CONSTRUCTION OF EQUIVALENT UNIFORM LOAD DIAGRAM FOR HIGHWAY BRIDGES

THESIS FOR THE DEGREE OF B. S.

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Construction of Equivalent Uniform Load Diagram

for

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From the beginning of a bridge design, it is necessary for the engineer to decide upon the load for which the bridge is to be designed to carry. Very seldom is it possible for him to obtain the actual weights of vehicles to be carried, and it therefore is necessary for him to develop types of loadings which will closely approach the actual ones. It has only been in recent years that a definite type of loading for highway bridge has been used. Previous to about 1924 a steam roller type was used as a bases of design -- that being the heaviest type of vehicle considered. At present we have various types of loadings, such as, the Cooper's E-loadings for railways, the H-loading for highways, and the electric railway loadings.

In general, these various loadings consist of a series of concentrated loads spaced at definite intervals so as to represent the wheel loads of the train or truck as passes over the bridge. In working up the design, the particular loading chosen is moved back and forth over the bridge span until the position which gives the maximum stress is determined. The unfortunate thing about using these loadings is that there is no one particular position of the loading which will give the maximum stress in all parts and members of the bridge structure. Because of this it becomes necessary to determine a new position of the loading for practically every point which is to be considered in the design. This process is very laborious and time consuming but is absolutely necessary if the design is to be of any value. It is needless to state the necessity of knowing the capacity of the structure within reasonably close limits.

As in the case of most laborious jobs and processes, certain short cuts and aids have been developed. One of these is the moment diagram which finds its use in the determining of the stresses after the position of the concentrated load system has been determined. This diagram gives the axle loads and their spacing, and also the sum of the loads and of the distances from the head of the train or vehicle procession to each load, and the moment about each load of all the loads that precede it. The method of using it can be found in any textbook on structural design or particularly in "Structural Theory" by Sutherland and Bowman.

A second aid to the designer is in the form of equivalent loadings. These loadings may be of two types. The first one consists of a uniform load extending over the whole span along with a concentrated load so placed as to give the maximum stress. This type is illustrated in the Michigan State Highway Department Standard Road and Bridge Specifications which states in part,"A total load on each traffic lane composed of a uniform load of 450 pounds per linear foot and a single concentrated load of 21,000 pounds." This type it must be remembered is only an assumed equivalent, and therefore, in many cases the results may vary guite a bit from the results obtained from the regular loading.

From the second type of equivalent loading, known as an equivalent uniform load, more accurate results may be obtained and if used properly the results are equivalent to those obtained by the regular loading. Work with this type has only been done, as for as we can ascertain, with the railway loadings. A great share of this work on equivalent loads was done by Dr. Steinman and presented in the paper "Locomotive Loadings for Railway Bridges", Transactions American Society of Civil Engineers, 1923. The data compiled by Dr. Steinman is presented in the form of diagrams readily gives the equivalent load to use in any case after the influence diagram has been constructed. Its great value lies in the amount of time and labor it saves the designer.

An equivalent loading chart of this type would be welcome to the highway bridge designer, so we propose in this thesis to present such a diagram which is suitable for determining the equivalent uniform load which when applied to the whole span will give the maximum stress developed by the regular H-15 loading.

Method used in development of chart:

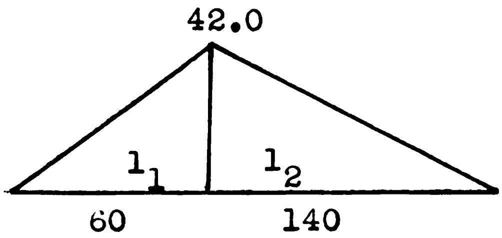
The H-15 loading is a concentrated load system which represents a fifteen ton truck followed and preceded by a continuous procession of eleven and one-quarter ton trucks. The distance between axles of the same truck is taken as fourteen feet, and the distance from the rear axle of one truck to the front axle of the following truck is taken as thirty feet. The load of each truck is considered as having eight-tenths carried by the rear wheels and two-tenths by the front.

In compiling the data for the construction of the diagram, this H-15 loading was first put in the form of a moment

diagram to facilitate its use in determining maximum stresses. The complete diagram as we used it consisted of not just one, but of a series of diagrams so arranged that when considering a situation there was a diagram which could be used without having any load passing off of the span. This helped greatly in that it alleviated the work of subtracting the effects of the loads which had passed off.

The first step in the actual computation of the equivalent uniform load is the determination of the positions of the concentrated loads which will give the desired maximum stress. This may be done in any of the ways described in the texts on structural design, but because of the apparent uniformity of the loads this might more easily be done by direct application of the moment diagrams. It can easily be seen that with the H-type loadings the maximum moment will occur with the heaviest concentrated load at the peak of the influence line. In this case, the first step is eliminated leaving only the computation of the bending moment to be done in order to determine the stress.

As an example, consider finding the equivalent uniform load for the sixty foot point of a two hundred foot span.



Draw the influence line for the moment as shown in Fig.1. Next apply the moment diagram to determine the maximum moment, remembering to test for the condition where the loads are passing from the short segment to the long as well as from the long segment to the short.

Long to short: (140-60) Select from the series the moment diagram which has its heaviest load at a distance of 60 feet or less. This is M.D. I which has its 24 kip load at a distance of 58 feet.

$$\text{Mom.} = \frac{11226 + (120.0 \times 8)}{200} 60 - 1137 = 2519^{k'}$$ ✓

Short to long: (60-140) Use diagram M.D. VI

$$\text{Mom.} = \frac{9711 + (115.5 \times 16)}{200} 140 - 5556 = 2535^{k'}$$ ✓

Equivalent Load (q)

$$q = \frac{\text{Moment}}{\text{Area of influence triangle}} = \frac{2535}{\frac{1}{2} \times 200 \times 42}$$

$$= 603.6 \text{ lbs. per linear foot}$$

This load of 603.6 lbs. per linear foot when applied to a 200 foot span will produce the same bending moment at the 60 foot point as would the H-15 loading. The advantage of knowing this load when finding the bending moment is quite apparent after working backwards through the last problem.

Given q = 603.6 lbs. Find the maximum bending moment at the 60 foot point of a 200 foot span.

Solution: Draw the influence line as in Fig.1.

Substitute in the formula B.M. = $\frac{1}{2}ql_1l_2$

l_1 and l_2 are the segments of the span.

B.M. = $\frac{1}{2} \times 603.6 \times 60 \times 140 = 2535.1$

This is unquestionably a much shorter process than that used in first determining the bending moment from the moment diagram. The only thing which now prevents the use of these various uniform loadings is a source from which to obtain the proper "q" for the particular situation under consideration. For this purpose we offer the accompanying diagram along with an explaination of the method of its construction with illustrations to prove its validity.

The computation of the diagram consisted chiefly in computing a uniform loading for sufficiently large number of possible conditions. This of course could be extended indefinitely, so we set the limits at a 300 foot span. Most ordinary spans fall well within this limit.

The basis of the computation of moments is the influence line for moment, so in selecting the points to be computed, we assumed various conditions of this influence line. The first condition considered was with the short segment of the influence line held constant at 10 feet and the long segment varied from 10 to 300 feet by small intervals. Next the short segment was held at 15 feet. This was continued until the short segment had been increased to 300 feet by the same intervals as the long segment had been increased.

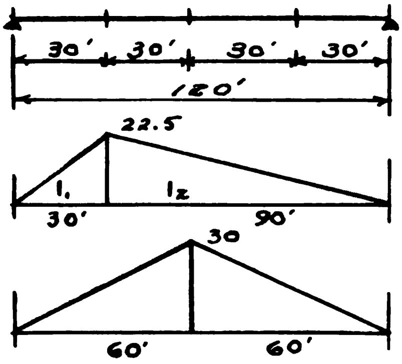
This data gives a concept of the range over which the uniform loads are spread as well as the points which have the same uniform load. This data may also be plotted upon the diagram in the form of lines through the points of equal uniform loads.To facilitate the selection of these points, and to reduce the errors of interpolation between the points, the computations are compiled in the form of graphs with the short span held constant using the long span as the abscissa and the "q" as the ordinate. From these graphs the desired points were taken and plotted upon the diagram, and lines of equal load sketched in.

Upon inspecting the resulting diagram, it was found desirable to compute the "q" for a few additional points so as to more accurately locate the position of the load lines. These points were computed, graphed, and plotted as the others were, thus completing the diagram as here submitted. The actual results of the computations made may be found in the accompanying chart. The graphs for the major part of the work have also been shown.

Use of the diagram consists of finding the point at which the long and short spans intersect on the diagram, and selecting of the uniform load for this point. e.g. The uniform load for a short span of 80 and a long span of 110 is 602 lbs. per linear foot.

As to the validity of the results obtained from the diagram we offer the following examples as proof.

Example 1. Required the maximum bending moment at the quarter and half points of a 120 foot span.



For quarter point:

Using moment diagram M.D. I

$$M = \frac{3990}{120} \times 30 - 84 = 913.5^{k'}$$

Using uniform load diagram

q = 679

$$M = \frac{1}{2} \times 679 \times 30 \times 90 = 916.6$$

For half point:

Using moment diagram M.D. I

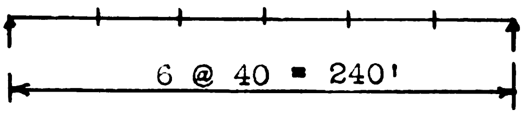
$$M = \frac{4715}{120} \times 60 - 1137 = 1220.5$$

Using uniform load diagram

$q = 678$

$$M = \frac{1}{2} \times 678 \times 60 \times 60 = 1220.4$$

Example 2. Required the maximum bending moment for the 40, 80 and 120 of a 240 foot span.



At 40 foot point.

Using moment diagram

$$M = \frac{13839 + 124.5 \times 10}{240} \times 200 - 10239$$

$= 2371$ ✓

Using uniform load.

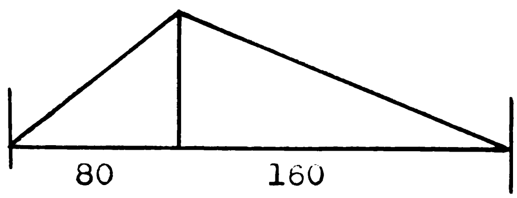
$q = 581$

$$M = \frac{1}{2} \times 581 \times 40 \times 200 = 2324$$

At the 80 foot point.

Using moment diagram

$$M = \frac{14586}{240} \times 80 - 1137 = 3725$$

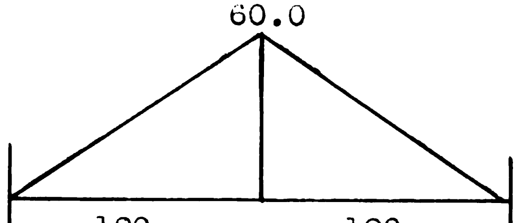


Using uniform load

$q = 584$

$$M = \frac{1}{2} \times 584 \times 80 \times 160 = 3737.6$$

At the 120 foot point



Using moment diagram

$$M = \frac{14745}{240} \times 120 - 3180 = 4193$$

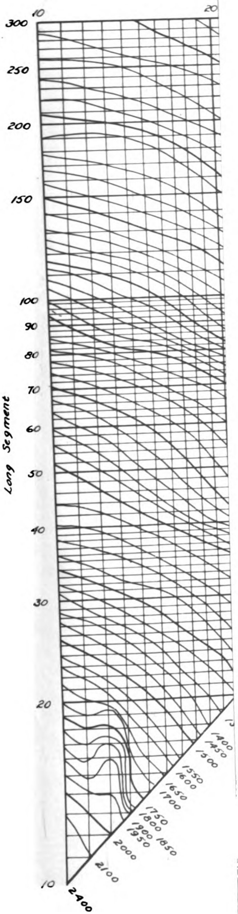
Using uniform load

$q = 583$

$$M = \frac{1}{2} \times 583 \times 120 \times 120 = 4198$$

These results by the two methods vary less than 0.5 of one per cent either way, but are sufficiently close for any ordinary design. The variation is probably due to errors in plotting and in interpolating the results.

In conclusion we wish to point out that this diagram is not limited to only the H-15 loading, but may be applied to any of the H loadings by using a converdion factor. We selected the H-15 loading as it is used in 50 per cent or more cases of highway bridge design.


10
20
300
250
200
150
100
90
80
70
60
50
40
30
20
10
Long Segment
1400
1450
1500
1550
1600
1650
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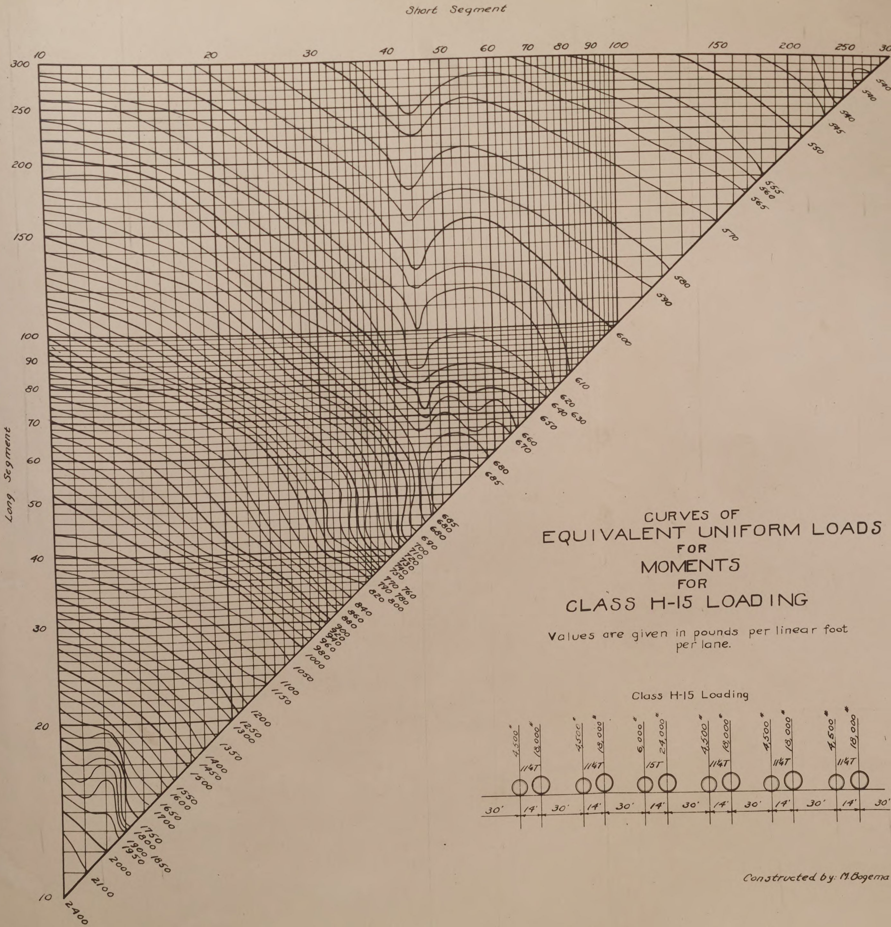
1900
1950
2000
2100
2400



CURVES OF EQUIVALENT UNIFORM LOADS FOR MOMENTS FOR CLASS H-15 LOADING

Values are given in pounds per linear foot per lane.

Class H-15 Loading

4,500# 18,000# 11¼T — 4,500# 18,000# 11¼T — 6,000# 24,000# 15T — 4,500# 18,000# 11¼T — 4,500# 18,000# 11¼T — 4,500# 18,000# 11¼T

30' 14' 30' 14' 30' 14' 30' 14' 30' 14' 30' 14' 30'

Constructed by: M. Bogema and P. Bell.

Equivalent Load Chart

	10	15	20	25	30	35	40	45	50	55	60
300	608	598	589	579	571	565	557	557	561	562	562
280	614	604	594	584	576	570	564	560	564	566	565
260	621	608	599	588	579	572	566	562	566	568	568
240	632	623	607	596	585	578	572	567	572	573	573
220	639	627	612	660	588	581	574	569	574	575	575
200	655	640	626	612	598	590	583	577	582	584	584
180	667	667	634	618	605	595	585	580	586	587	588
160	690	670	652	634	618	608	598	591	596	598	597
150	701	678	659	641	626	613	602	594	600	602	602
140	711	689	666	646	631	617	605	597	603	605	604
130	722	697	674	652	634	620	608	599	606	607	606
120	746	718	693	669	648	634	620	611	617	619	617
110	768	739	709	672	662	645	630	619	625	627	625
100	787	753	722	693	676	651	636	624	630	626	629
95	797	761	728	698	676	654	636	625	632	629	631
90	805	766	732	700	676	655	636	625	632	628	632
85	826	783	746	712	685	663	644	626	638	640	638
80	850	805	767	729	700	676	657	636	650	651	649
75	880	830	787	747	712	688	670	646	660	661	659
70	906	848	804	761	729	702	680	657	670	670	668
65	932	878	825	777	747	717	689	670	678	672	674
60	963	895	842	792	762	729	699	678	682	700	678
55	987	916	856	802	747	739	707	683	688	701	
50	1016	937	872	813	780	743	708	675	689		
45	1038	952	878	814	776	739	700	678			
40	1116	1013	930	857	798	761	726				
35	1226	1104	1003	920	849	807					
30	1360	1210	1086	990	907						
25	1522	1332	1184	1066							
20	1720	1472	1290								
15	1952	1630									
10	2400										

Equivalent Load Chart

	65	70	*75	80	*85	90	*95	100	110	120	130
300	561	559	557	555	552	552	553	552	552	550	547
280	564	563	559	558	560	553	555	555	553	553	549
260	567	564	560	559	555	555	556	556	556	554	550
240	572	569	565	564	559	559	561	561	560	558	554
220	573	570	566	565	561	559	562	561	561	558	554
200	580	578	573	572	566	566	567	568	567	564	559
180	582	581	578	574	570	570	570	570	564	566	561
160	595	590	584	582	576	575	576	577	575	572	566
150	598	595	589	586	579	579	580	582	579	575	569
140	601	597	592	588	582	580	582	582	580	576	570
130	603	598	593	589	582	584	582	582	580	576	570
120	613	608	598	597	588	587	587	589	587	582	
110	621	616	606	605	594	595	594	596	593		
100	625	621	614	606	601	598	598	600			
95	626	622	616	609	602	598	599				
90	626	619		609		596					
85	632	625	619	611	603						
80	642	634		619							
75	651	643	634								
70	659	650									
65	665										

* Segments in this group are five feet longer, ie,105, 115, etc.

Equivalent Load Chart

	140	150	160	180	200	220	240	260	280	300
300	547	549	549	543	543	540	541	539	538	537
280	550	552	551	546	545	542	542	540	540	
260	550	553	552	546	546	543	543	541		
240	554	557	556	549	549	545	545			
220	554	557	556	649	549	545				
200	559	563	562	553	553					
180	561	565	564	554						
160	566	571	569							
150	569	574								
140	569									
130										

Moment Diagrams and Computation Graphs

for

H-15 Loading

Key to symbols used

M.D.	Moment diagram
Mom.	Moment of all preceding loads about point
SD	Distance in feet from first load
D	Distance between loads in feet
L	Concentrated load in kips
SL	Sum of loads up to that point in kips
q	Equivalent uniform load

M.D. I

Mom.	SD	D	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	6.0	28.5
1137	58	14	24	52.5
2712	88	30	4.5	57.0
3510	102	14	18	75.0
5760	132	30	4.5	79.5
6873	146	14	18	97.5
9798	176	30	4.5	102.0
11226	190	14	18	120.0
14826	220	30	4.5	124.5
16564	234	14	18	142.5
20844	264	30	4.5	147.0
22902	278	14	18	165.0
27352	308	30	4.5	169.5
30225	322	14	18	187.5
35250	352	30	4.5	192.0
37938	366	14	18	210.0

M.D. II

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	6	24.0
876	44	14	24	48.0
1020	74	30	4.5	52.5
1755	88	14	18	70.5
3870	118	30	4.5	75.0
4920	132	14	18	93.0
7710	162	30	4.5	97.5
9075	176	14	18	115.5
12540	206	30	4.5	120.0
14220	220	14	18	138.0
18360	250	30	4.5	142.5
20355	264	14	18	160.5
25170	294	30	4.5	165.0
27480	308	14	18	183.0
32970	338	30	4.5	187.5
35595	352	14	18	205.5
39760	382	30	4.5	210.0

B.& B.

M.D. III

Mom.	SD	D	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	4.5	27.0
1116	58	14	18	45.0
2466	88	30	6	51.0
3180	102	14	24	75.0
5430	132	30	4.5	79.5
6543	146	14	18	97.5
9468	176	30	4.5	102.0
10896	190	14	18	120.0
14496	220	30	4.5	124.5
16239	234	14	18	142.5
20514	264	30	4.5	147.0
22572	278	14	18	165.0
27522	308	30	4.5	169.5
29895	322	14	18	187.5
35520	352	30	4.5	192.0
38208	366	14	18	210.0
44508	396	30	4.5	214.5
47511	410	14	18	232.5
54636	440	30	4.5	237.0
57954	454	14	18	255.0

M.D. IV

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	4.5	22.5
855	44	14	18	40.5
2070	74	30	6	46.5
2721	88	14	24	70.5
4836	118	30	4.5	75.0
5886	132	14	18	93.0
8676	162	30	4.5	97.5
10041	176	14	18	115.5
13506	206	30	4.5	120.0
15186	220	14	18	138.0
19326	250	30	4.5	142.5
21321	264	14	18	160.5
26136	294	30	4.5	165.0
28446	308	14	18	183.0
33936	338	30	4.5	187.5
36561	352	14	18	205.5
42726	382	30	4.5	210.0
45666	396	14	18	228.0
52506	426	30	4.5	232.5
55761	440	14	18	250.5
63276	470	30	4.5	255.0

M.D.V

Mom.	SD	D	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	4.5	27.0
1116	58	14	18	45.0
2466	88	30	4.5	49.5
3159	102	14	18	67.5
5187	132	30	6,0	73.5
6216	146	14	24.0	97.5
9141	176	30	4.5	102.0
10569	190	14	18	120.0
14169	220	30	4.5	124.5
15912	234	14	18	142.5
20187	264	30	4.5	147.0
22385	278	14	18	165.0
27335	308	30	4.5	169.5
29708	322	14	18	187.5
35333	352	30	4.5	192.0
38021	366	14	18	210.0
44321	396	30	4.5	214.5
47324	410	14	18	232.5

M.D. VI

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	4.5	22.5
855	44	14	18	40.5
2070	74	30	4.5	45.0
2700	88	14	18	63.0
4590	118	30	6	69.0
5556	132	14	24	93.0
8346	162	30	4.5	97.5
9711	176	14	18	115.5
13176	206	30	4.5	120.0
14856	220	14	18	138.0
18996	250	30	4.5	142.5
20991	264	14	18	160.5
25806	294	30	4.5	165.0
28116	308	14	18	183.0
33606	338	30	4.5	187.5
36231	352	14	18	205.5
42396	382	30	4.5	210.0
45336	396	14	18	228.0
52176	426	30	4.5	232.5
55431	440	14	18	250.5

B.& B.

M.D. VII

Mom.	SD	D	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	4.5	27.0
1116	58	14	18	45.0
2466	88	30	4.5	49.5
3159	102	14	18	67.5
5187	132	30	4.5	72.0
6195	146	14	18	90.0
8895	176	30	6.0	96.0
10239	190	14	24.0	120.0
13839	220	30	4.5	124.5
15582	234	14	18	142.5
19857	264	30	4.5	147.0
21915	278	14	18	165.0
26865	308	30	4.5	169.5
29238	322	14	18	187.5
34863	352	30	4.5	192.0
37551	366	14	18	210.0
43851	396	30	4.5	214.5
46854	410	14	18	232.5
53829	440	30	4.5	237.0
57147	454	14	18	255.0
64797	484	30	4.5	259.5

M.D. VIII

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	4.5	22.5
855	44	14	18	40.5
2070	74	30	4.5	45.0
2700	88	14	18	63.0
4590	118	30	4.5	67.5
5535	132	14	18	85.5
8100	162	30	6	91.5
9381	176	14	24	115.5
12840	206	30	4.5	120.0
14526	220	14	18	138.0
18666	250	30	4.5	142.5
20661	264	14	18	160.5
25476	294	30	4.5	165.0
27786	308	14	18	183.0
33276	338	30	4.5	187.5
35901	352	14	18	205.5
42066	382	30	4.5	210.0
45006	396	14	18	228.0
51846	426	30	4.5	232.5
55101	440	14	18	250.5
62616	470	30	4.5	255.0
66186	484	14	18	273.0

B. & B.

M.D. IX

Mom.	SD	D	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	4.5	27.0
1116	58	14	18	45.0
2466	88	30	4.5	49.5
3159	102	14	18	67.5
5187	132	30	4.5	72.0
6195	146	14	18	90.0
8895	176	30	4.5	94.5
10218	190	14	18.	112.5
13593	220	30	6	118.5
15252	234	14	24	142.5
19527	264	30	4.5	147.0
21585	278	14	18	165.0
26535	308	30	4.5	169.5
28908	322	14	18	187.5
34533	352	30	4.5	192.0
37221	366	14	18	210.0
43521	396	30	4.5	214.5
46524	410	14	18	232.5
53499	440	30	4.5	237.0
56818	454	14	18	255.0
64467	484	30	4.5	259.5
68100	498	14	18	277.5
76125	528	30	4.5	282.0

M.D. X

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	4.5	22.5
855	44	14	18	40.5
2070	74	30	4.5	45.0
2700	88	14	18	63.0
4590	118	30	4.5	67.5
5535	132	14	18	85.5
8100	162	30	4.5	90.0
9360	176	14	18	108.0
12600	206	30	6	114.0
14176	220	14	24	138.0
18336	250	30	4.5	142.5
20331	264	14	18	160.5
25146	294	30	4.5	165.0
27456	308	14	18	183.0
32946	338	30	4.5	187.5
35571	352	14	18	205.5
41736	382	30	4.5	210.0
44676	396	14	18	228.0
51516	426	30	4.5	232.5
54771	440	14	18	250.5
62286	470	30	4.5	255.0
65856	484	14	18	273.0
74046	514	30	4.5	277.5

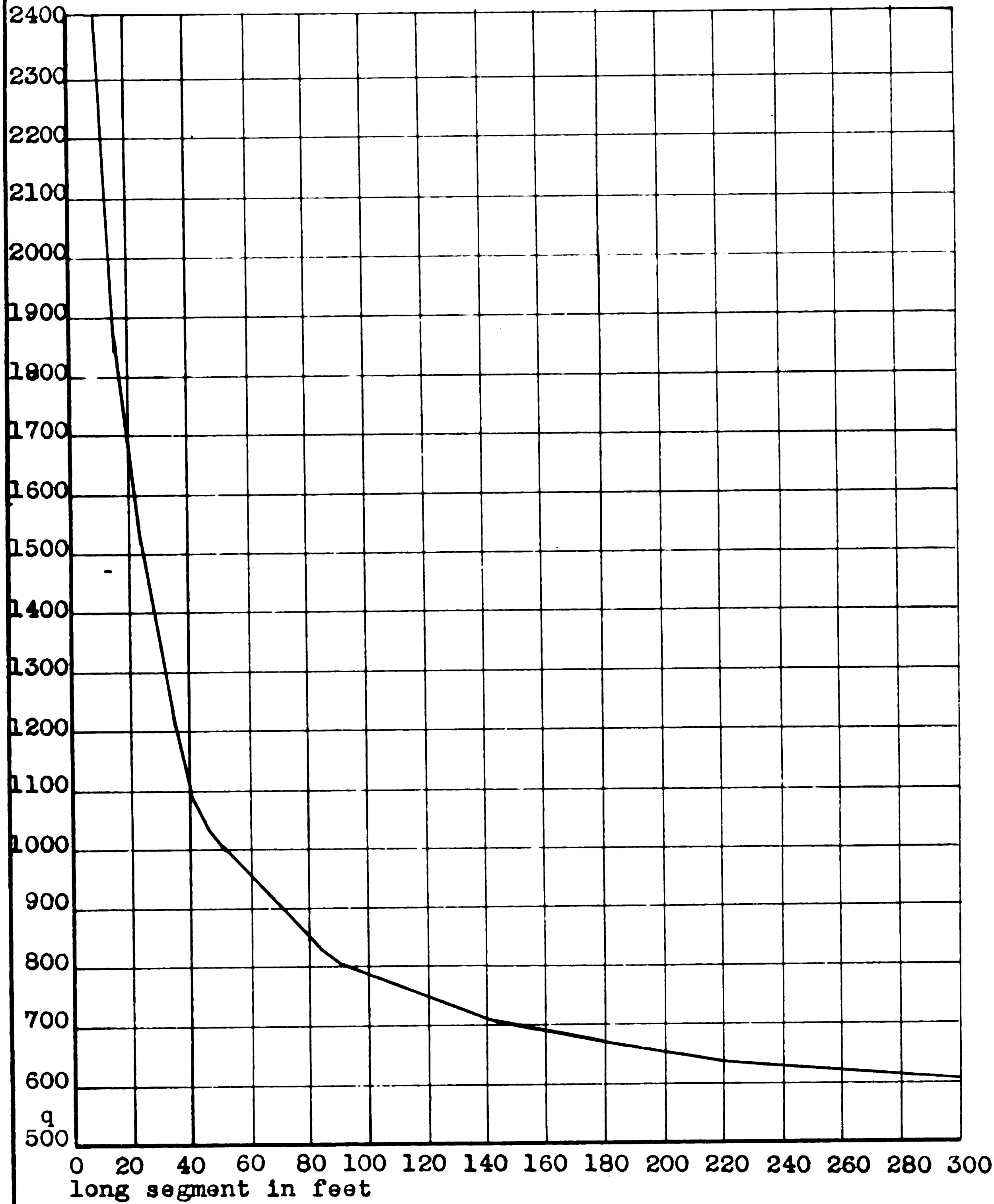
M.D. XI

Mom.	SD	d	L	SL
0	0	0	4.5	4.5
63	14	14	18	22.5
738	44	30	4.5	27.0
1116	58	14	18	45.0
2466	88	30	4.5	49.5
3159	102	14	18	67.5
5187	132	30	4.5	72.0
6195	146	14	18	90.0
8895	176	30	4.5	94.5
10215	190	14	18	112.5
13593	220	30	4.5	117.0
15231	234	14	18	135.0
19281	264	30	6	141.0
21256	278	14	24	165.0
26206	308	30	4.5	169.5
28579	322	14	18	187.5
34204	352	30	4.5	192.0
36892	366	14	18	210.0
43192	396	30	4.5	214.5
46195	410	14	18	232.5
53170	440	30	4.5	237.0
56488	454	14	18	255.0
64138	484	30	4.5	259.5
67771	498	14	18	277.5
76096	528	30	4.5	282.0
80044	542	14	18	300.0

M.D. XII

Mom.	SD	D	L	SL
0	0	0	18	18.0
540	30	30	4.5	22.5
855	44	14	18	40.5
2070	74	30	4.5	45.0
2700	88	14	18	63.0
4590	118	30	4.5	67.5
5535	132	14	18	85.5
8100	162	30	4.5	90.0
9360	176	14	18	108.0
12600	206	30	4.5	112.5
14175	220	14	18	130.5
18090	250	30	6	136.5
20001	264	14	24	160.5
24816	294	30	4.5	165.0
27126	308	14	18	183.0
32616	338	30	4.5	187.5
35241	352	14	18	205.5
41406	382	30	4.5	210.0
44346	396	14	18	228.0
51186	426	30	4.5	232.5
54441	440	14	18	250.5
61956	470	30	4.5	255.0
65526	484	14	18	273.0
73716	514	30	4.5	277.5
77601	528	14	18	295.5
86436	558	30	4.5	300.0

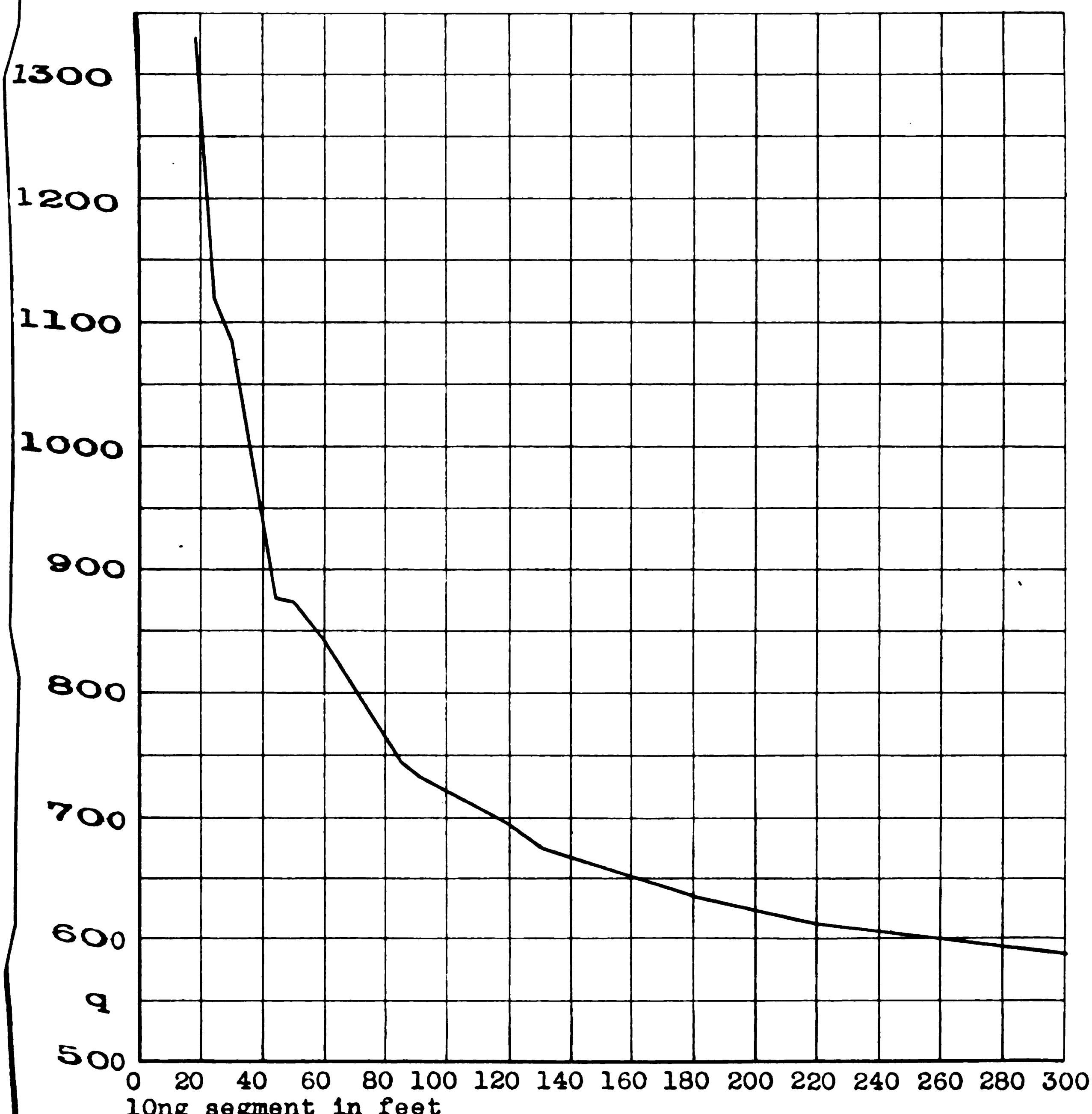
B.& B.



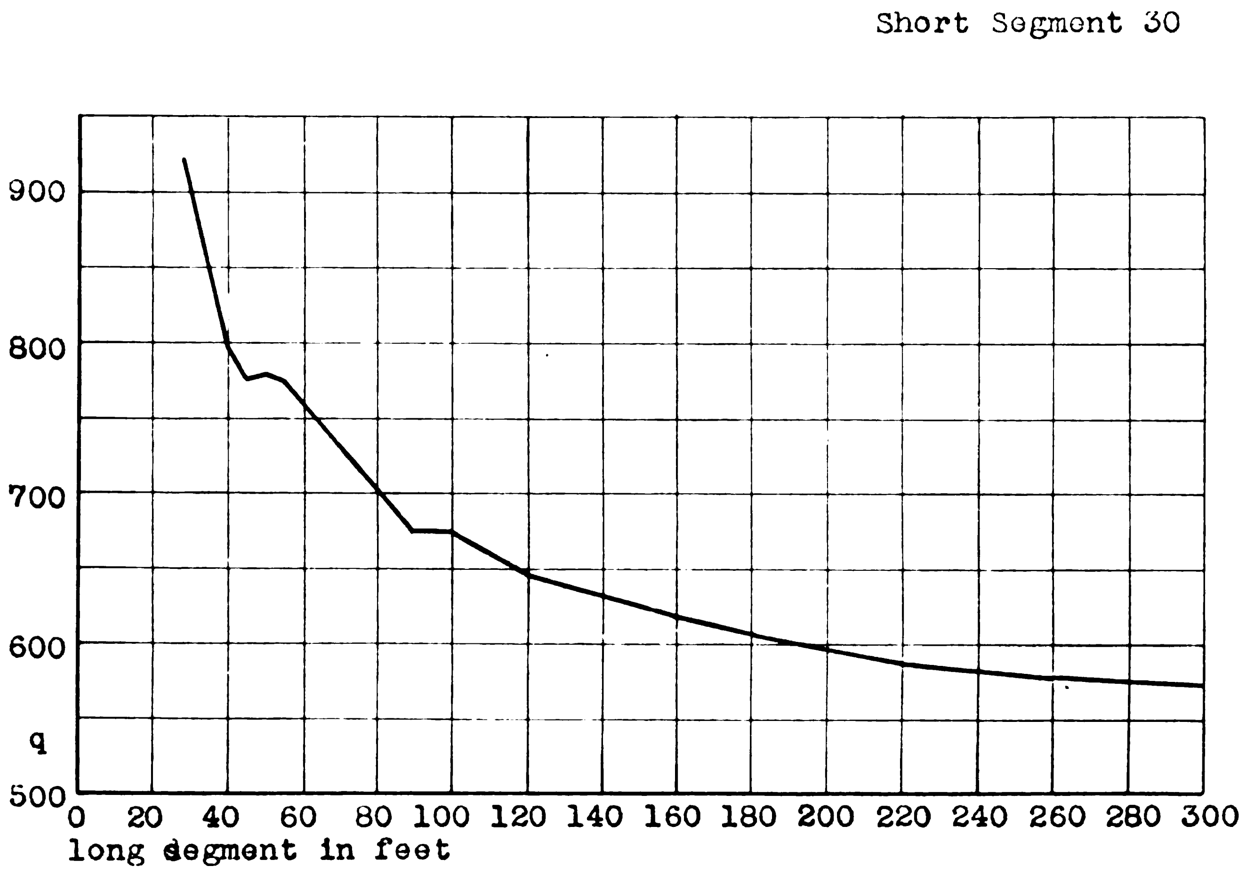
Short Segment 10

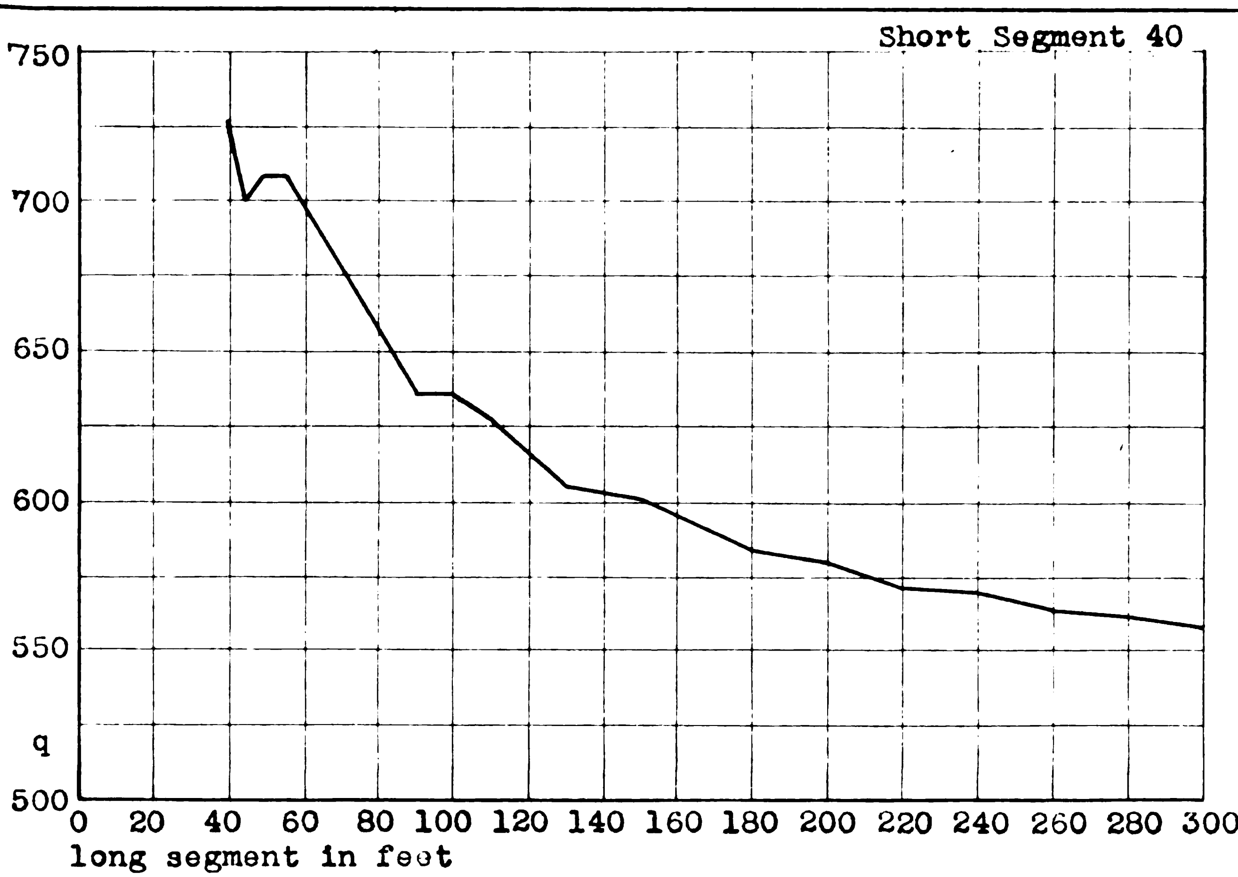
B. & B.

Short Segment 20



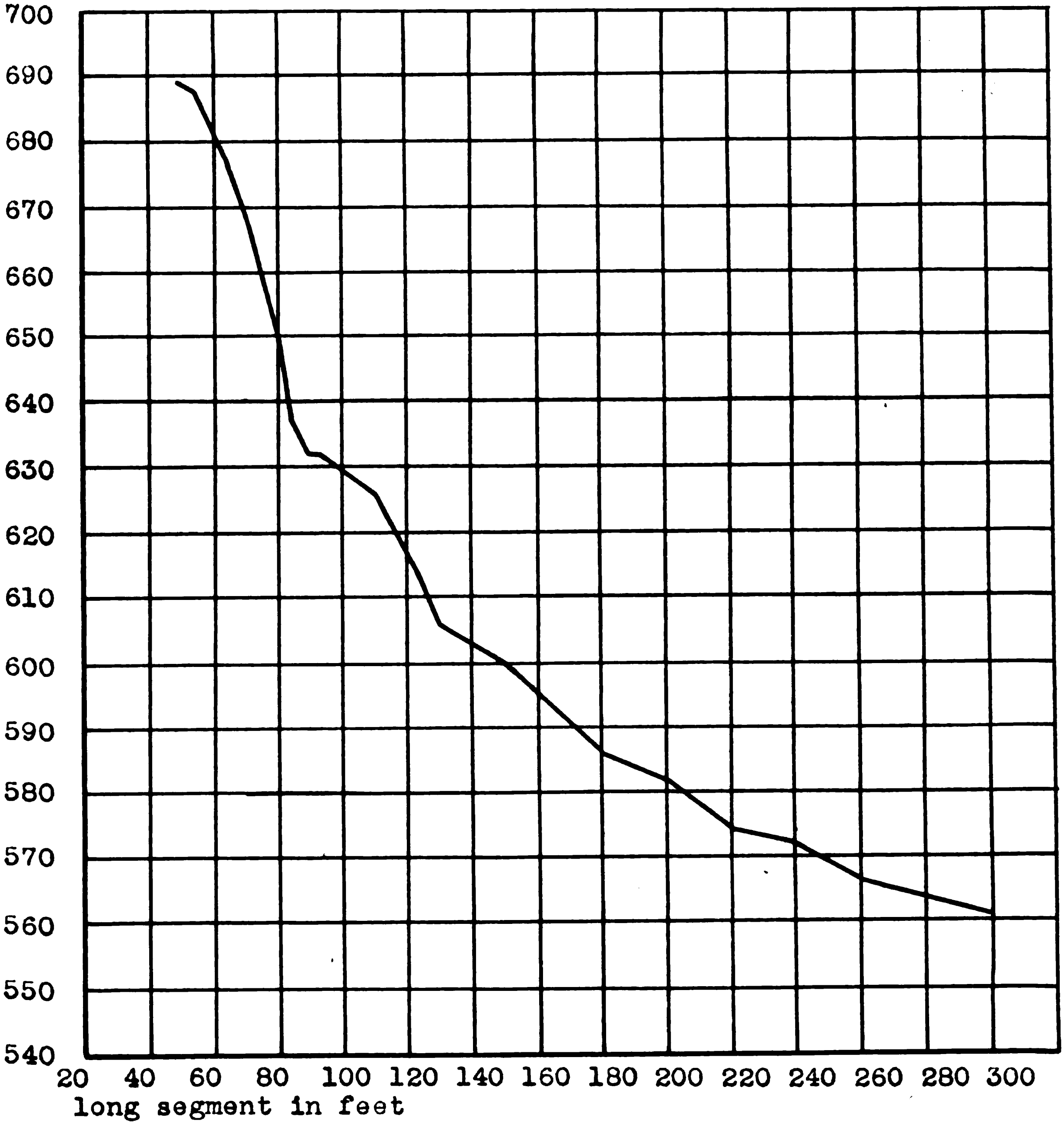
B.& B.


Short Segment 30
900
800
700
600
q
500
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
long segment in feet

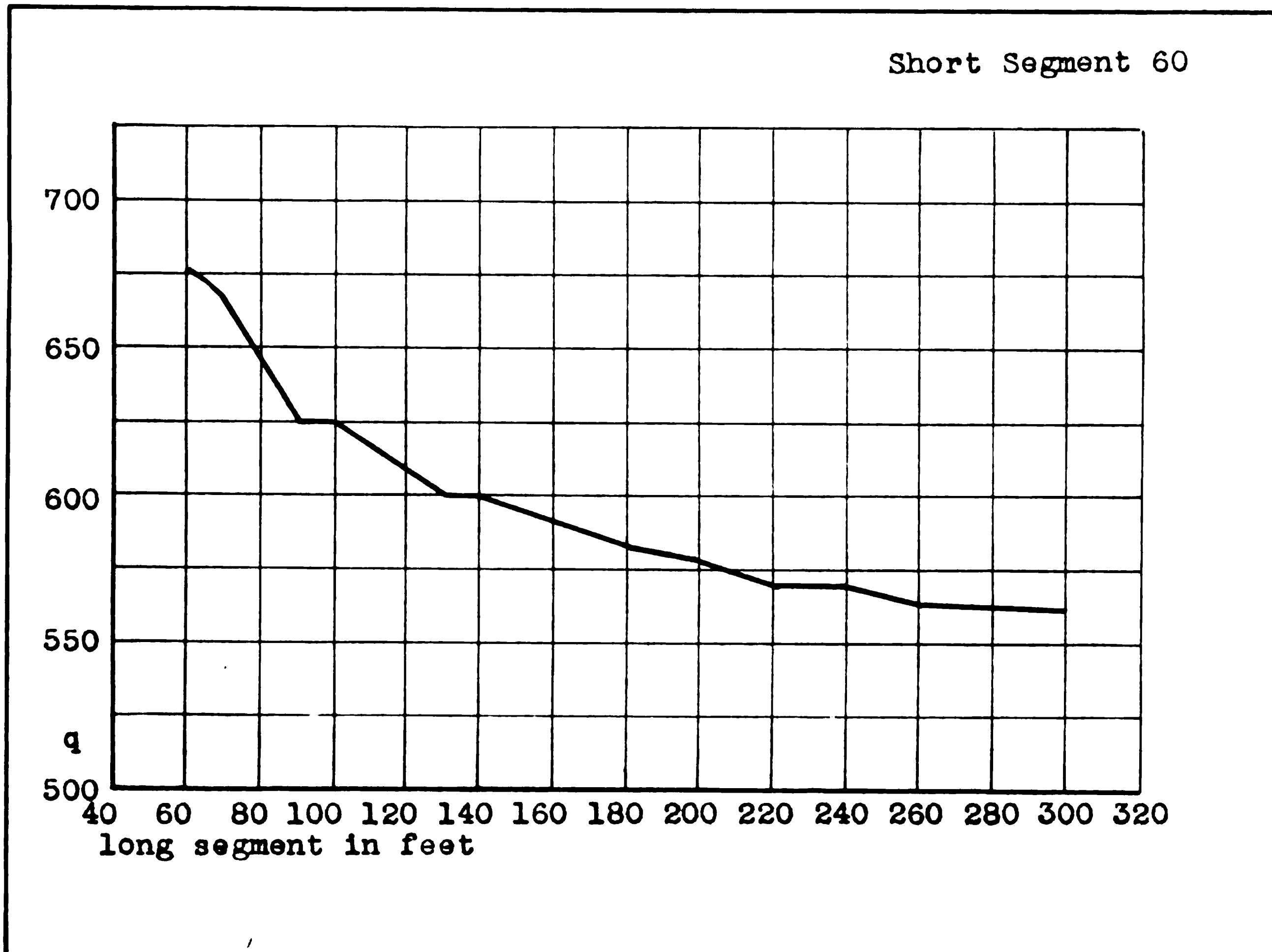

Short Segment 40
750
700
650
600
550
q
500
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
long segment in feet

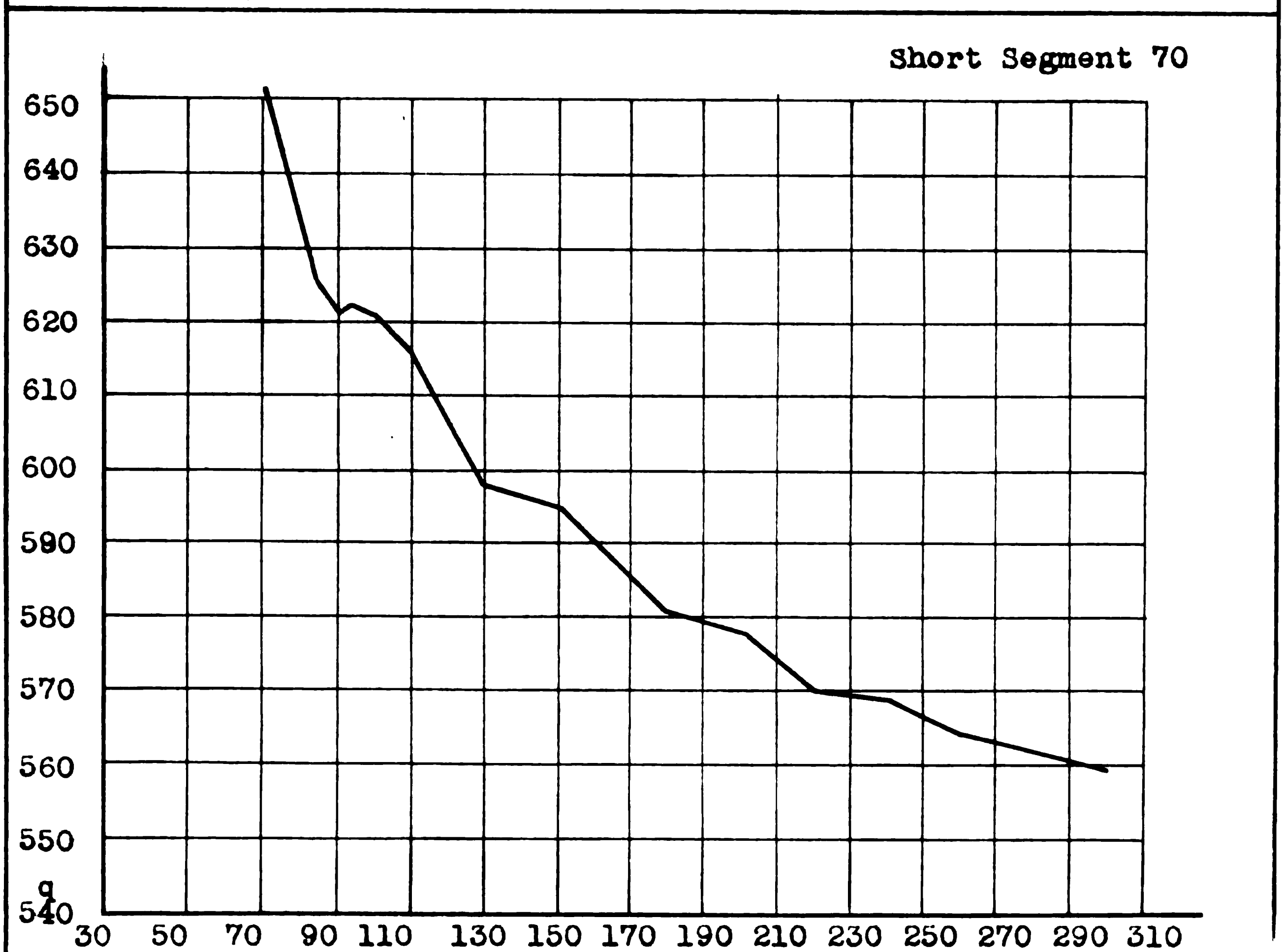
B. & B.

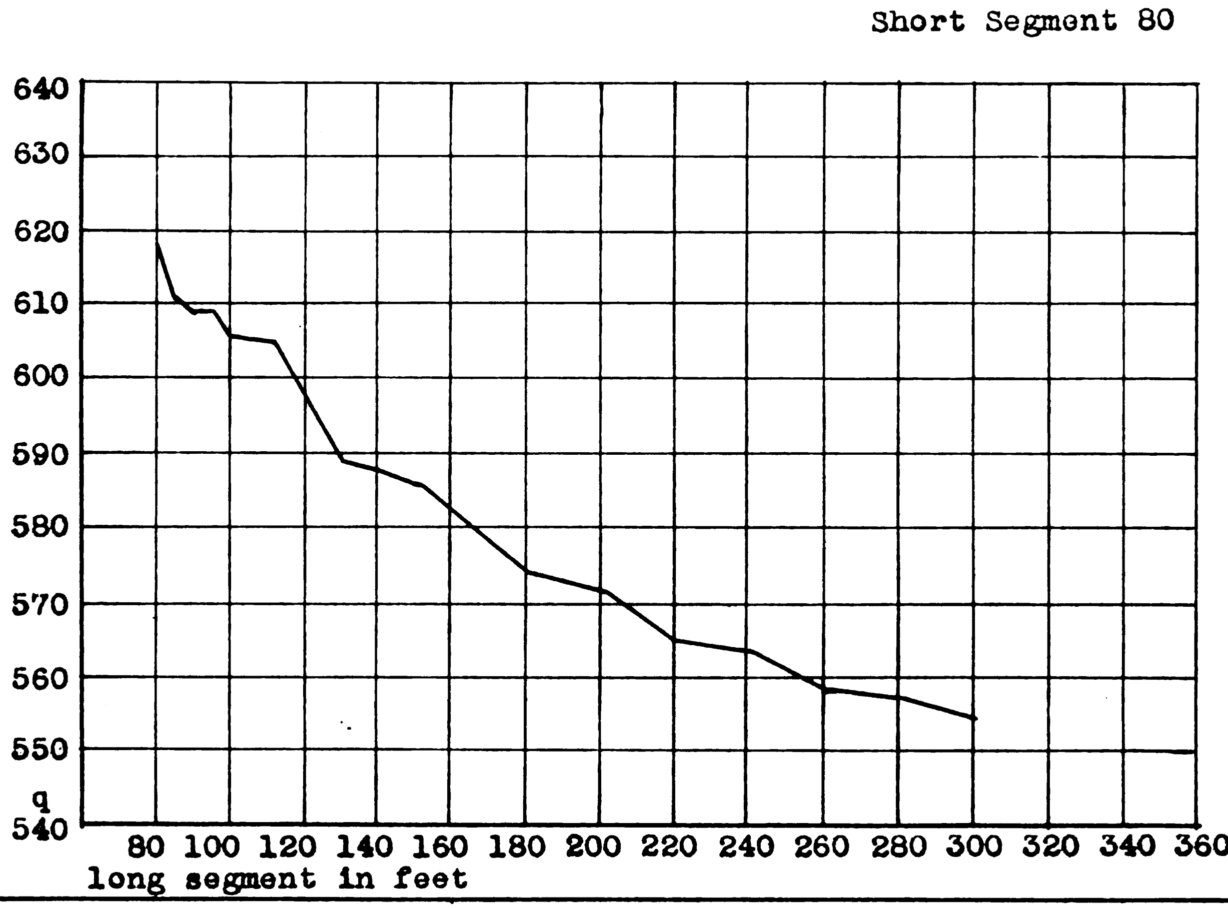
Short Segment 50

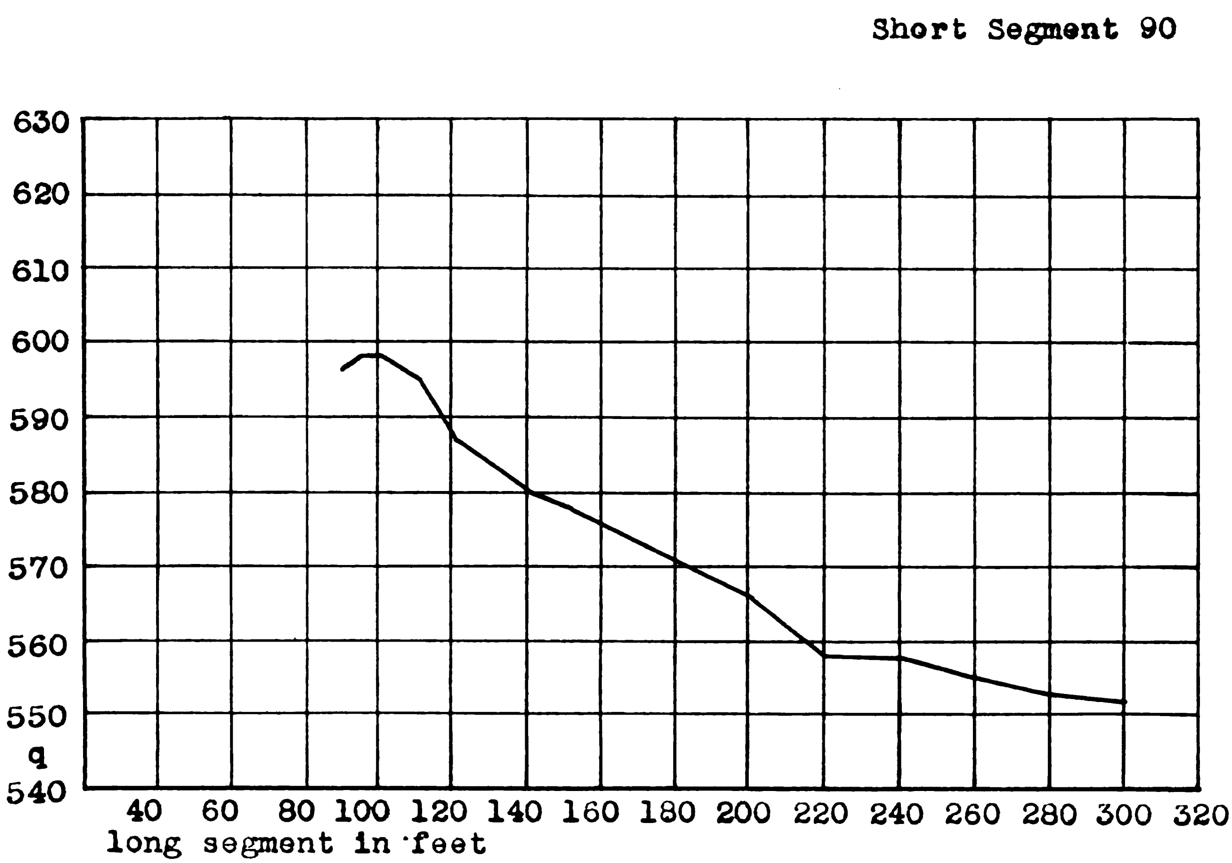


B. & B.


Short Segment 60
700
650
600
550
q
500
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320
long segment in feet

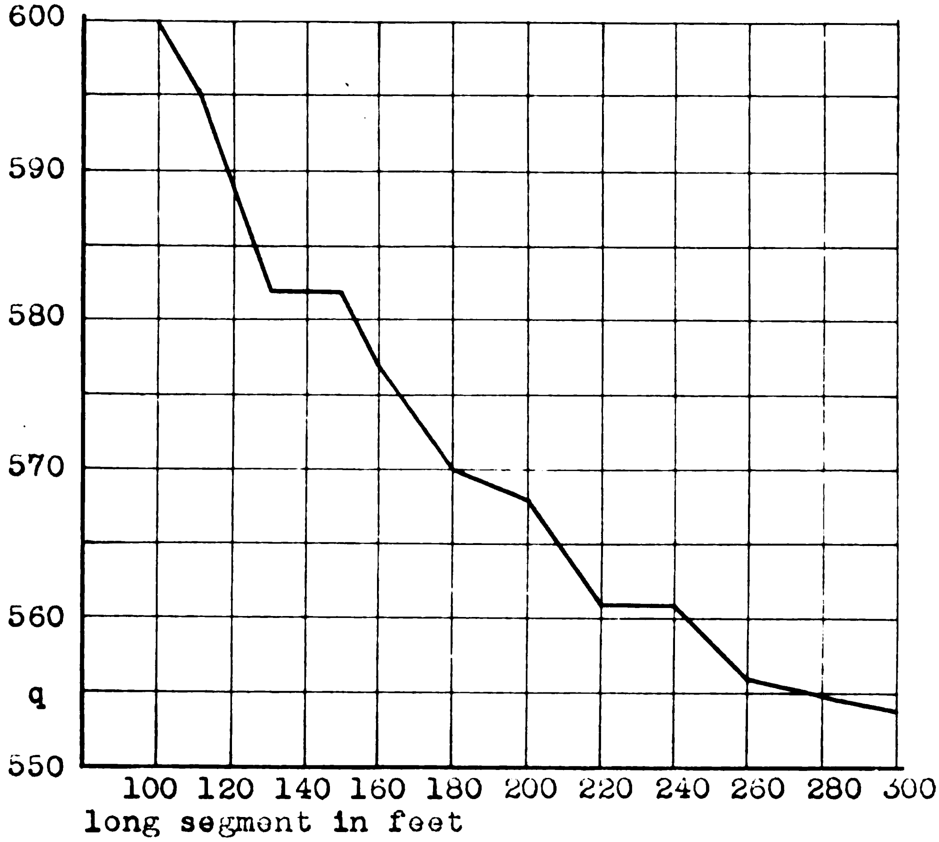

Short Segment 70
650
640
630
620
610
600
590
580
570
560
550
q
540
30 50 70 90 110 130 150 170 190 210 230 250 270 290 310


Short Segment 80
640
630
620
610
600
590
580
570
560
550
q
540
80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
long segment in feet

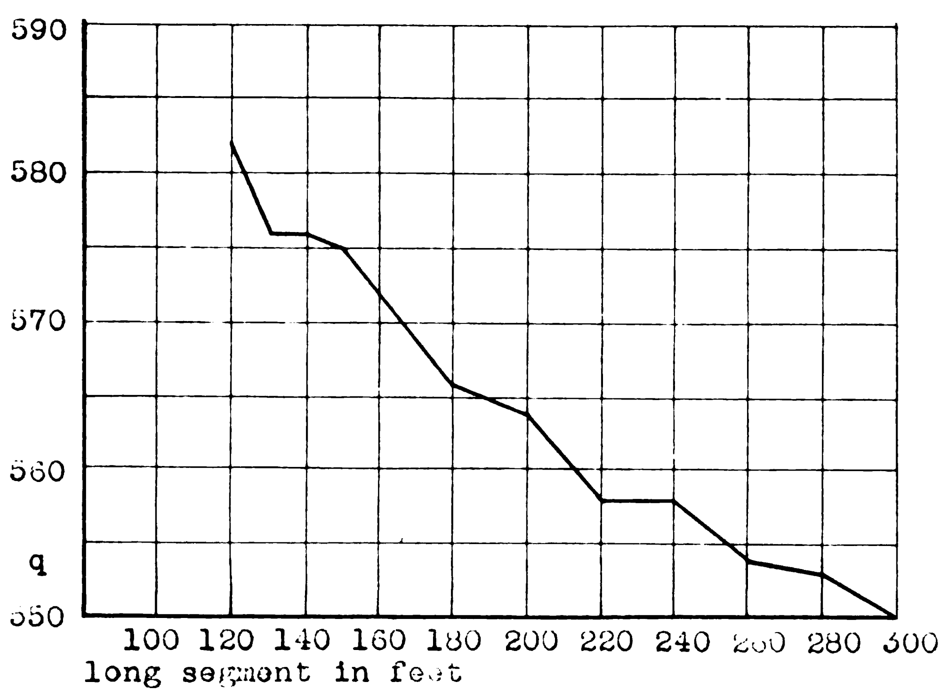

Short Segment 90
630
620
610
600
590
580
570
560
550
q
540
40 60 80 100 120 140 160 180 200 220 240 260 280 300 320
long segment in feet

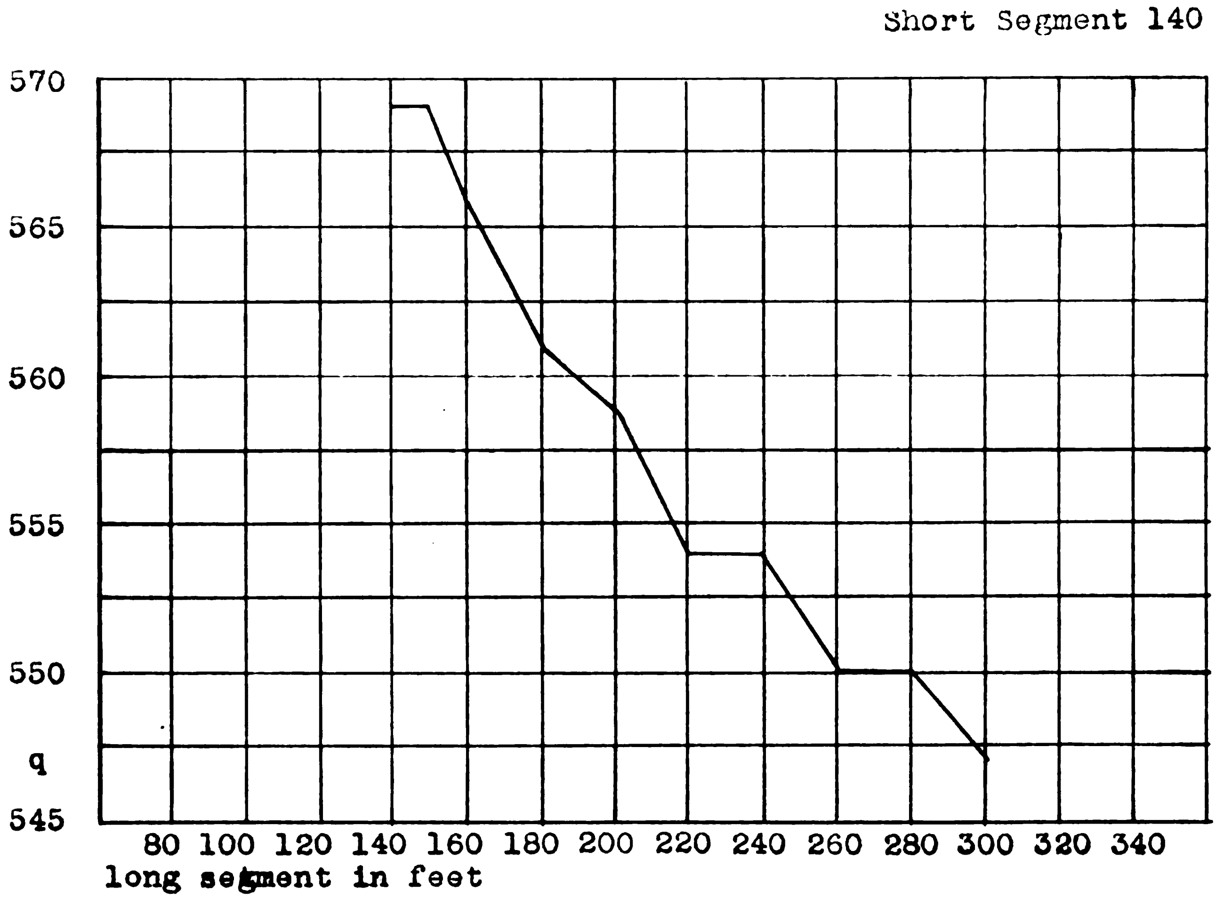
B.& B.

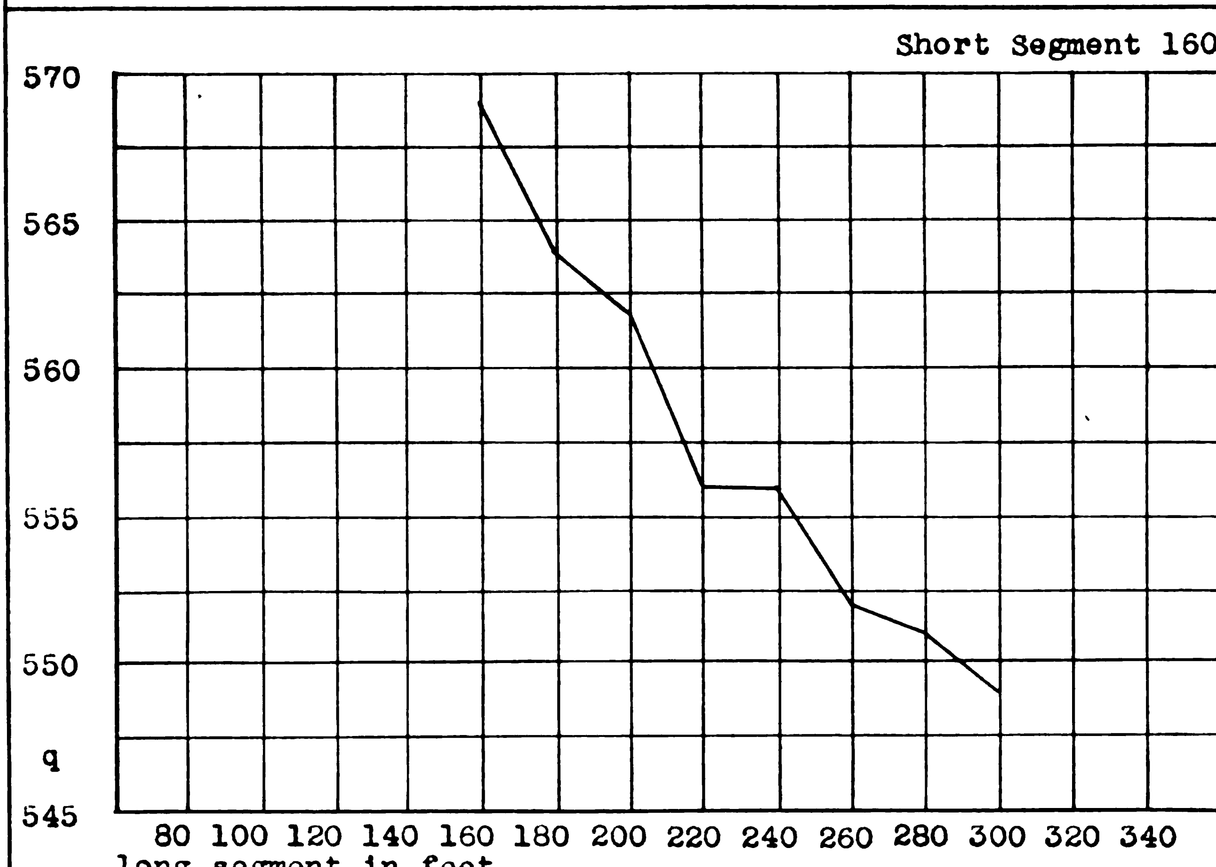
Short Segment 100



Short Segment 120

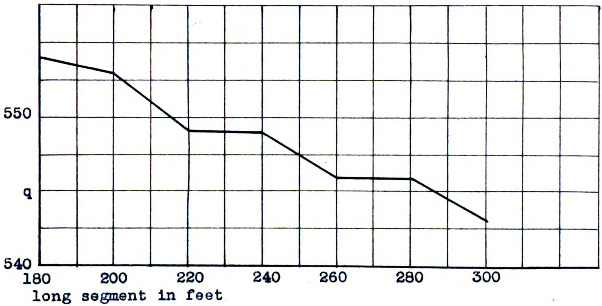



Short Segment 140
570
565
560
555
550
q
545
80 100 120 140 160 180 200 220 240 260 280 300 320 340
long segment in feet

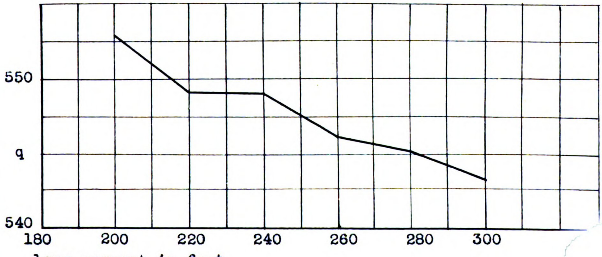

Short Segment 160
570
565
560
555
550
q
545
80 100 120 140 160 180 200 220 240 260 280 300 320 340
long segment in feet

B.& B.

Short Segment 180

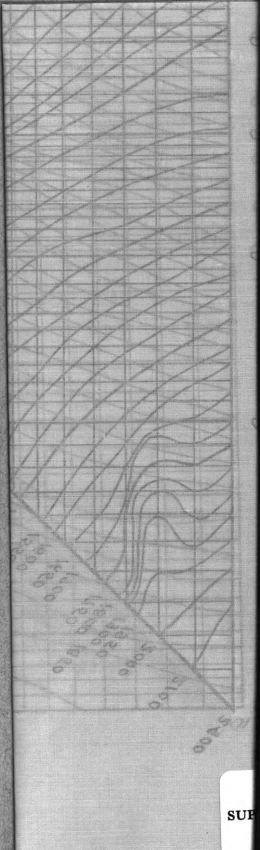


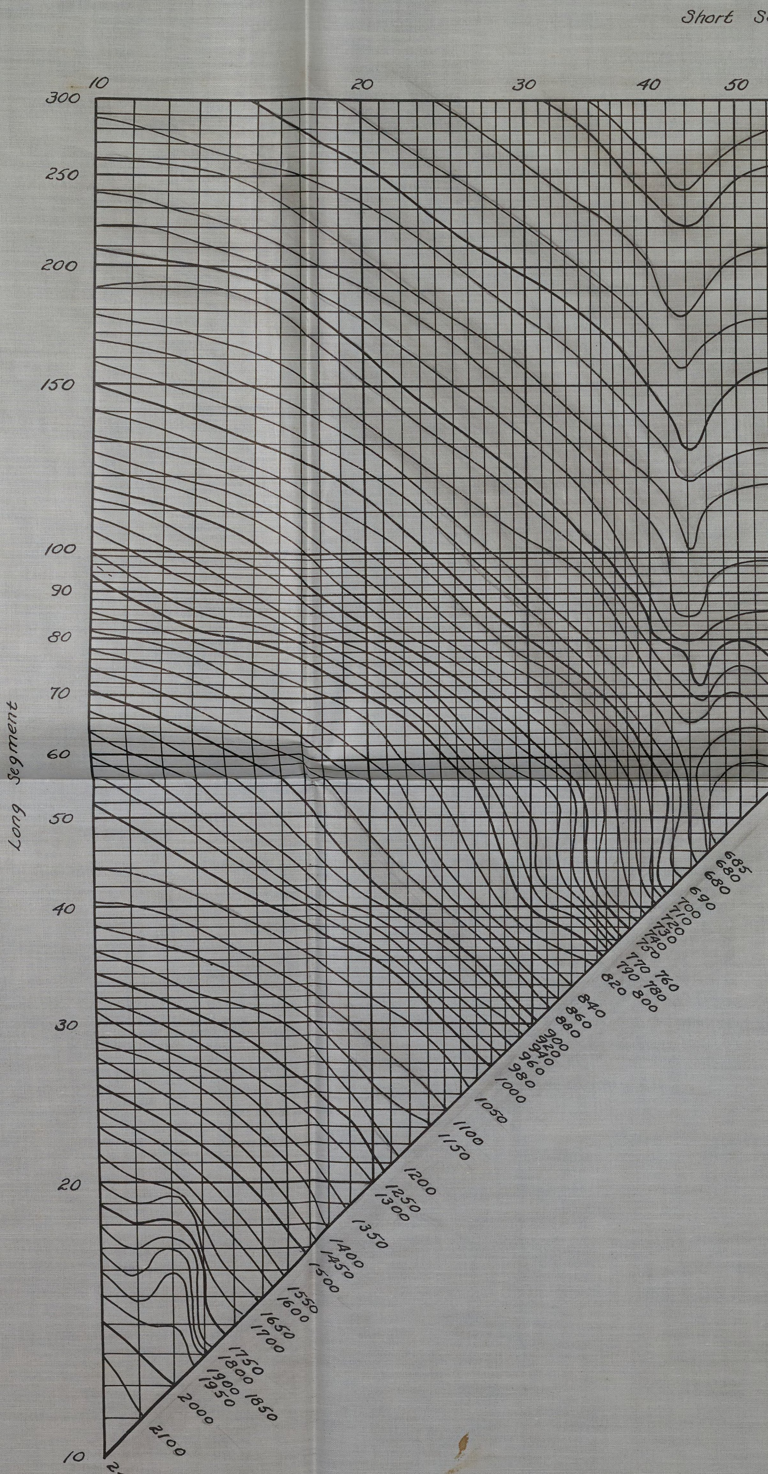
Short Segment 200



ROOM USE ONLY

Pocket has 1 Diagram

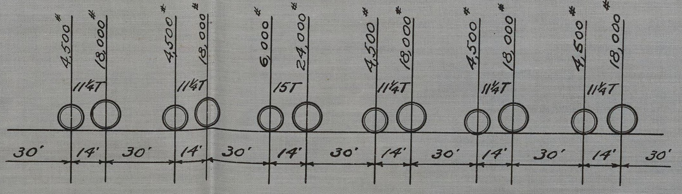




CURVES OF EQUIVALENT UNIFORM LOADS FOR MOMENTS FOR CLASS H-15 LOADING

Values are given in pounds per linear foot per lane.

Class H-15 Loading



Constructed by: M. Bogema & P. Bell.