

Highway Materials Research Laboratory  
132 Graham Avenue, Lexington 29, Kentucky

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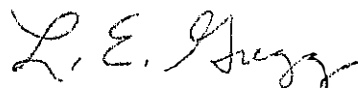
TO: D. V. Terrell  
Director of Research

You will recall the reports which have been made on the concrete pavement without transverse joints on U.S. 31-W between Franklin and the Tennessee State Line. Observations and crack surveys have been carried out at three times in 1950, and in addition those cracks which were not grooved and sealed in 1949 were given that treatment this year.

The attached report which was prepared by Mr. W. B. Drake, Research Engineer, covers all of the developments during 1950 and extends our information on this project over a period of about 18 months. In his treatment of the data, Mr. Drake shows how the average crack interval is gradually decreasing and records each crack with regard to the date it was first noted and the degree of severity.

Thus far no attempt has been made to correlate the crack intervals with construction joint spacings mainly because we feel that the pavement is not old enough to make such an analysis valid - it being obvious that too many influences could enter into crack development during the first several months that a pavement is in service. Inasmuch as there are various joint intervals represented, however, we may be able to ultimately get some idea of the effect of the joint spacings in bringing about different unbroken slab lengths after several years of service.

Respectfully submitted,



L. E. Gregg  
Assistant Director of Research

Copies to Research Committee Members  
Mr. Galbreath (3)

Commonwealth of Kentucky  
Department of Highways

REPORT NO. 3

on

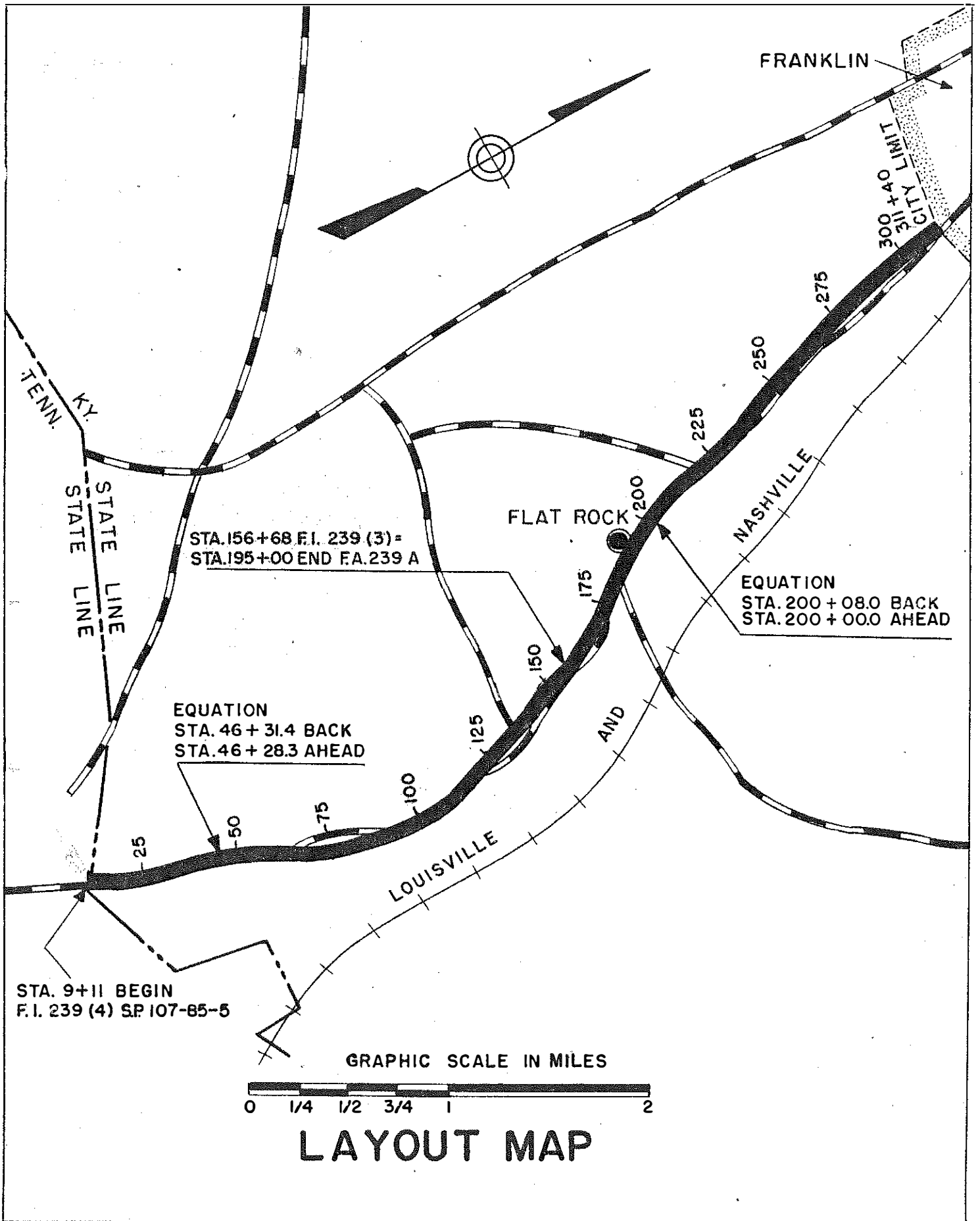
A CONCRETE PAVEMENT WITHOUT  
TRANSVERSE JOINTS

by

W. B. Drake  
Research Engineer

Highway Materials Research Laboratory  
Lexington, Kentucky

February, 1951



## INTRODUCTION

This is the third report of observations and operations pertaining to a concrete pavement without the usual transverse joints constructed in the summer of 1949. Report No. 2 which was presented to the Research Committee December, 1949, contained a detailed description of the project, pictures of the class of cracking described, a record of the crack filling operation to December, 1949, and three crack survey reports with a strip map of the project.

The purpose of this report is to present three additional crack surveys taken in 1950 with the additional crack filling operations up to this time. All of the ungrooved cracks were cut out and filled with various types of fillers late in the past year, so that this type of treatment has been extended throughout the project.

## CRACK SURVEYS

At the time of the second report, a system of classifying cracks with regard to severity was established. Table 1 lists the classification assigned. The locations of these are noted on the strip map in the Appendix and are referred to in the tabulations of crack-survey data which are discussed later.

Table 1  
Classification of Cracks

Class of Crack	Characteristics
A	Open crack with spalling
B	Open crack without spalling
C	Fine crack total width of both lanes
D	Fine crack only part way across road

June 23, 1949

On June 23, 1949, when the paving operations were in the vicinity of Station 270 + 00, a crack survey was made. No attempt was made to classify the cracks at that early date. Table 2 lists the crack distribution at that time.

Table 2  
Summary of Crack Distribution  
June 23, 1949

Section (Station)	Approx.* Distance in Feet	No. of Construction Joints	No. of Cracks	Approx. Avg. Crack Interval in Feet Discounting Joints
9+11 to 50+00	4089	8	25	165
50+00 to 100+00	5000	6	18	275
100+00 to 150+00	5000	7	22	225
150+00 to 200+00	5000	5	12	415
200+00 to 225+00 (Approx.)	--	-	None	-

\*Distances were computed without regard to equations in the stations.

September 7, 1949

A second and more detailed crack survey was made on September 7. For this a strip map of the road was prepared showing the location and shape of the cracks with a designation or classification of each crack. Table 3 is a summary of this survey.

November 18, 1949

About two months after the second inspection, a third survey was made. Table 4 is a summary of the data from this third survey. Tables 1, 2, 3 and 4 were reported and discussed in Report No. 2, December, 1949.

At this time the cracks and joints from Station 185 + 80 to 311 + 30 were grooved and sealed with the cold mastic filler.

February 16, 1950

On February 16, the fourth crack survey was made. During the three winter months following the preceding survey the total number of cracks increased from 318 to 327 or 9 new cracks were in evidence. Of the 9 cracks, 6 (or two-thirds of them) occurred in fill sections. Eight of the new cracks were Class C, the type that are fine but extend through the full width of pavement. One 5000-foot section from Station 100 + 00 to 150 + 00 had 4 of the new cracks. This increase of 4 cracks decreased the crack interval for that section from 106-feet to 86-feet, and the 9 cracks lowered the average crack interval for the entire road from 95-feet to 92-feet. The average interval for both cracks and construction joints for the 30230-foot

TABLE 3

SUMMARY OF DATA FROM SECOND CRACK SURVEY, SEPTEMBER 7, 1949

Section (Stations)	Approx.* Distance in Feet	Number of Construction Joints	Number of Cracks	Class of Crack				Location of Grade Line			Approximate Avg. Crack Interval In Feet Discount Constr. Joint
				A	B	C	D	Cut	Fill	00	
9+1 To 50+00	4089	8	35	5	17	11	2	10	24	1	117
50+00 To 100+00	5000	6	31	9	14	6	2	13	18	-	161
100+00 To 150+00	5000	7	47	9	19	10	9	16	31	-	106
150+00 To 200+00	5000	5	50	9	17	16	8	9	40	1	100
200+00 To 250+00	5000	7	34	8	10	14	2	12	18	4	147
250+00 To 300+00	5000	6	34	7	21	2	4	12	21	1	147
300+00 To 311+40	1140	2	7	6	1	-	-	-	7	-	163
TOTALS	30230	41	238	53	99	59	27	72	159	7	127

\*Distances are computed without regard to equations noted on layout plot.

Average Interval Total Cracks and Construction Joints =  $\frac{30230}{279} = 108$  feet

TABLE 4

SUMMARY OF DATA FROM THE THIRD CRACK SURVEY, NOVEMBER 18, 1949

Section (Stations)	Approx.* Distance In Feet	Number of Construction Joints	Number of Cracks	Class of Crack				Location of Grade Line			Approximate Avg. Crack Interval in Feet Discount Constr. Joint
				A	B	C	D	Cut	Fill	00	
9+11 To 50+00	4089	8	44	5	17	15	7	15	28	1	93
50+00 To 100+00	5000	6	47	12	15	14	6	24	23	-	106
100+00 To 150+00	5000	7	58	9	19	13	17	21	36	1	86
150+00 To 200+00	5000	5	58	9	17	24	8	13	45	-	86
200+00 To 250+00	5000	7	57	8	20	22	7	26	27	4	88
250+00 To 300+00	5000	6	45	7	21	11	6	19	25	1	111
300+00 To 311+40	1140	2	9	6	1	2	-	-	9	-	126
TOTALS	30230	41	318	56	110	101	51	118	193	7	95

\*Distances are computed without regard to equations noted on layout plot.

Average interval both cracks and construction joints =  $\frac{30230}{359} = 84$  feet



was 8211-feet. Six of the 9 new cracks occurred in the section of pavement that had not been grooved and sealed. The ungrooved section represented 53 per cent of the pavement length but contained 2/3 of the new cracks. (See Table 5)

June 5, 1950

The fifth crack survey was made on June 5, approximately one year after construction and 4 months after the preceding survey. Ten new cracks were observed at that time. Five of the new ones were Class D or half width, with the remaining five being Class C cracks. The average crack interval dropped from 92 to 90 feet with the average interval for both cracks and construction joints being 80-feet. The conditions at this time are summarized in Table 6. It should be noted that five of these new cracks occurred between Station 200 + 00 to 250 + 00. This section was grooved and sealed. Since the sealing operation new cracks in grooved and ungrooved sections are evenly distributed per foot of pavement.

October 19, 1950

On October 19, the sixth crack survey was taken. The pavement at that time had been subjected to one full winter season and two summers. The average interval, crack and construction joints, at that time was 79-feet. The actual crack interval, exclusive of the 41 construction joints, was 88-feet. During the eleven month period since November, 1949 the average crack interval had decreased only five feet. The

TABLE 5

SUMMARY OF DATA FROM THE FOURTH CRACK SURVEY, FEBRUARY 16, 1950

Section (Stations)	Approx.* Distance In Feet	Number of Construction Joints	Number of Cracks	Class of Crack				Location of Grade Line			Approximate Avg. Crack Interval in Feet Discount Constr. Joint
				A	B	C	D	Cut	Fill	OO	
9+11 To 50+00	4089	8	45	5	17	16	7	16	28	1	91
50+00 To 100+00	5000	6	47	12	15	14	6	24	23	-	106
100+00 To 150+00	5000	7	62	9	19	16	18	21	39	2	81
150+00 To 200+00	5000	5	60	9	17	26	8	13	47	-	83
200+00 To 250+00	5000	7	57	8	20	22	7	26	27	4	88
250+00 To 300+00	5000	6	47	7	21	13	6	20	26	1	106
300+00 To 311+40	1140	2	9	6	1	2	-	-	9	-	126
TOTALS	30230	41	327	56	110	109	52	120	199	8	92

\*Distances are computed without regard to equations noted on layout plot.

Average interval both cracks and construction joints =  $\frac{30230}{368} = 32$  feet

TABLE 6

## SUMMARY OF DATA FROM THE FIFTH CRACK SURVEY, JUNE 5, 1950

Section (Stations)	Approx.* Distance In Feet	Number of Construction Joints	Number of Cracks	Class of Crack				Location of Grade Line			Approximate Avg. Crack Interval in Feet Discount Constr. Joint
				A	B	C	D	Cut	Fill	00	
9+11 To 50+00	4089	8	45	5	17	16	7	16	28	1	91
50+00 To 100+00	5000	6	48	12	15	14	7	24	24	-	104
100+00 To 150+00	5000	7	63	9	19	16	19	22	39	2	79
150+00 To 200+00	5000	5	63	9	17	29	8	13	50	-	79
200+00 To 250+00	5000	7	62	8	20	24	10	28	30	4	81
250+00 To 300+00	5000	6	47	7	21	13	6	20	26	1	106
300+00 To 311+40	1140	2	9	6	1	2	-	-	9	-	126
TOTALS	30230	41	337	56	110	114	57	123	206	8	90

\*Distances are computed without regard to equations noted on layout plot.

Average interval both cracks and construction joints =  $\frac{30230}{378} = 80$  feet

total number of cracks increased from 318 to 343, or 25 new cracks developed. Only 6 new cracks were formed in the four months since the last survey. Table 7 is a summary of the sixth crack survey.

### Summary

The strip map in Appendix 1 contains the progress of the cracking since November, 1949. The cracks that developed between each survey are designated by a particular color. The grade line and the former ground line are plotted opposite each section. The tables presented are only summaries of the data shown in the strip map.

### SEALING OPERATIONS

As reported in December, 1949, the OA-2 (asphalt cement) filler did not hold in the fine type of crack that was prevalent on this section of pavement. The 140 cracks and joints between Station 185 + 80 and 311 + 40 that were filled with cold mastic sealer in 1949 were examined October 19, 1950. The material was still plastic under a thin crust at the exposed surface. All of the material placed was intact and not one instance of material failure was noted. The bond with the concrete was excellent. No difference was noted among any of the 4 types of Enamelite used.

It was decided to groove the remaining cracks from Station 9 + 11 to Station 185 + 80 and fill them with various types of commercial crack and joint sealers. The cracks were cut with

TABLE 7

SUMMARY OF DATA FROM THE SIXTH CRACK SURVEY, OCTOBER 19, 1950

Section (Stations)	Approx.* Distance In Feet	Number of Construction Joints	Number of Cracks	Class of Crack				Location of Grade Line			Approximate Avg. Crack Interval in Feet Discount Constr. Joint
				A	B	C	D	Gut	Fill	00	
9+11 To 50+00	4089	8	45	5	17	16	7	16	28	1	91
50+00 To 100+00	5000	6	50	12	15	14	9	25	25	-	100
100+00 To 150+00	5000	7	65	9	19	16	21	22	41	2	77
150+00 To 200+00	5000	5	64	9	17	29	9	13	51	-	78
200+00 To 250+00	5000	7	63	8	20	25	11	29	30	4	79
250+00 To 300+00	5000	6	47	7	21	13	6	20	26	1	106
300+00 To 311+40	1140	2	9	6	1	2	-	-	9	-	126
TOTALS	30230	41	343	56	110	115	63	125	210	8	88

\*Distances are Computed without regard to equations noted on layout plot.

Average interval both cracks and construction joints =  $\frac{30230}{384} = 79$  feet

the Department's Concrete Cutting Machines.

Between Stations 9 + 11 and 20 + 00, 15 full-width cracks and joints and 6 one-lane cracks were sealed with OA-2 filler. Three hundred and fifty-two linear feet of crack were filled with approximately 375 pounds of material for an average of 1.06 pounds per linear foot.

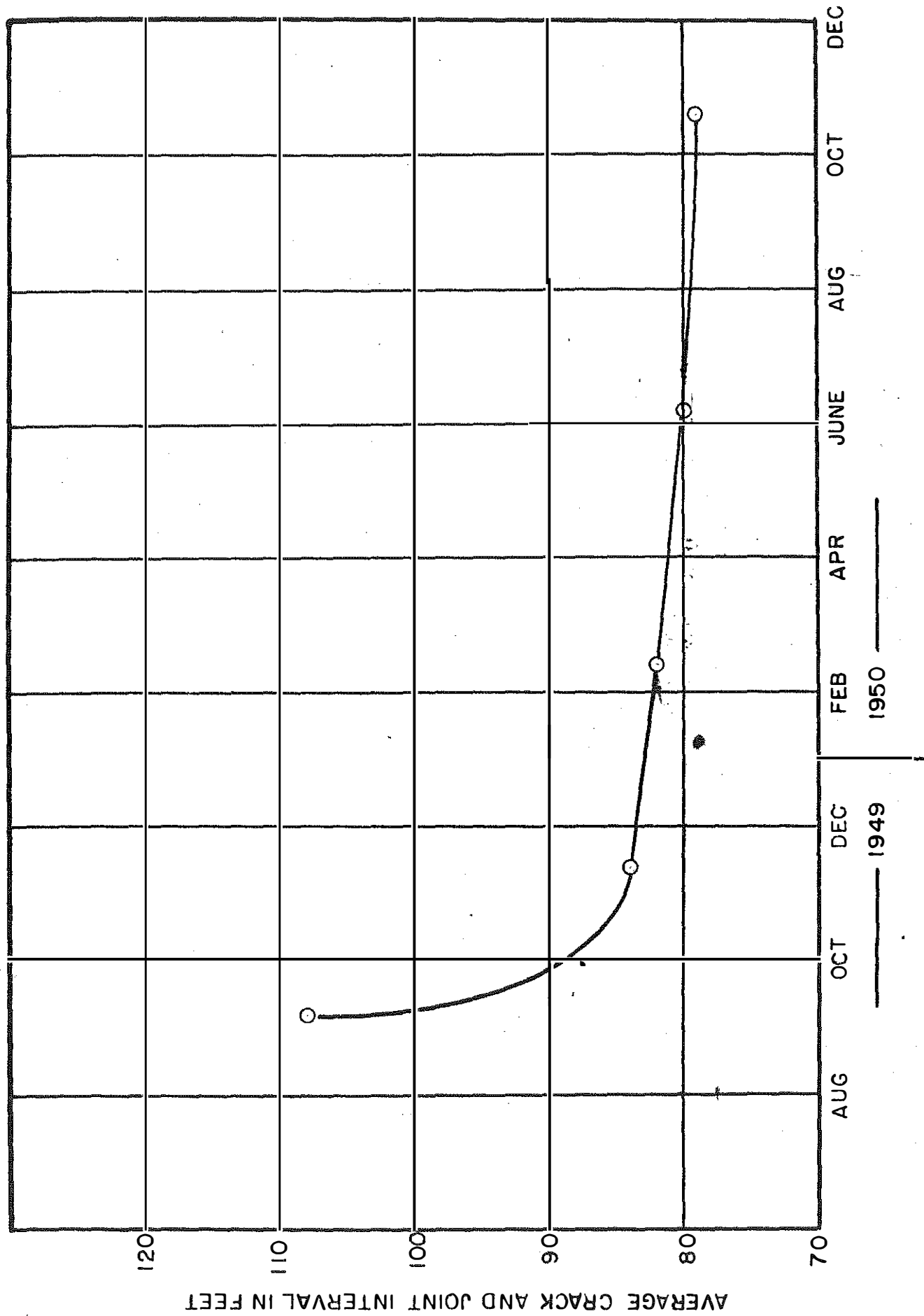
Between Stations 20 + 00 and 40 + 30, 25 full-width cracks joints and 5 half-width cracks for a total length of 605-feet of crack were filled with Enamelite Cold Mastic Filler. This material, which is covered by Special Specification No. 46, is the type that was placed in the majority of the cracks from Station 185 + 80 to Station 311 + 40 in 1949. Approximately 495 pounds were used to fill 605 linear feet of crack, or 0.82 pound per foot was placed.

Between Stations 40 + 30 and 185 + 80, 189 cracks and joints were filled with "Hot Rubber Filler". This section contained 4092 linear feet of crack and 1998 pounds were placed, for an average of 0.49 pound per foot.

#### Summary

The section of Enamelite (Cold Mastic Filler) placed in November, 1949, is in excellent condition. There are no indications that water is entering any of the cracks and joints.

During 1950 three crack surveys were taken with the crack interval dropping from 84 to 79 feet. The graph following this page is a plot of the average crack and joint interval for the time this pavement has been observed. The curve appears to be



flattening out.

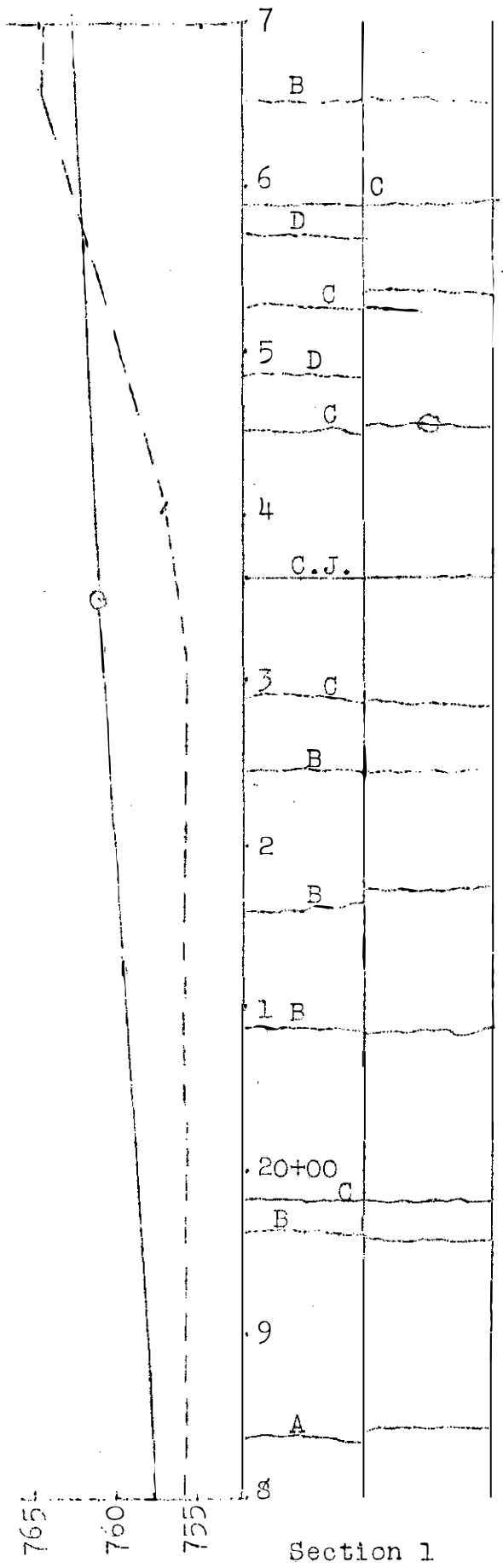
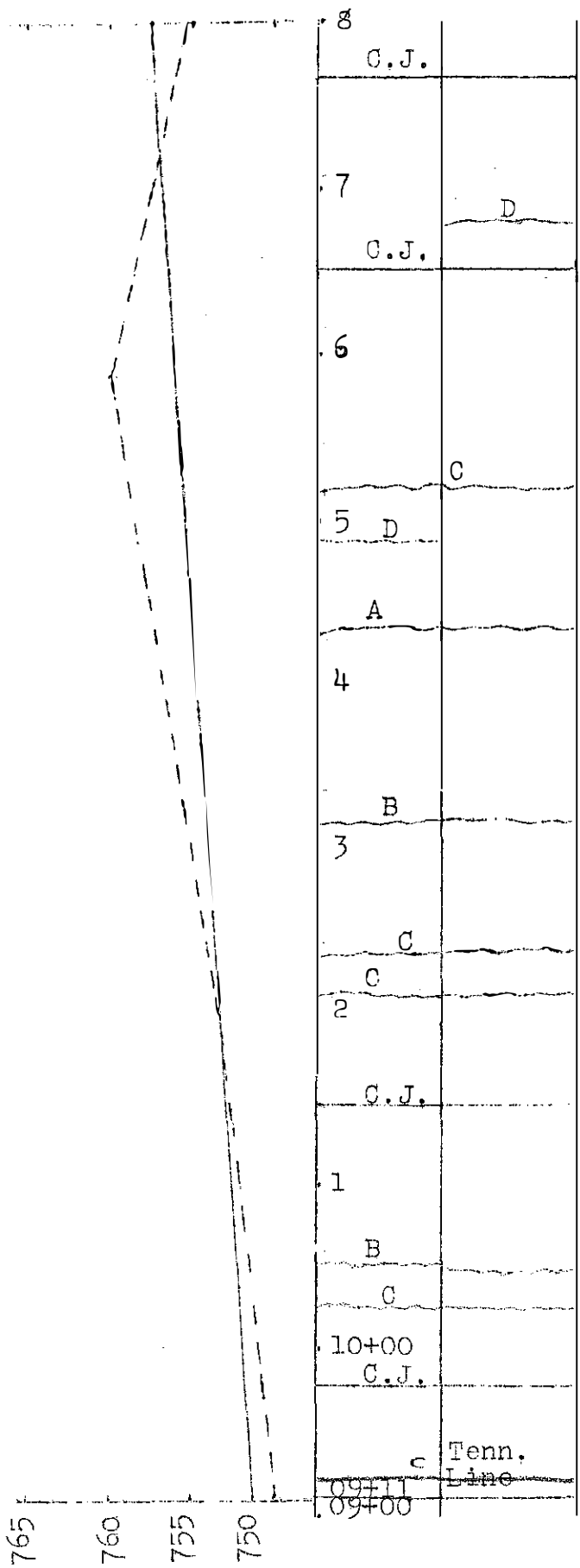
Three new tests sections of sealing materials were placed in 1950. Each crack of these sections was cut and grooved with the same machines used in 1949. Twenty-one cracks and joints between Stations 9 + 11 and 20 + 00 were sealed with OA-2, while 30 others between Stations 20 + 00 and 40 + 30 were sealed with Enamelite Cold Mastic Filler. Between Stations 40 + 30 and 185 + 80, 189 cracks were sealed with hot rubber filler. These sections with the ones sealed in 1949 should give a very good comparison of the sealing materials.

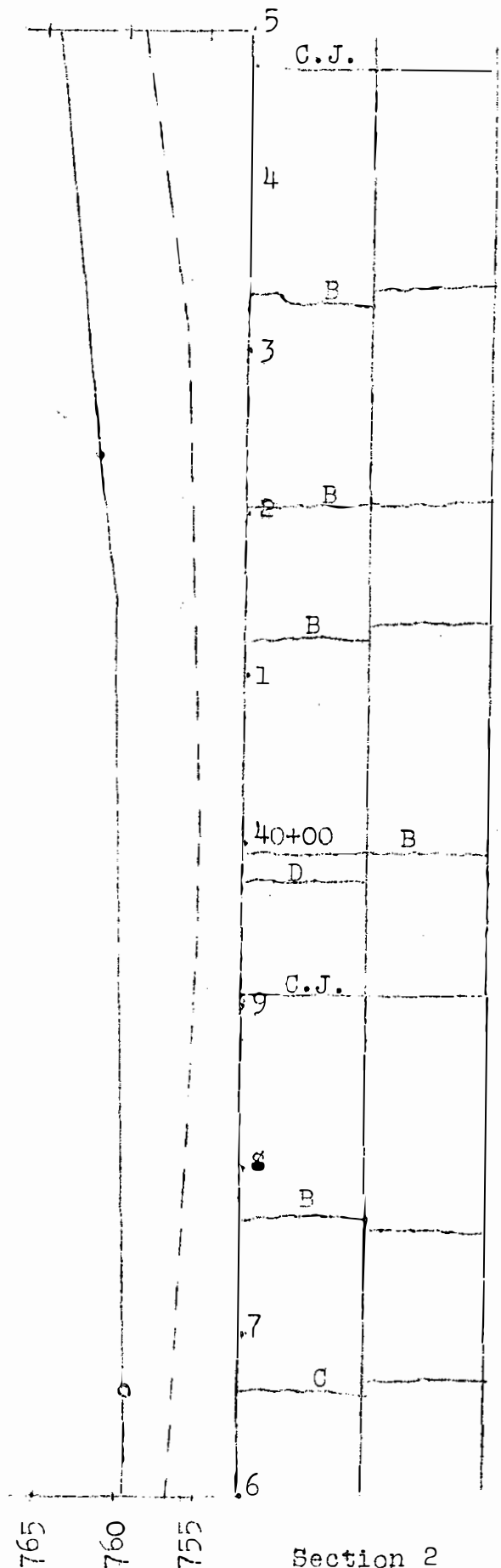
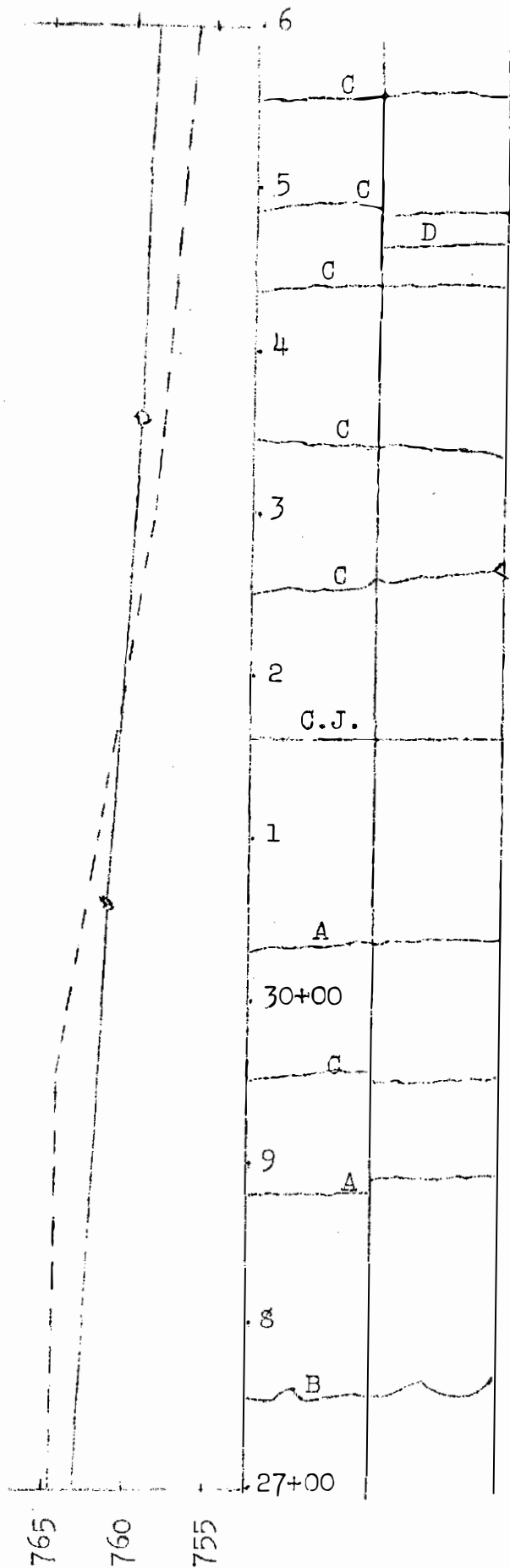


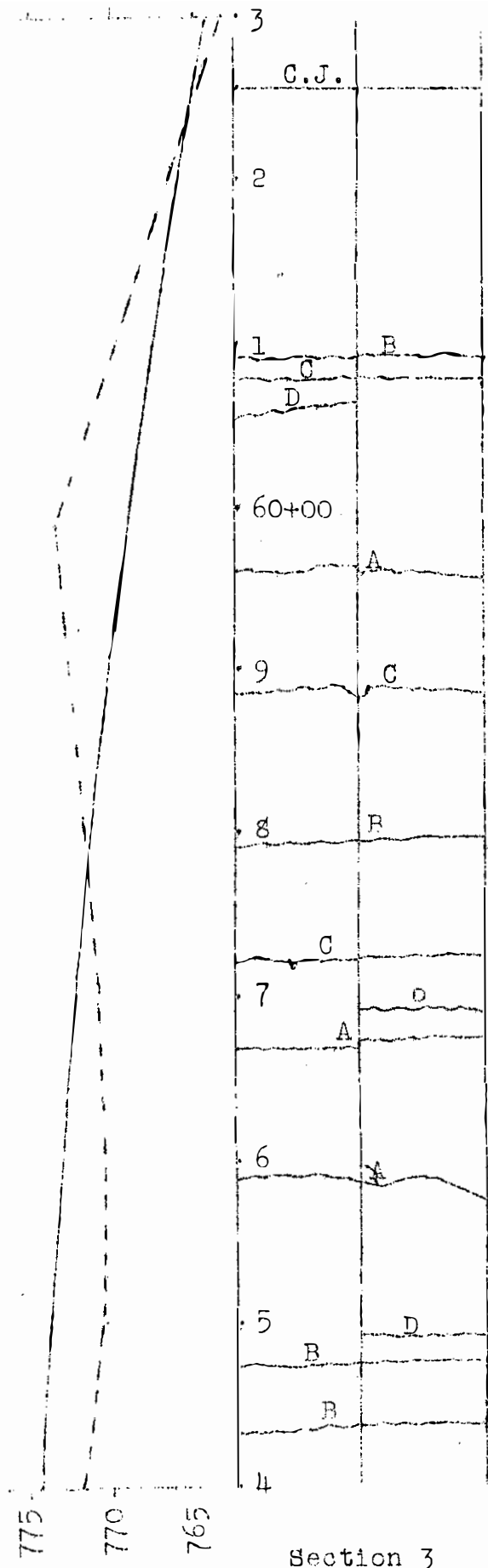
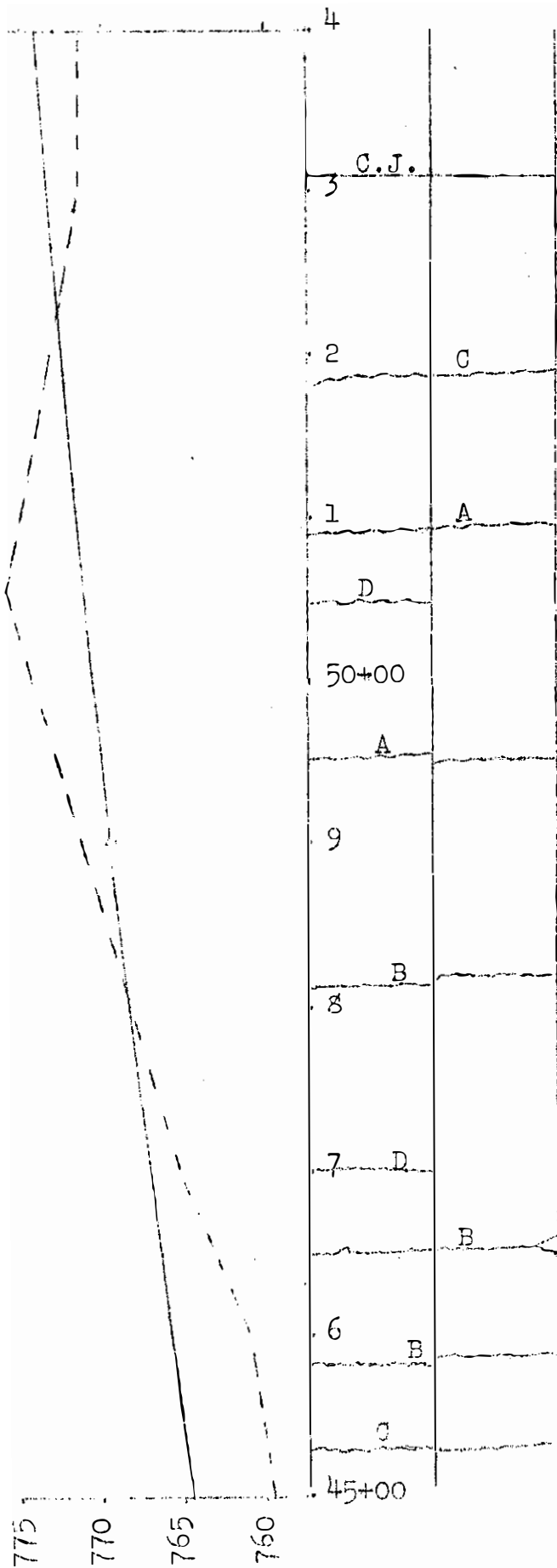
## APPENDIX I

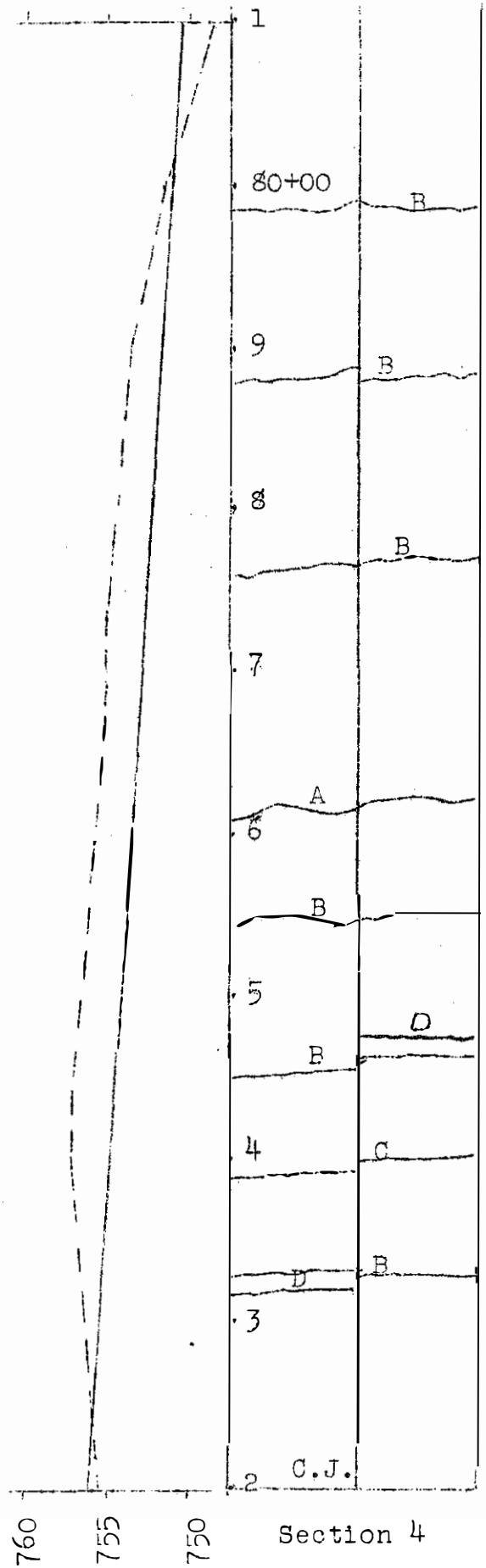
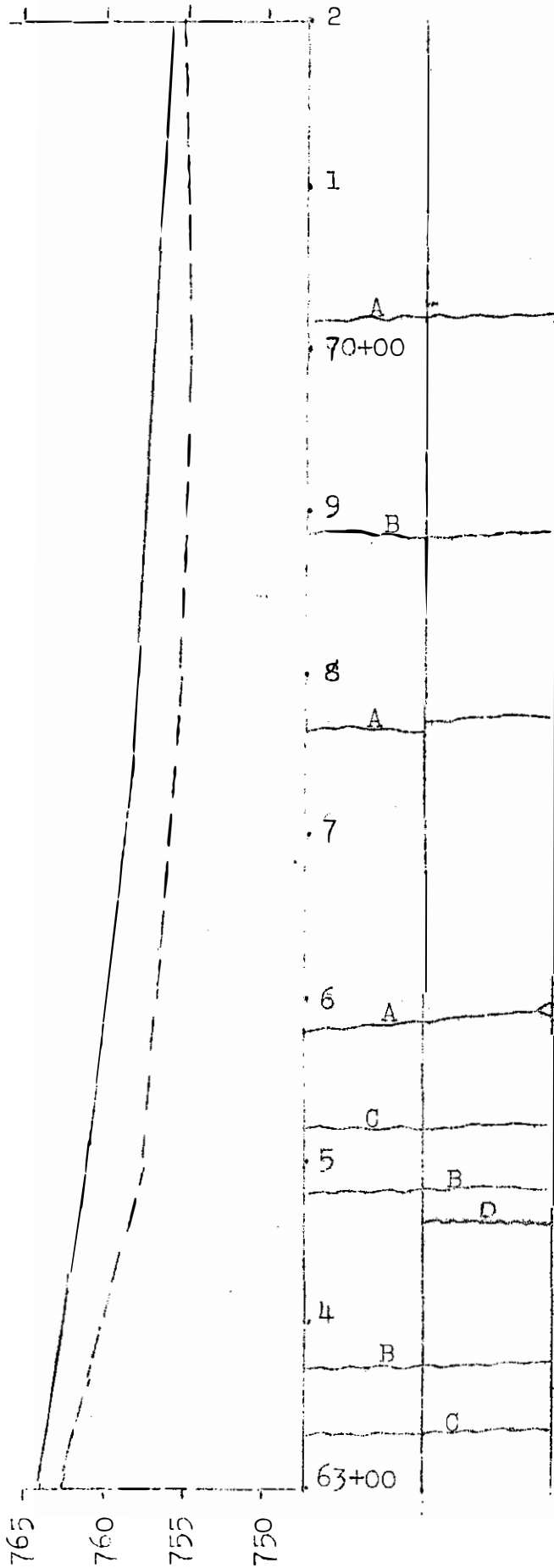
### STRIP MAP OF PROJECT

Cracks marked in black occurred before November 18, 1949 (third survey). The cracks shown in blue occurred between November 18, 1949 and February 16, 1950 (fourth survey). The cracks shown in green were noted in the fifth survey on June 5, 1950. The cracks marked in yellow appeared on the October 19, 1950 survey (sixth survey). The class of crack is noted by the letter A, B, C or D. Construction joints are marked C.J. The grade line of the road is shown with each section. The ground line is shown dashed.

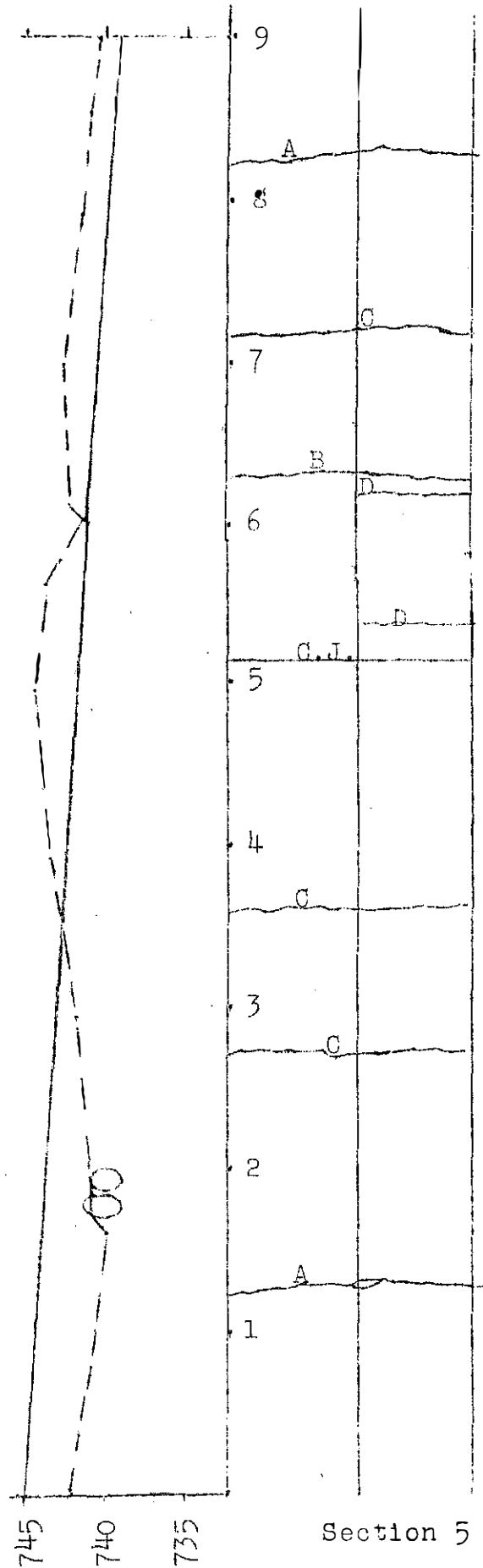
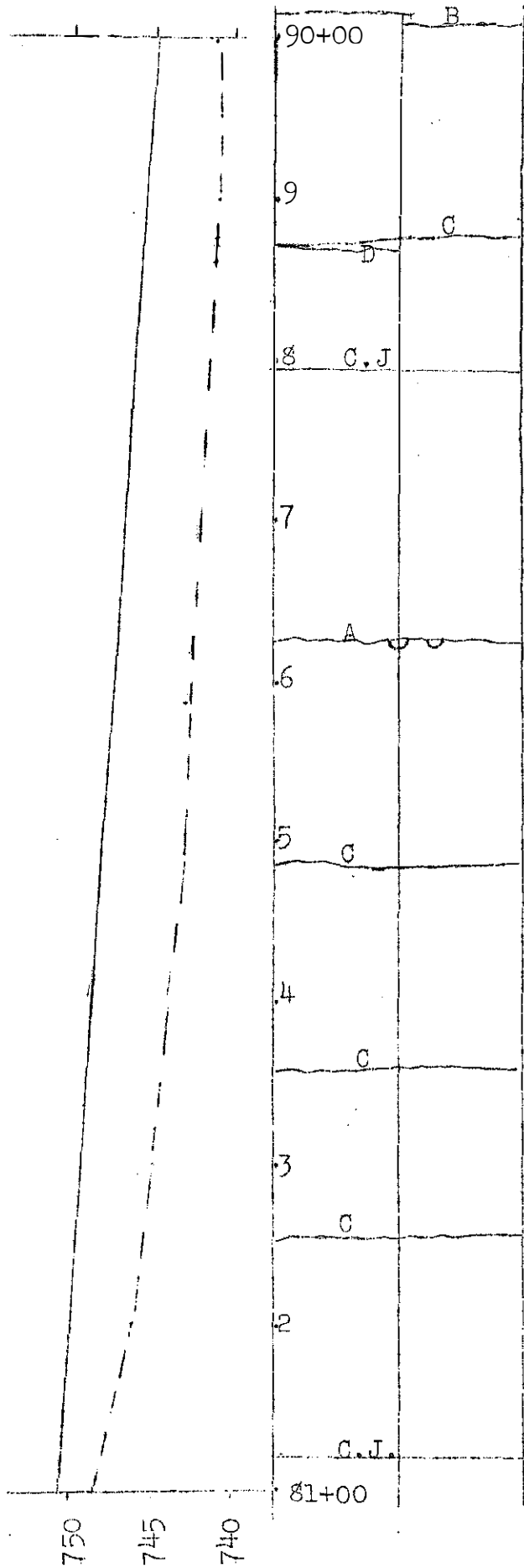


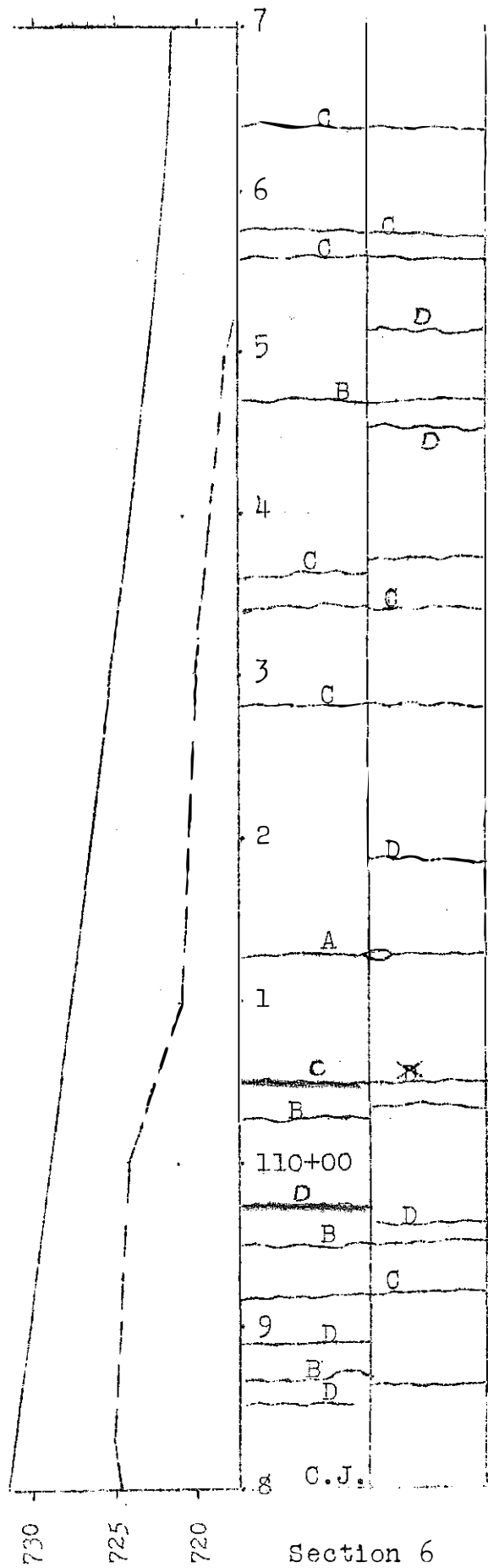
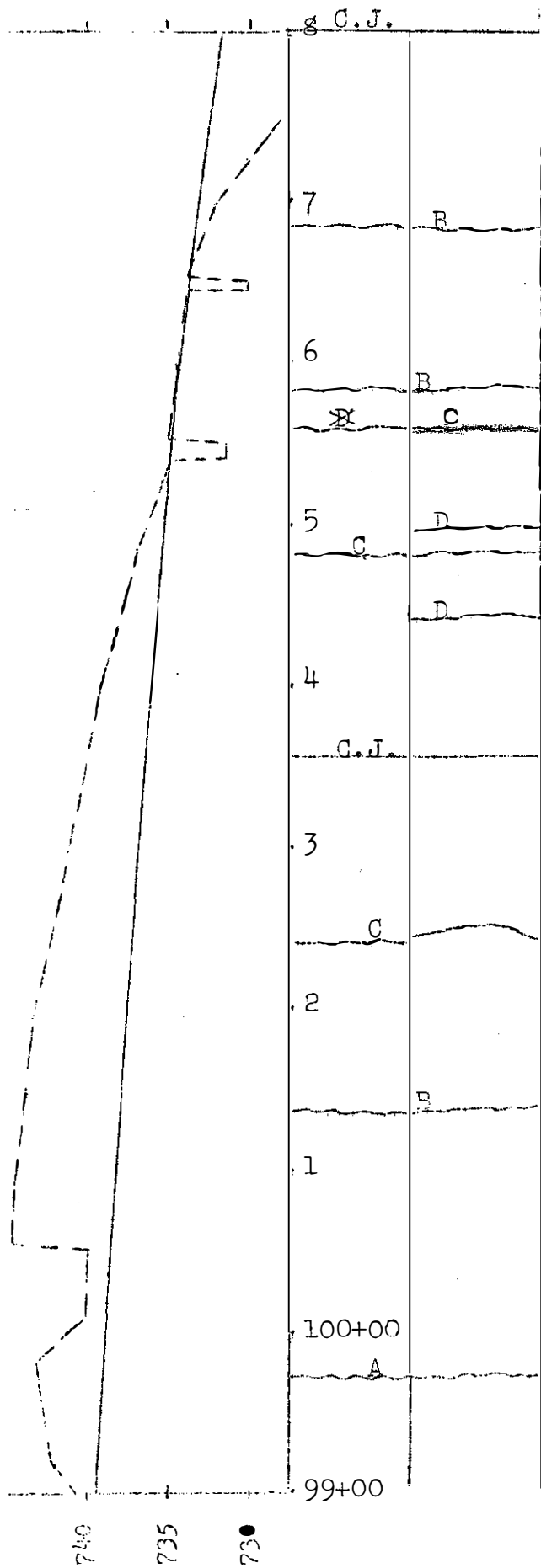


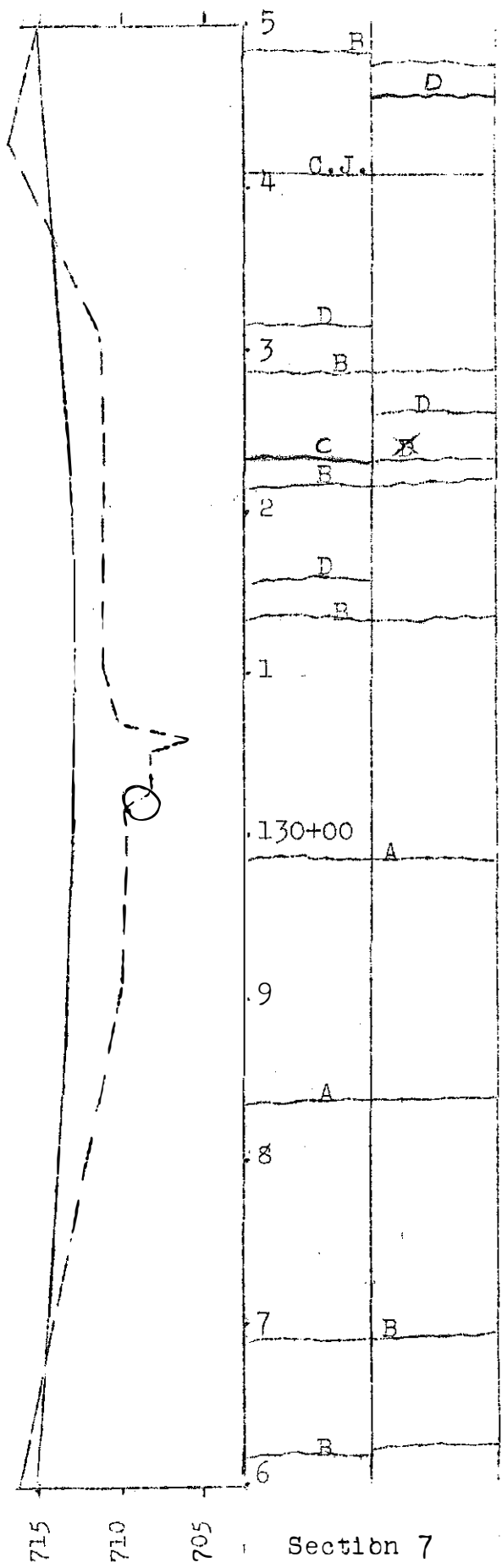
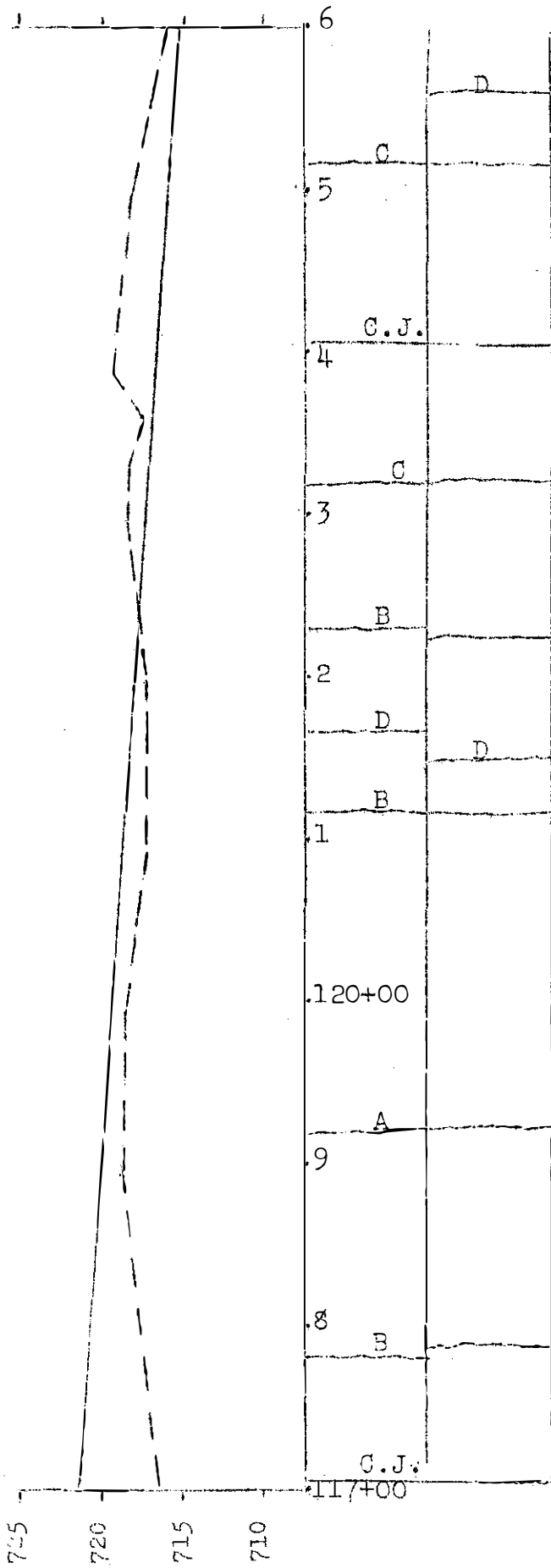




Section 4

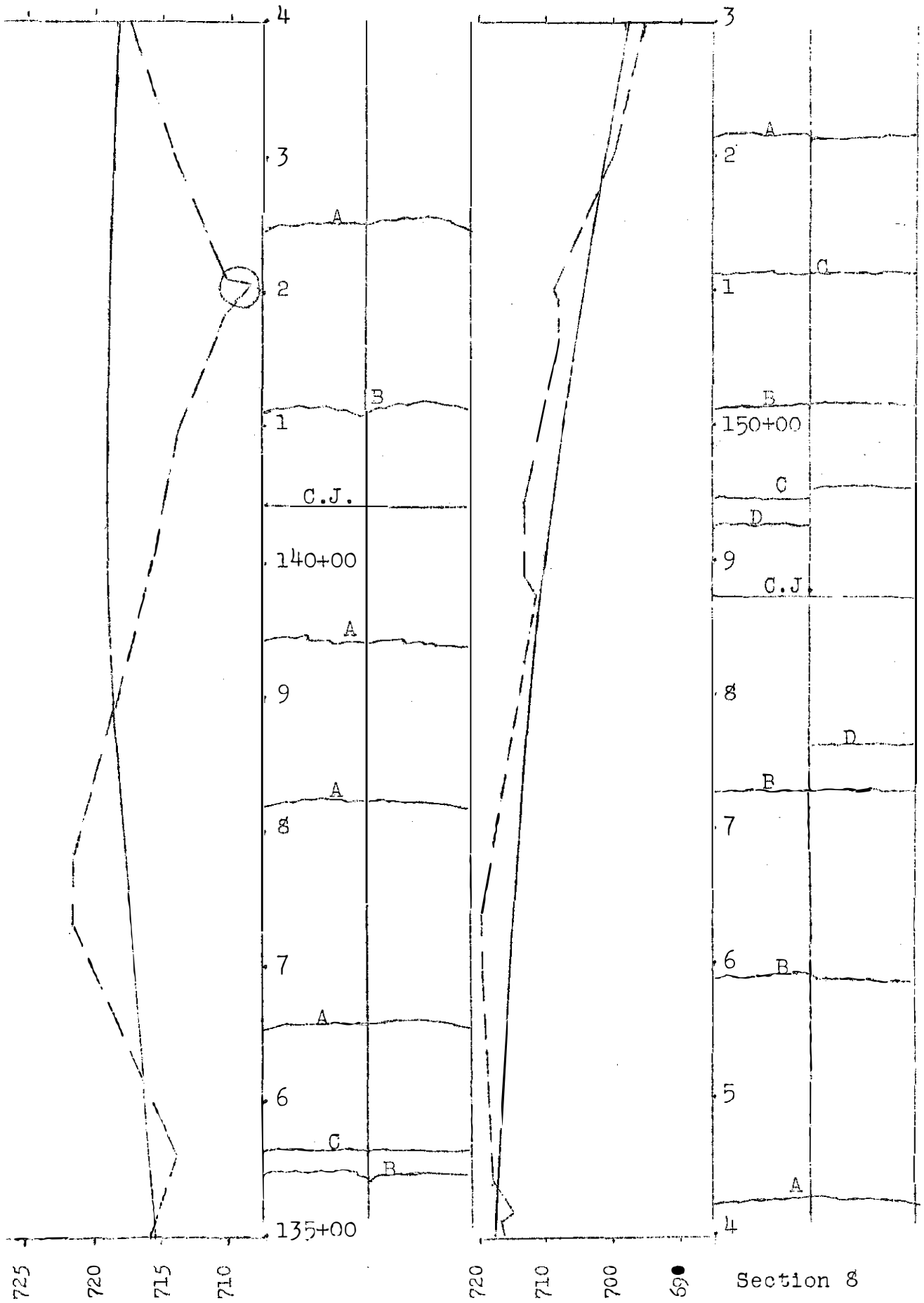




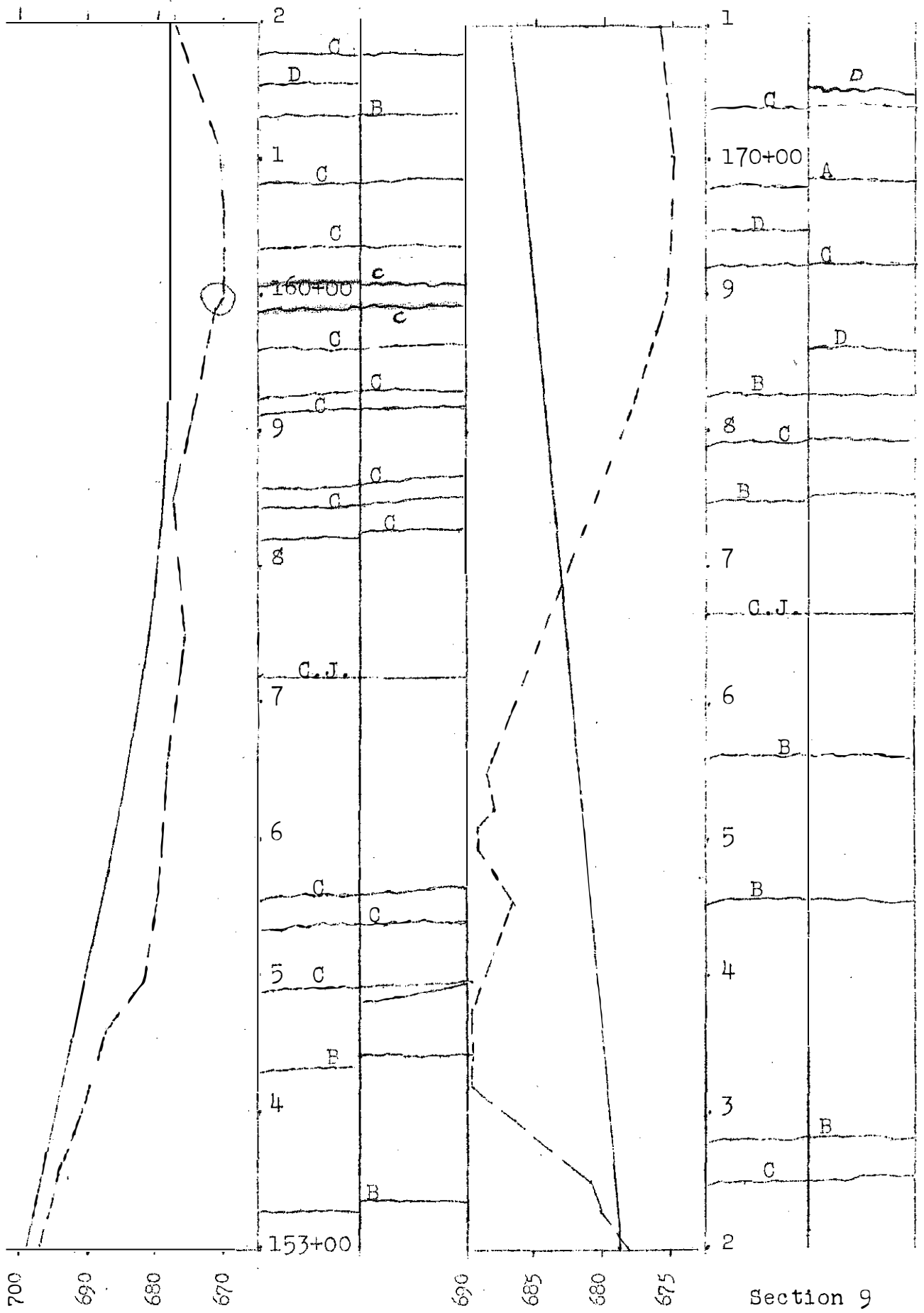


Section 7

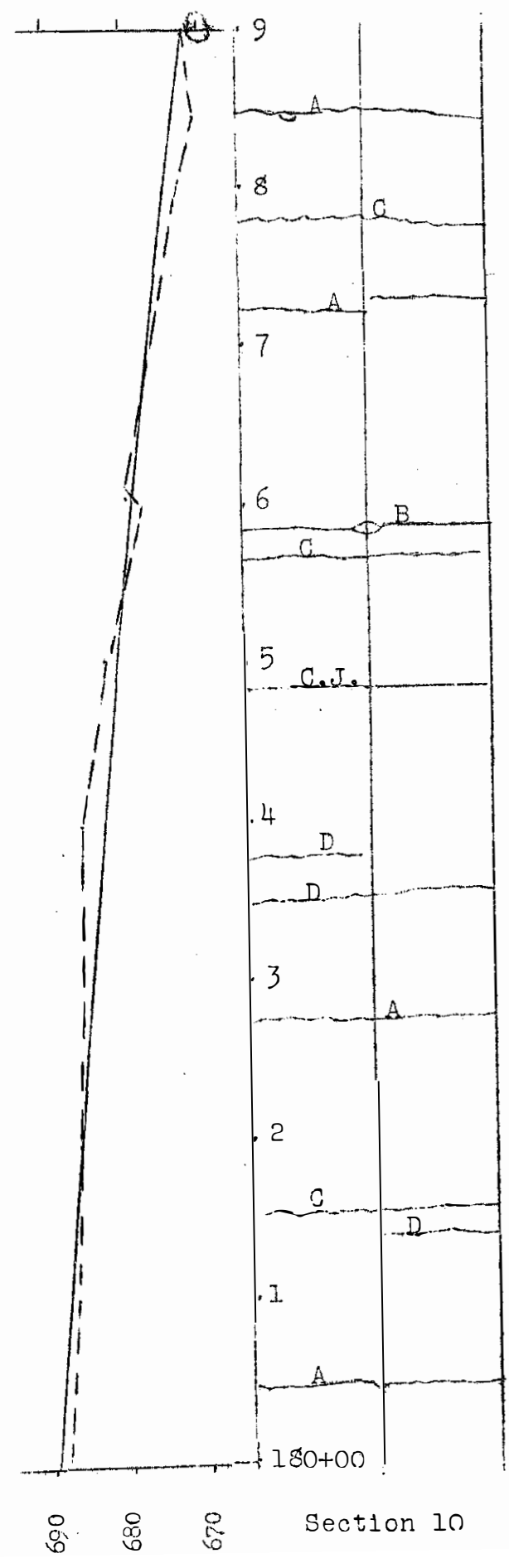
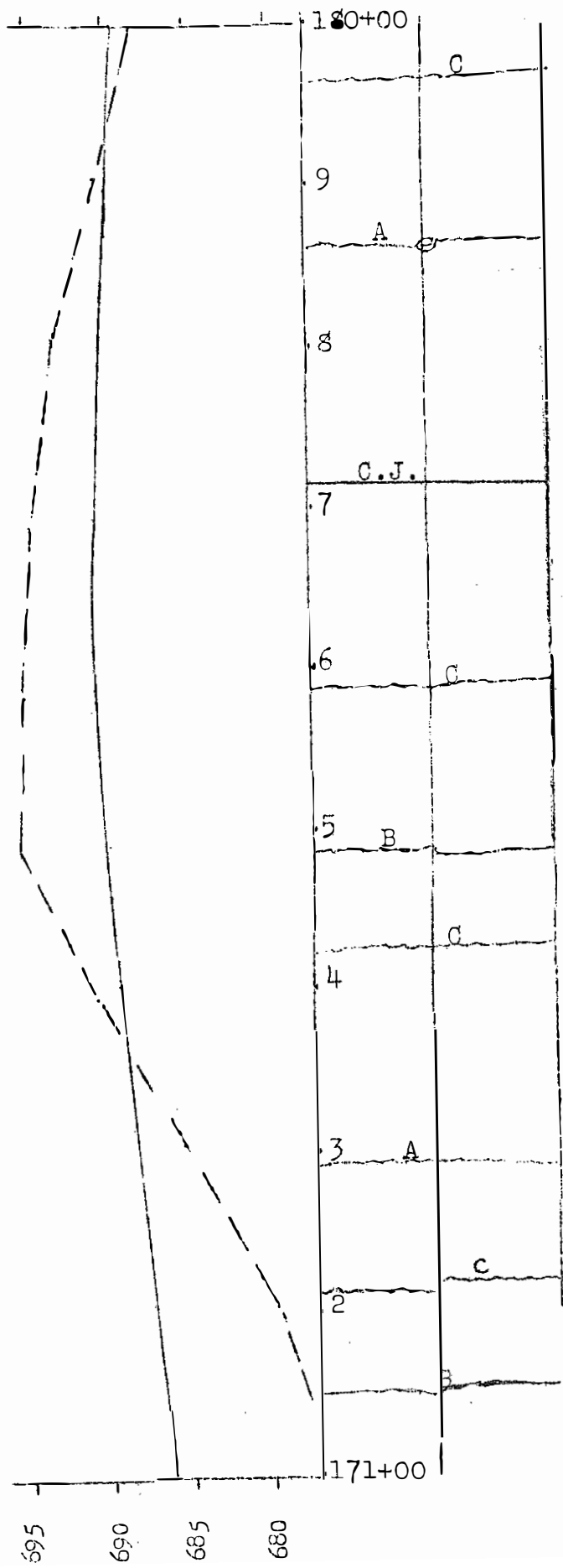




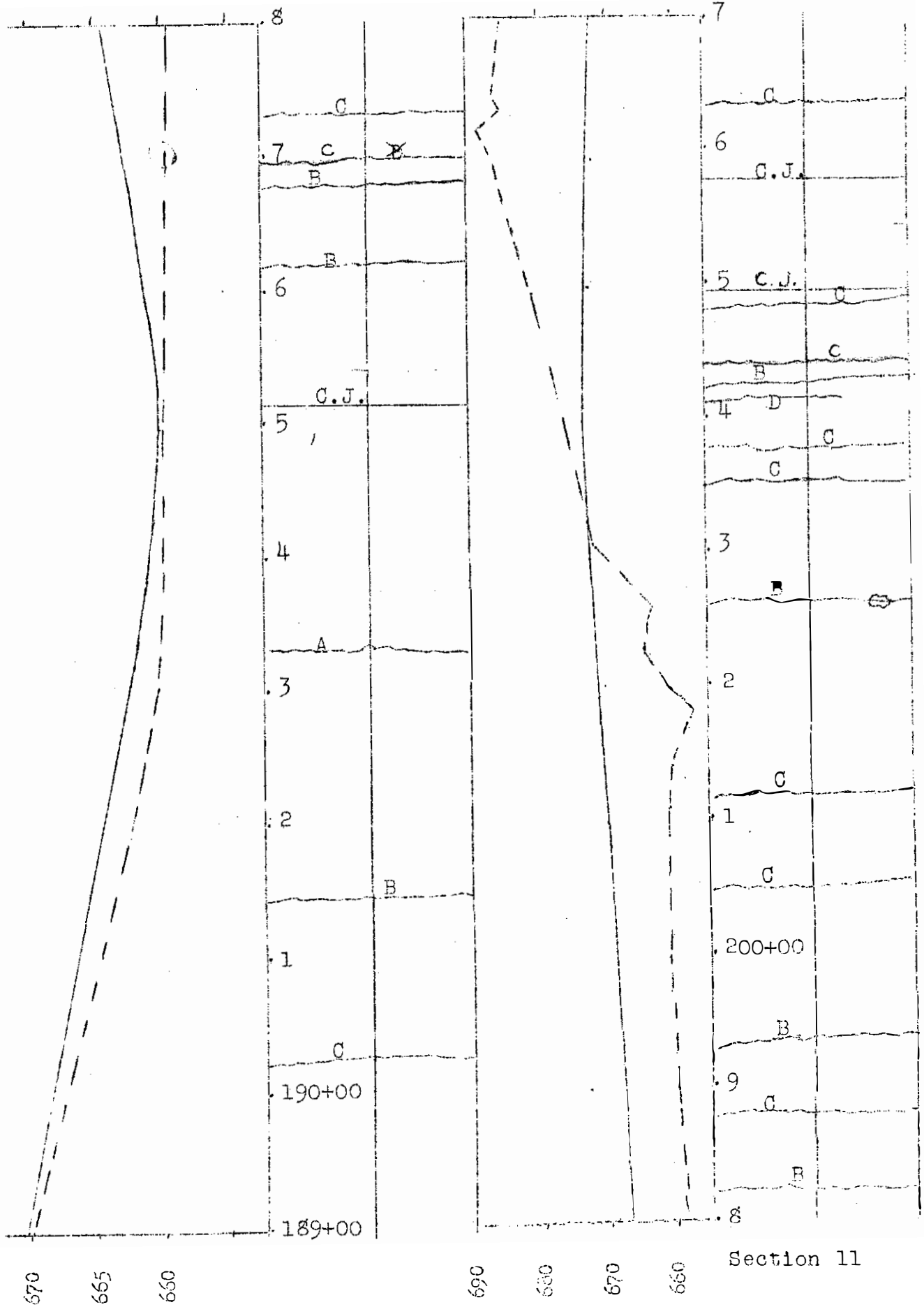
Section 8



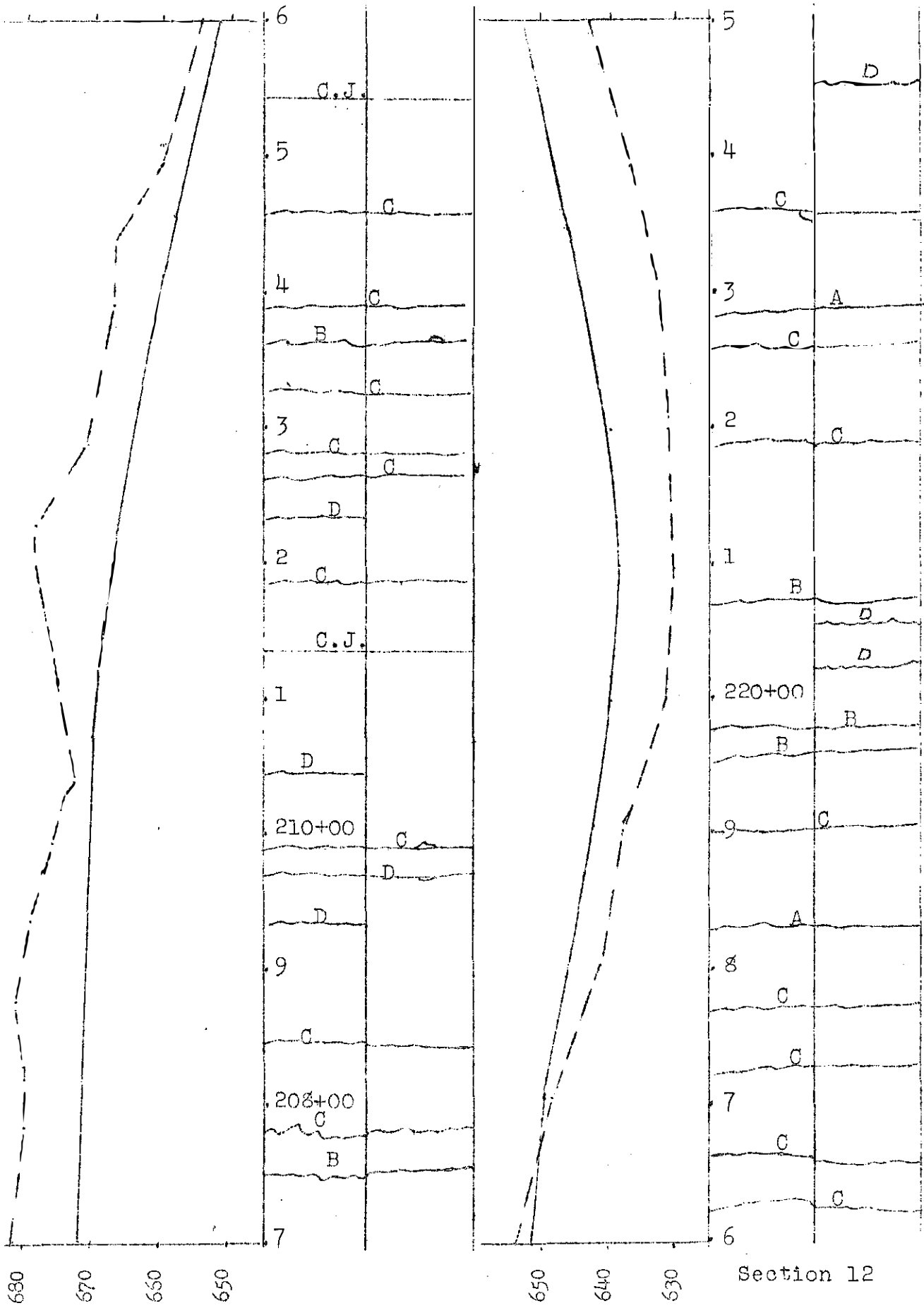
Section 9



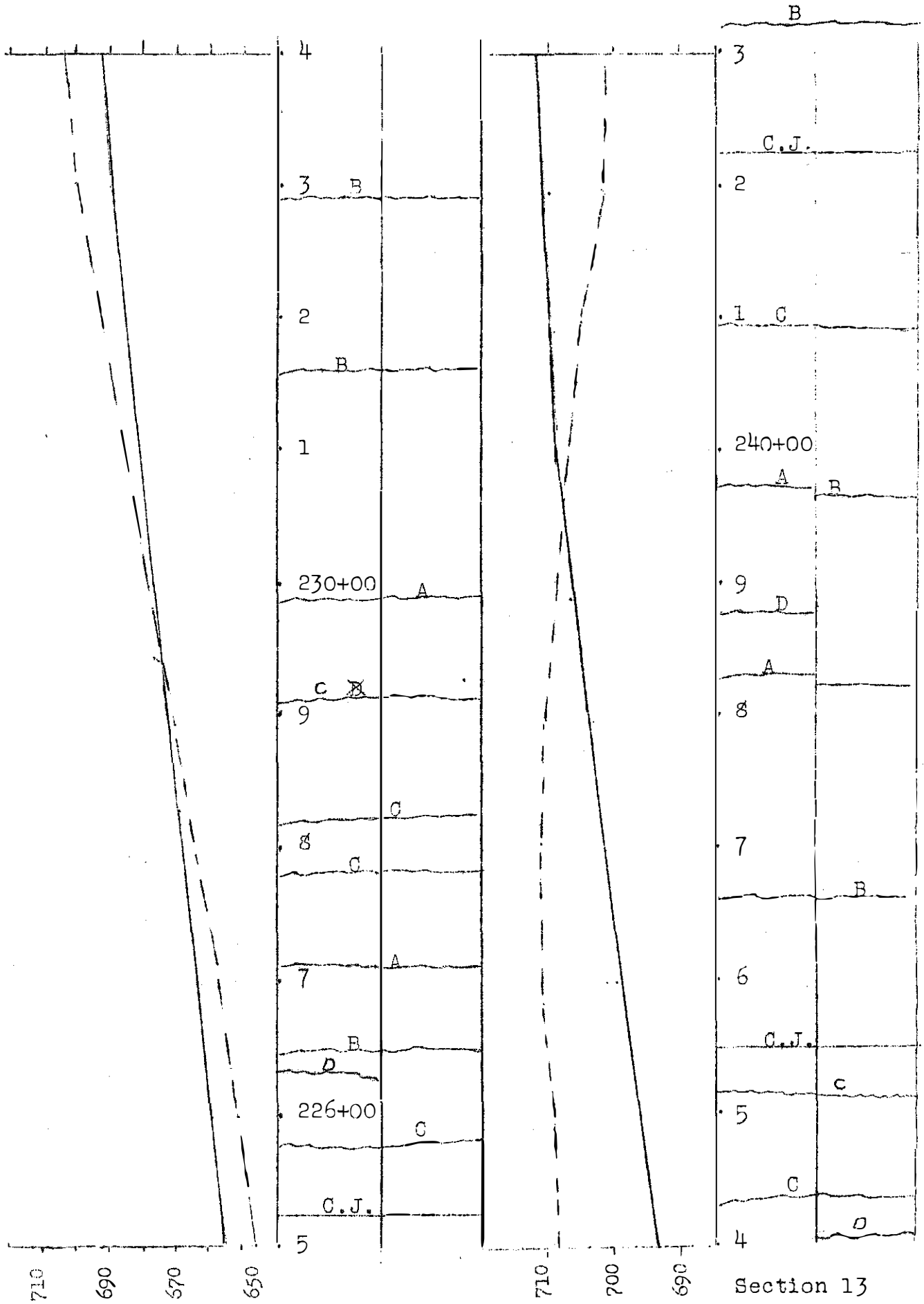
Section 10

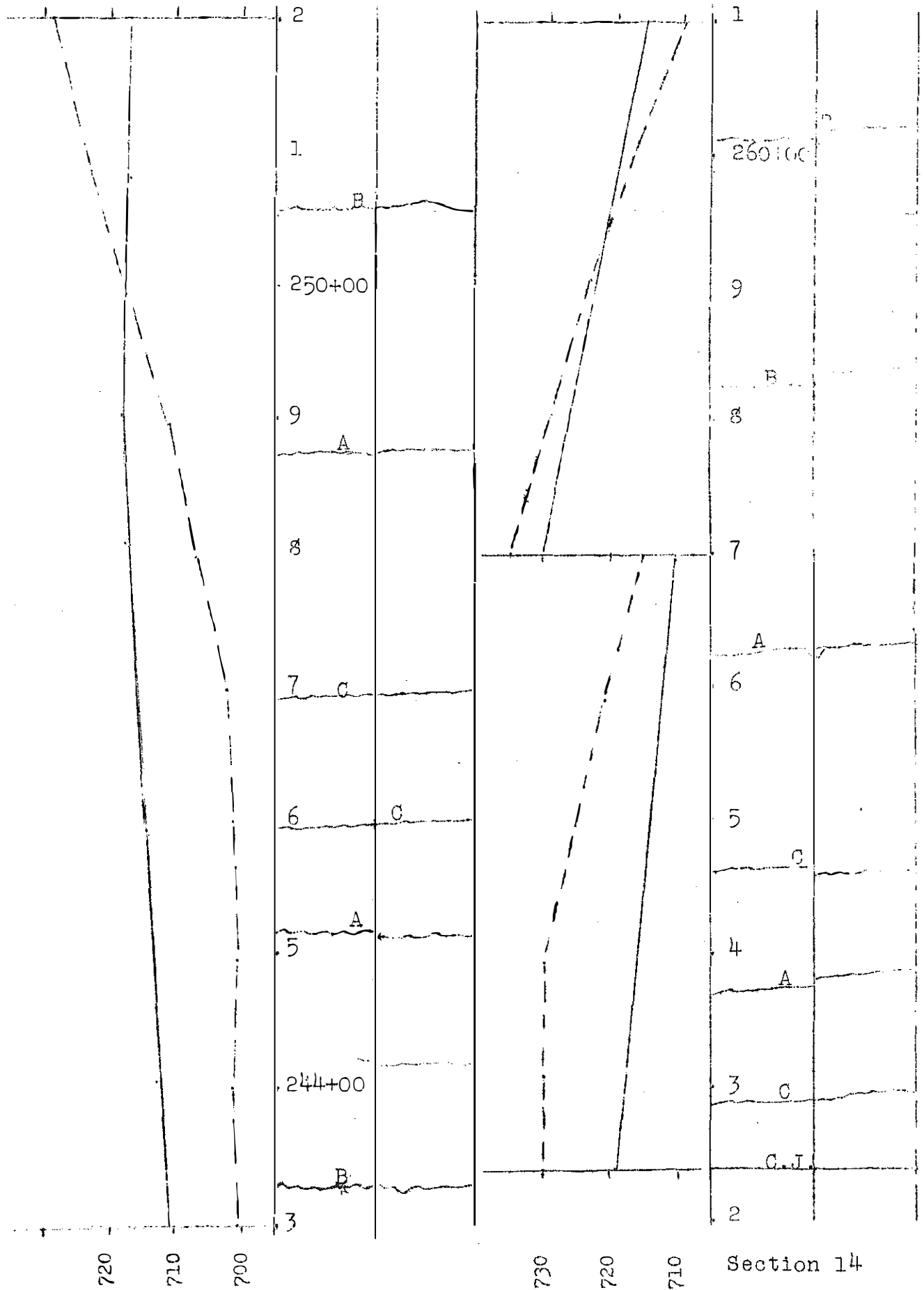


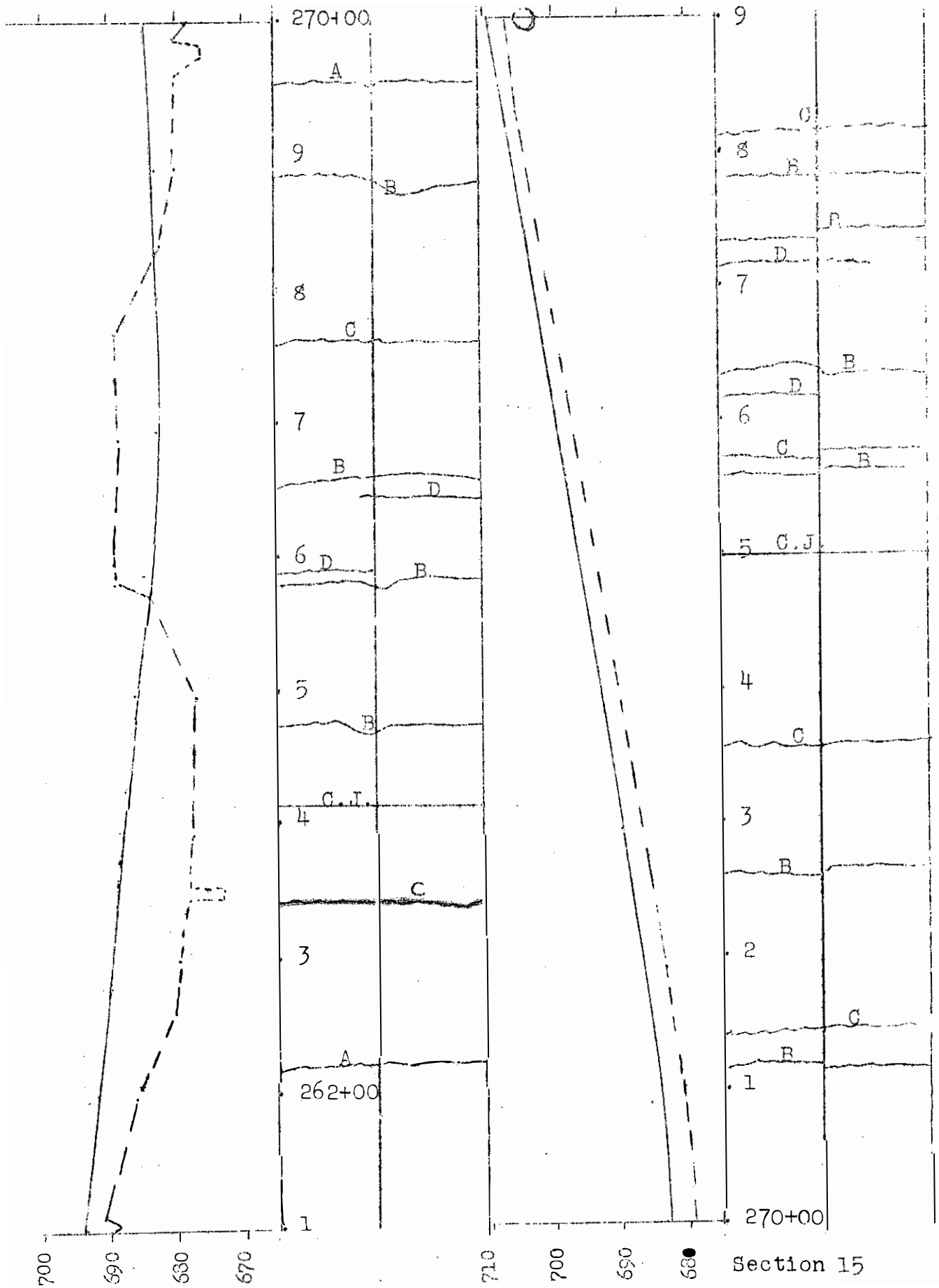
Section 11



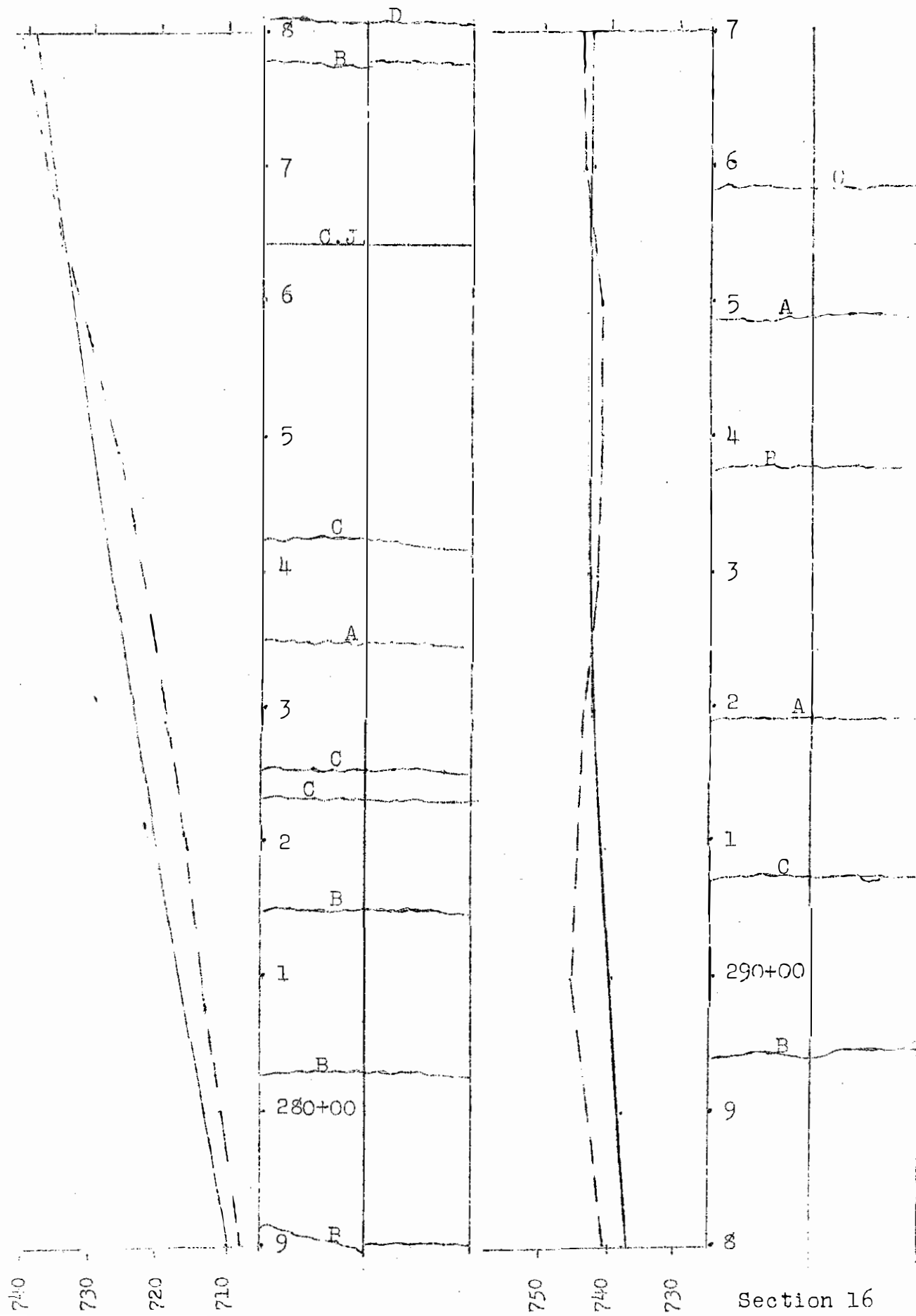
Section 12











Section 16

