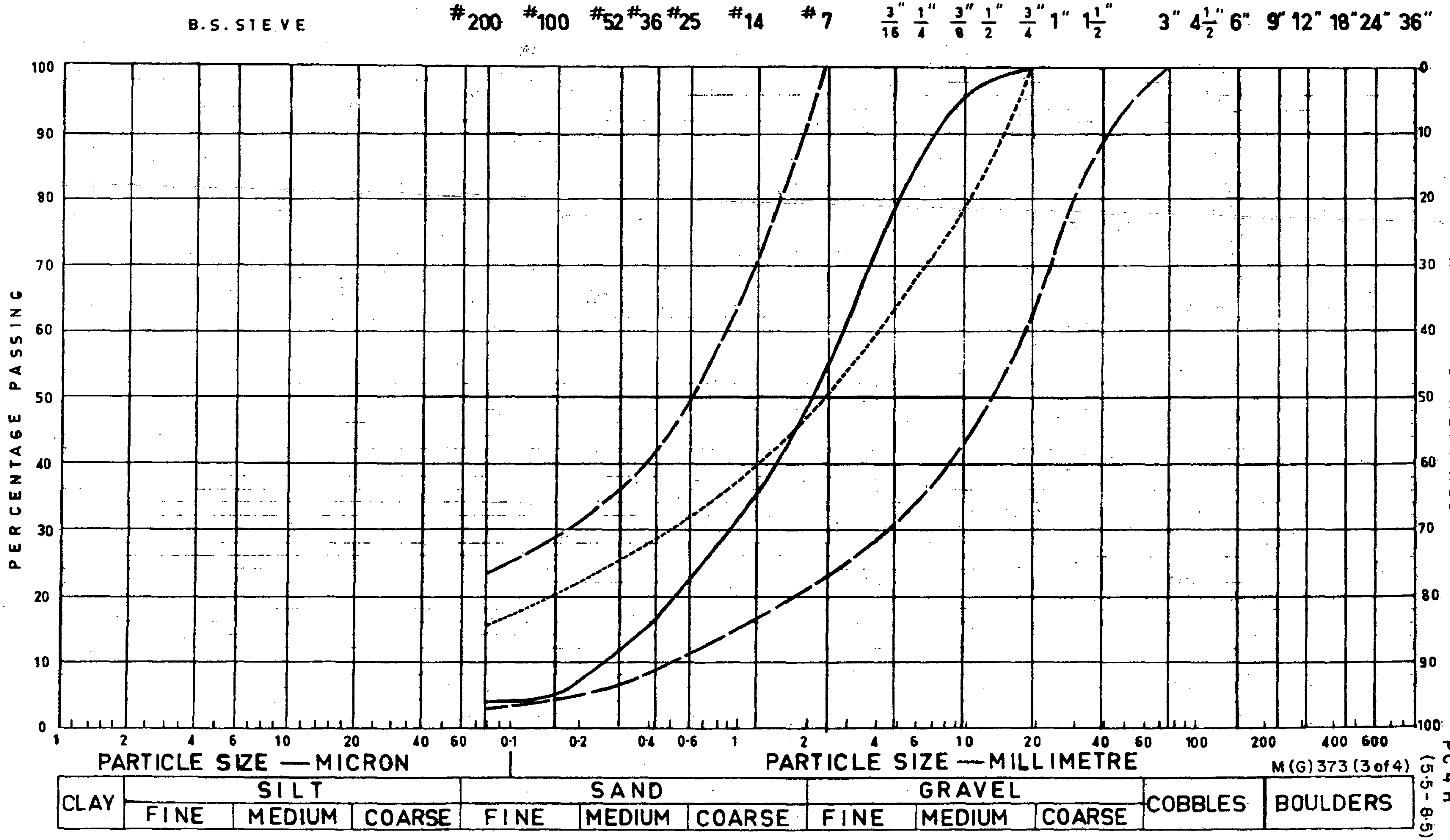

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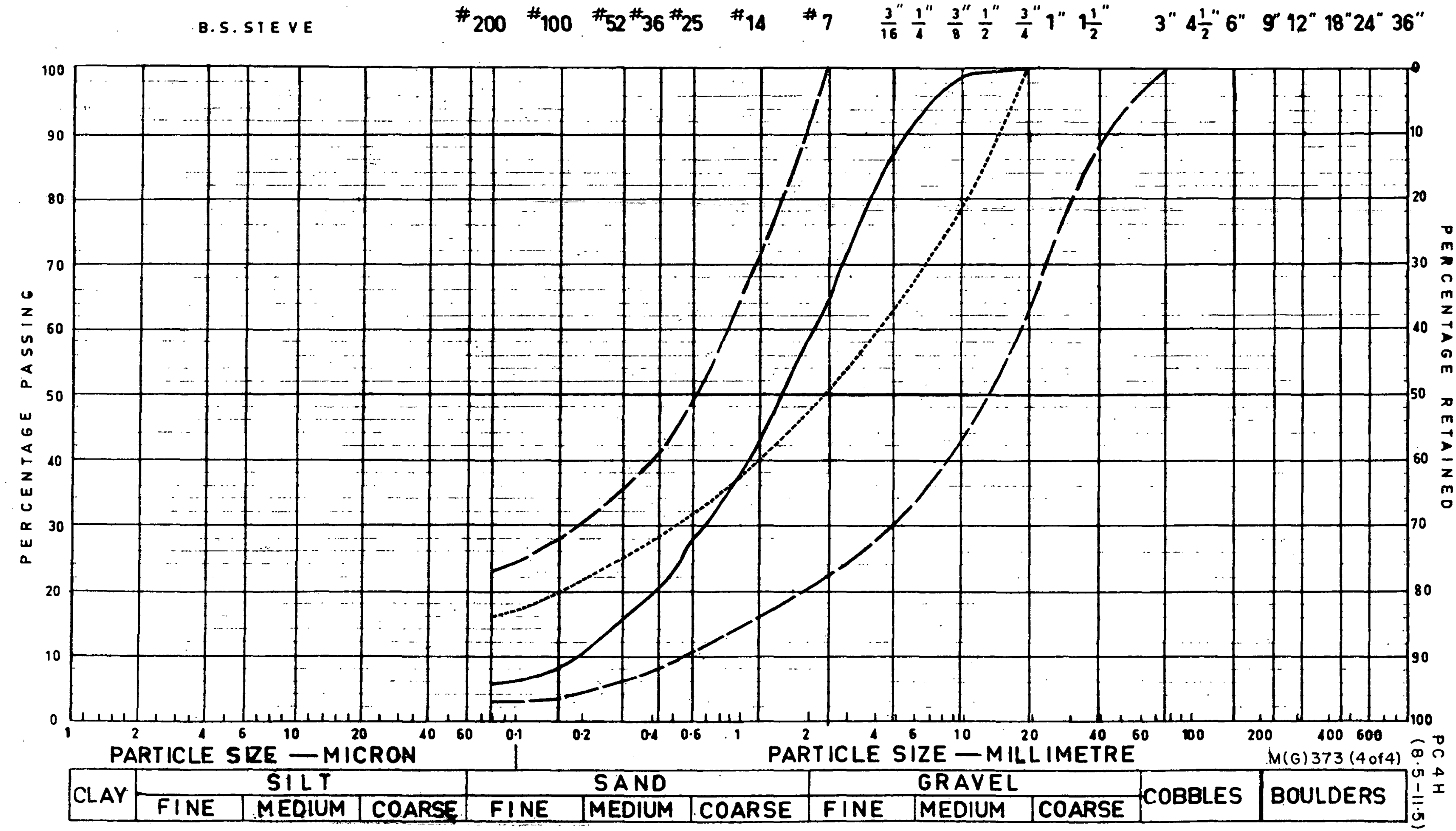

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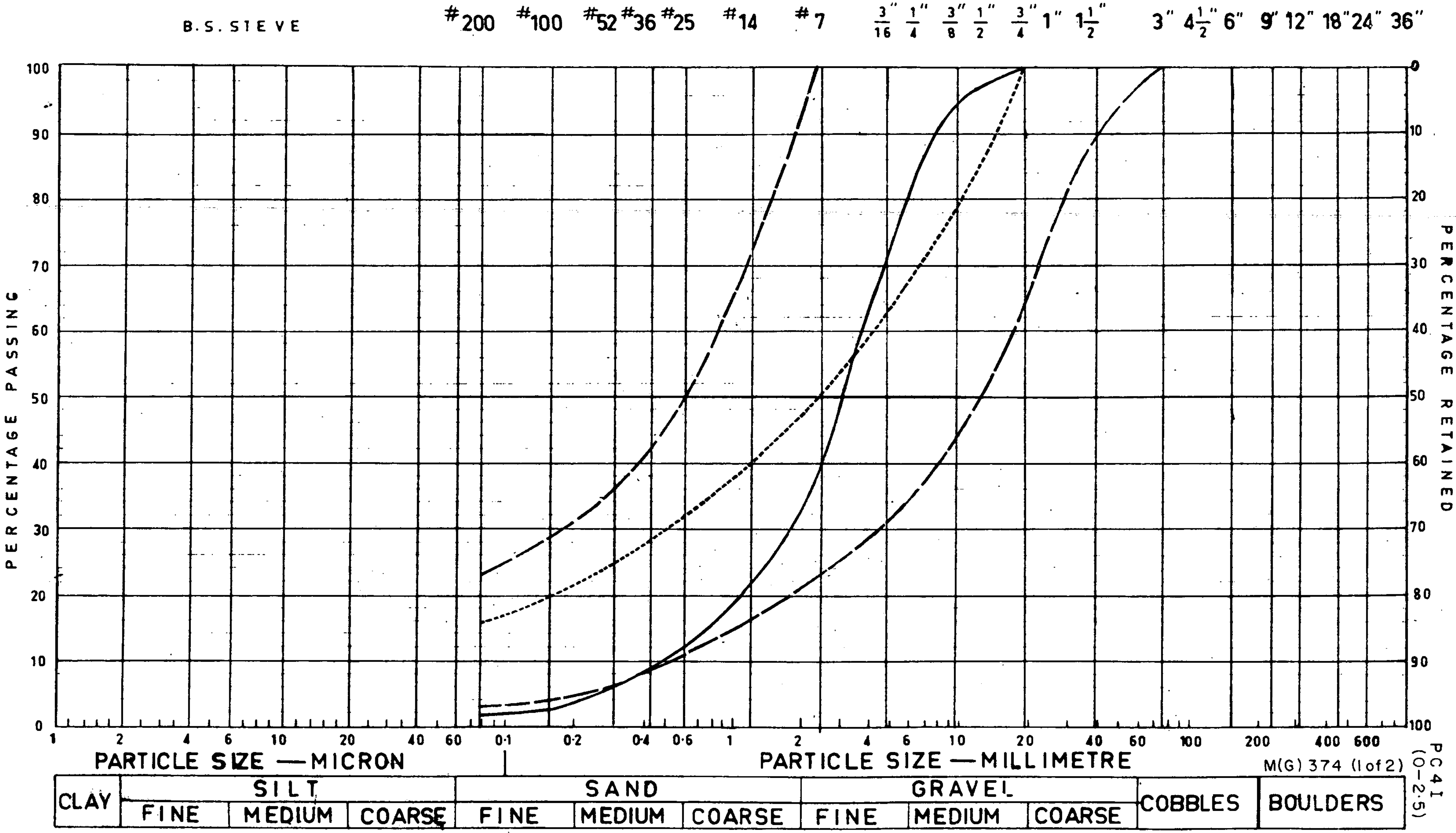

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