STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

A REPORT OF CORING PROGRAM FOR CHECKING THICKNESSES OF CEMENT TREATED BASES AND ASPHALT CONCRETE PAVEMENT PLACED DURING 1959 CONSTRUCTION SEASON

June 14, 1960

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State of California
Department of Public Works
Division of Highways
Materials and Research Department

June 14, 1960

Mr. J. W. Trask
Assistant State Highway Engineer
Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is:

A REPORT OF

CORING PROGRAM FOR

CHECKING THICKNESSES OF

CEMENT TREATED BASES

AND ASPHALT CONCRETE PAVEMENT

PLACED DURING 1959 CONSTRUCTION SEASON

Study made by - Pavement Section
Under general direction of - - - - - - - - - - - - - - - Ernest Zube
Work supervised by - - - - - - - - - - - - - - - - - - - Clyde G. Gates

Very truly yours,

F. N. Hveem

F. N. Hveem
Materials & Research Engineer

cc:MHarris
All Districts

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Introduction

Early in 1959, the Construction Department initiated a request for the Materials and Research Department to check the thickness of asphaltic pavements, bases and subbases being constructed throughout the state. In undertaking this program, the primary emphasis was as a check on the cement treated bases. After the necessary core drill unit and auxiliary equipment were secured, the actual coring program started on July 15, 1959 and continued through October, at which time most of the cement treated base projects had been closed down because of the late season.

The thickness of each individual layer including the asphalt surfacing was recorded. In general, thickness measurements were made on the inside of the holes rather than on the cores because many of the cores from newly constructed sections disintegrated or were broken up during the coring operation. Accurate identification of the various layers was not difficult wherever there was a marked change in the materials used. However, in some cases where the CTB was made of the same aggregate as the underlying subbase, identification of the boundary was often difficult. In these cases a few drops of an alkali indicator, phenolphthalein, was applied to the walls of the hole. The reaction with cement produces a red color delineating the boundary with the underlying untreated material which shows no color reaction.

No attempt was made to thoroughly sample or core each project because of time and expense involved. Table I shows the identification of the various projects cored.

Copies of our coring logs and notes were left with each Resident Engineer. One copy was sent to the District Operations Engineer and another copy to Headquarters Construction Department.

Analysis of Data

The data obtained from the coring program is summarized graphically in Figures 1, 2 and 3 which cover CTB, AB and AC respectively. The vertical scale on the charts indicate the deviation in 1/4" increments, from planned thicknesses and the bar graphs indicate the number of cores (on the horizontal scale) exhibiting corresponding differences for the various projects. The project identification numbers and the planned thicknesses of the layers are shown in the horizontal direction on the figures.

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According to Figures 4 and 5, of the 162 cores drilled in cement treated bases, 23% were exactly the specified thickness, 50% of the cores fell within the thickness tolerance of ± 0.05' (±0.6") permitted by the 1960 Standard Specifications, 33% showed thickness deficiency over 0.05' and 17% showed excessive thicknesses. The largest deficiency was 6" and the largest excess was 4".

Figure 2 shows a general scattering of thickness of aggregate bases checked. In this case 59% of the thicknesses varied within the tolerance of ± 0.05'. In general the variations in the aggregate base thicknesses appear to be more equally divided on either side (plus and minus) of the planned thickness than do the CTB's which tend to weigh more heavily on the thin (minus) side.

Figure 3 represents 174 asphalt concrete (AC) cores from both surface and leveling courses. The deviations in thicknesses are less than for cement treated bases and aggregate bases. This is not surprising since most asphalt concrete is placed with paving machines where there is some provision for thickness control.

Table II is a comparison of test results obtained from a limited number of field cores tested in Headquarters Laboratory and samples fabricated from street samples for control purposes during construction. In this case compressive strengths were determined in lieu of R-values for the Class "C" CTB due to the age of the field cores (45 to 160 days). Fortunately, some of the field control samples had been subjected to 7 day compressive strength tests also.

Analysis of the density and strength data from the two projects tabulated shows a marked difference between them. Project No. 8 shows indications of poor compaction. The average field control densities and compressive strengths are considerably higher than the same values from the cores tested. In contrast, Project No. 5 reveals identical values for the average densities from cores and field control tests. The compressive strength for the cores is somewhat higher than that of the field control which is to be expected due to the increased age at time of testing. The densities and strengths obtained from this contract indicate that good compaction was obtained during construction.

Conclusions

The results of this coring program show that there are substantial discrepancies in the thicknesses of cement treated bases, aggregate bases and asphalt concrete pavements. Also, compaction is not adequate on all projects.

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Samples were taken on some 34 different contracts and presumably the results are typical of the work which has been done in recent years. It is hoped that the data shown herein and the results of the future coring program will lead to closer control and conformance with the specifications.

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TABLE I

Identification of Projects Involved
In Coring Program

Project No.	Contract No.	District, County, Route and Section	Pavement & Base Type	
			Pavement	Base
1	59-3TC4	III-Nev-38-A	PCC	CTB
2	58-3DDC17	III-Pla-1245	AC	Lime treated base
3	59-3TC9	III-Pla-38-C	AC	AB
4	59-8VC18	VIII-Riv-78-C,Per	AC	CTB
5	59-8VC10	VIII-Riv-19-D	AC	CTB
6	60-8VC1	VIII-SBd-26-B	AC	CTB
7	59-8DDC10	VIII-SBd-715	AC	AB
8	59-8VC8	VIII-Riv,SBd-43-C,F	AC	CTB
9	59-8VC15	VIII-SBd-26-D,Ria	PCC	CTB
10	59-8VC16	VIII-SBd-26-D	PCC	CTB
11	59-8VC12	VIII-SBd-26-D	AC	AB
12	59-8DDC12	VIII-SBd-1268	PCC	CTB
13	59-5VC13	V-SB-56-B	AC	CTB
14	58-5VC7	V-Slo,SB-57-A	AC	AB
15	59-5VC12	V-Slo-33-B	AC	CTB
16	59-5VC18	V-Slo-33-C	AC	CTB
17	59-5TC2	V-Mon-2-D,C	AC	CTB
18	60-3TC7	III-ED-11,38-J,K,B	AC	CTB
19	57-7VC39	VII-LA-165-LA,A	AC	CTB
20	60-7VC34	VII-Ora-175-Ana,Ful,B	AC	CTB
21	60-7VC10	VII-LA-77-A,EMte	AC	CTB
22	59-11VC8	XI-SD-12-SD	AC	AB
23	58-11VC14	XI-SD-12-SD	AC	AB
24	59-11VC7	XI-SD-200-SD	AC	AB
25	59-11VC12	XI-SD-12-SD	AC	CTB
26	54-11VC25	XI-Imp-27-C	AC	CTB
27	60-11VC2	XI-Imp-187-B	AC	AB
28	59-11VC1	XI-Imp-187-B,C	AC	AB
29	58-11VC13	XI-Imp-201-C	AC	AB
30	59-11VC16	XI-Imp-26-E	AC	AB
31	60-4TC6	IV-Ala-227-Oak	AC	CTB
32	59-10TC1	X-Cal-24-E	AC	CTB
33	58-10TC14	X-Tuo-13-B	AC	CTB
34	58-10TC2	X-Mpa-18-D,E	AC	CTB

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TABLE II

Tabulation of Test Results from Tests Performed
On Cores and Field Control Tests

Performed on the street samples during construction

	Project No.	Cores			Field Lab Compacted (Control)		
		Core Age	Comp. Strength	Density	Core Age	Comp. Strength	Density
Contract No. 59-8VC8	8	Approx 160 days	465	123.0	7 days	416	131.0
			-	123.5		377	130.6
			320	124.0		415	131.7
			-	125.6		421	130.6
			225	119.0			
			275	122.0			
			-	110.8			
			225	118.4			
			235	119.7			
			260	121.3			
			520	127.4			
		Average	316	120.4	Average	407	131.0
Contract No. 59-8VC10	5	Approx. 75 days	355	129.5	7 days	350	
			590	133.0		317	129.0
			425	126.4		316	130.0
						306	130.1
						315	130.5
						417	133.7
						483	133.9
						346	132.9
						360	131.6
						285	131.8
						309	130.8
		Average	457	130.0	Average	346	130.0

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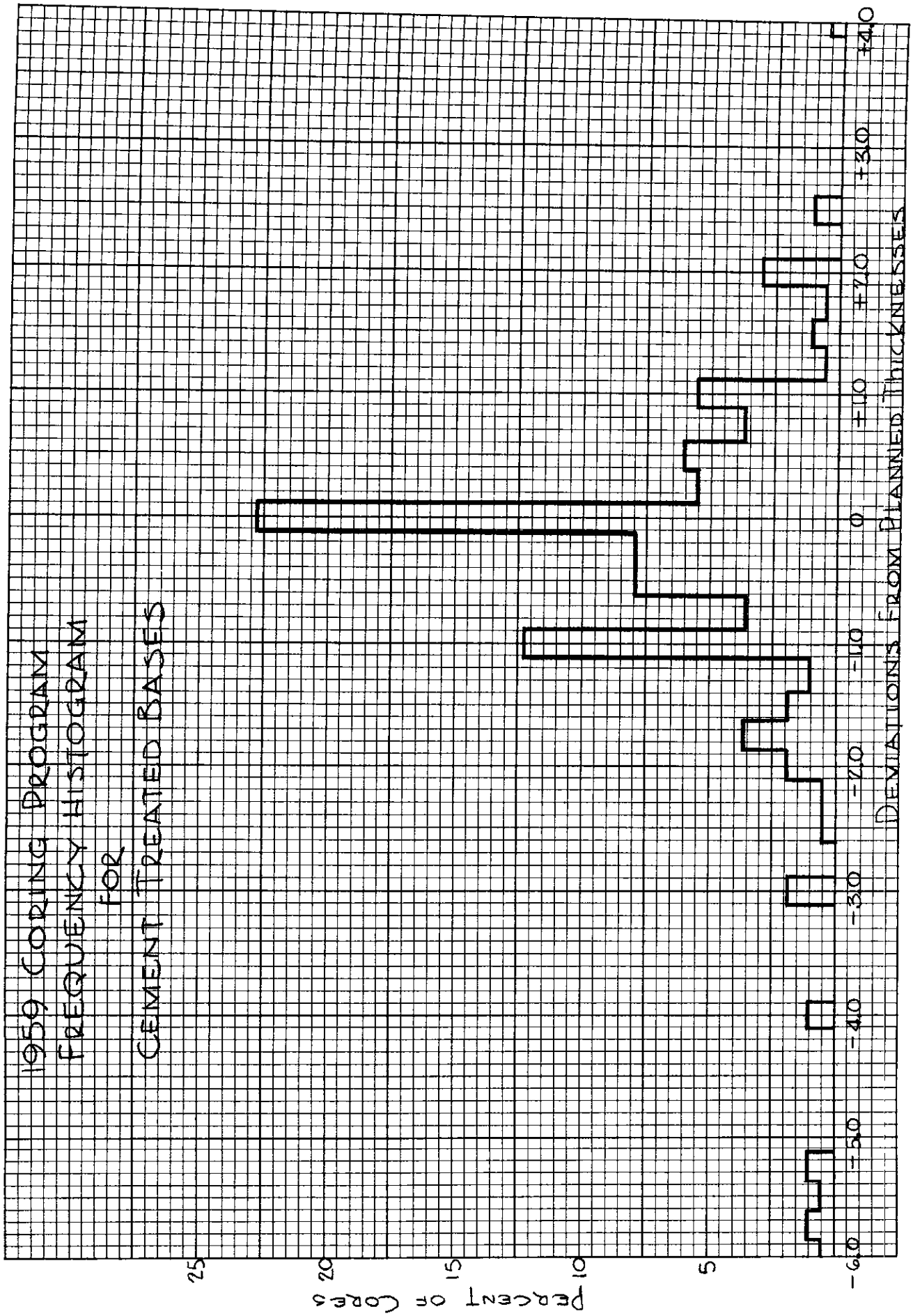
Figure 4



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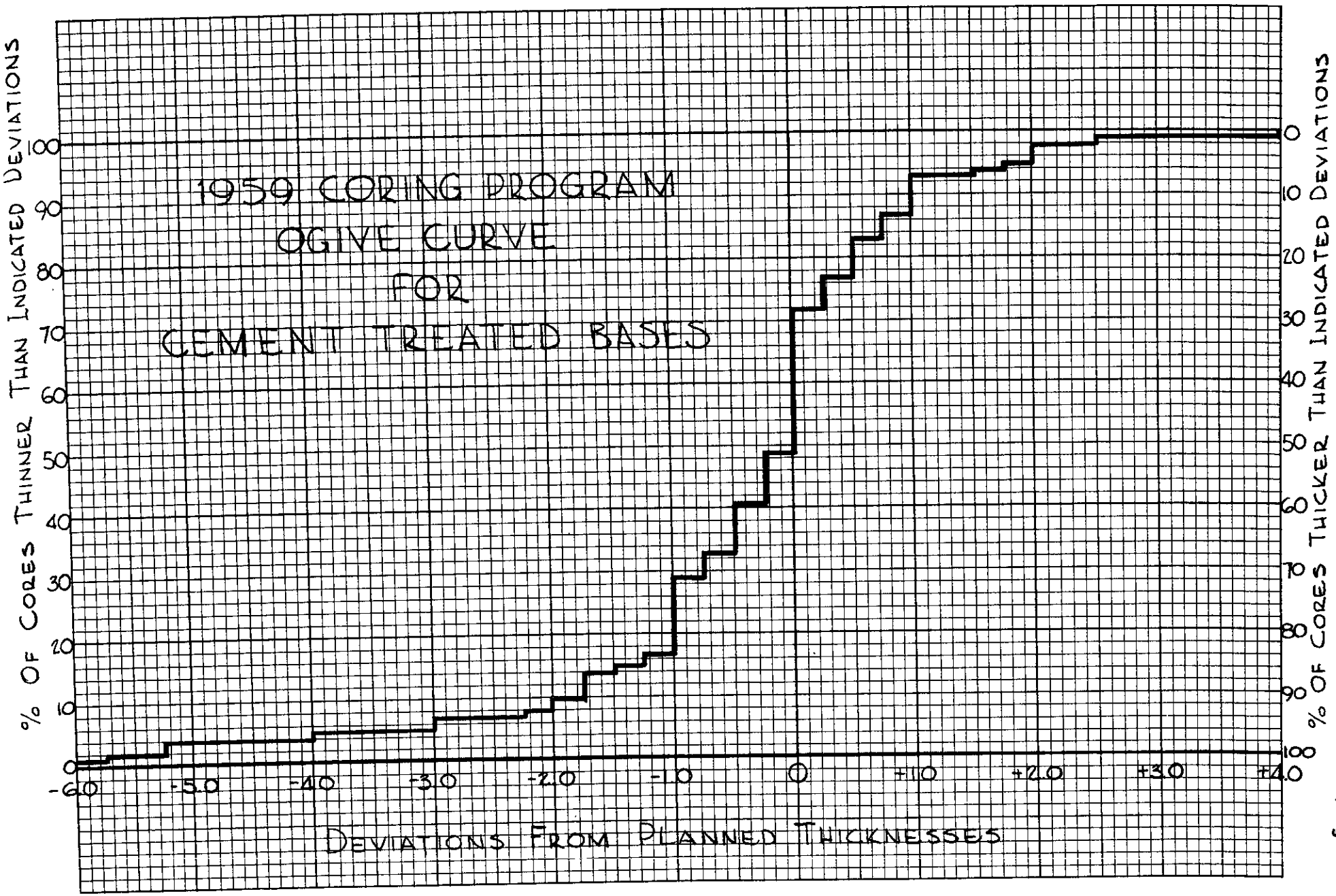

Figure 5

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