



123
717
THS

C
EUGENE HOWARD ROOK

STUDY OF THE STRESSES OF A
MOVABLE DAM FOR THE NEW
LOCK IN THE SAULT STE MARIE
SHIP CANAL AT
SAULT STE MARIE, MICHIGAN

Thesis for the Degree of B. S.
MICHIGAN STATE COLLEGE

Eugene H. Rook
1942

Study of the Stresses of a Movable Dam
for the
New Lock in the Sault Ste Marie Ship Canal
at
Sault Ste Marie, Michigan

A Thesis Submitted to
The Faculty of
MICHIGAN STATE COLLEGE
of
AGRICULTURE AND APPLIED SCIENCE

by

Eugene H. Rook
Candidate for the Degree of
Bachelor of Science

1942

THESIS

1942

1942

Table of Contents

Definition	1
Conditions to be met	2
Diagrams of placement	4-5
Description of first dam analized	6-8
Forces caused by water	9
Stress in wickets	10-11
Description of second dam analized	11-12
Forces acting on sections of dam	13-15
Panel loads of trusses in sections	15-20
Calculations for length of diagonals	20-21
Algebraic analysis of trusses	22-29
Graphic analysis of trusses	30-45
Conclusion	46

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

THE HISTORY OF

THE

REIGN OF

CHARLES

THE FIRST

OF GREAT BRITAIN

AND

IRELAND

FROM THE YEAR 1625

TO THE YEAR 1649

BY

JOHN RUSSELL

OF THE MIDDLE TEMPLE

ESQ.

Study of the Stresses of a Movable Dam
for the
New Lock in the Sault Ste Marie Ship Canal
at
Sault Ste Marie, Michigan

Movable dams are structures that are built to partially or totally restrict the flow of water in a channel or canal for a period of time, usually short. They are entirely removable from the place of restriction of flow or are collapsible so that they are out of the way and permit the flow of water by or over them. Thus, they receive the name of a "movable" dam. It should be thoroughly understood that they are not permanent dams such as are made of concrete or masonry, but are either wood or steel structures that are used only in emergencies or temporarily for the purpose of making repairs, adjustments, or to regulate a water level.

There are many types of movable dams such as curtain dams, wicket dams, needle dams, shutter dams, rolling dams, drum dams, and so forth. However, most of these are useable only in shallow water, up to about 15 feet or in places where the water is restricted before its full head is attained. These types would not fit the conditions (which are stated on succeeding pages) under which the dam I am analyzing must operate. This dam must operate easily, quickly, and efficiently under a full head of about 35 feet, and at the beginning of placement most of this head will be converted into velocity. Therefore, the design must be more stable and stronger than the types listed above.

The data for ship canal at Sault Ste Marie, Michigan is listed

the first of these is the fact that the
the second is the fact that the
the third is the fact that the
the fourth is the fact that the
the fifth is the fact that the
the sixth is the fact that the
the seventh is the fact that the
the eighth is the fact that the
the ninth is the fact that the
the tenth is the fact that the
the eleventh is the fact that the
the twelfth is the fact that the
the thirteenth is the fact that the
the fourteenth is the fact that the
the fifteenth is the fact that the
the sixteenth is the fact that the
the seventeenth is the fact that the
the eighteenth is the fact that the
the nineteenth is the fact that the
the twentieth is the fact that the
the twenty-first is the fact that the
the twenty-second is the fact that the
the twenty-third is the fact that the
the twenty-fourth is the fact that the
the twenty-fifth is the fact that the
the twenty-sixth is the fact that the
the twenty-seventh is the fact that the
the twenty-eighth is the fact that the
the twenty-ninth is the fact that the
the thirtieth is the fact that the
the thirty-first is the fact that the
the thirty-second is the fact that the
the thirty-third is the fact that the
the thirty-fourth is the fact that the
the thirty-fifth is the fact that the
the thirty-sixth is the fact that the
the thirty-seventh is the fact that the
the thirty-eighth is the fact that the
the thirty-ninth is the fact that the
the fortieth is the fact that the
the forty-first is the fact that the
the forty-second is the fact that the
the forty-third is the fact that the
the forty-fourth is the fact that the
the forty-fifth is the fact that the
the forty-sixth is the fact that the
the forty-seventh is the fact that the
the forty-eighth is the fact that the
the forty-ninth is the fact that the
the fiftieth is the fact that the
the fifty-first is the fact that the
the fifty-second is the fact that the
the fifty-third is the fact that the
the fifty-fourth is the fact that the
the fifty-fifth is the fact that the
the fifty-sixth is the fact that the
the fifty-seventh is the fact that the
the fifty-eighth is the fact that the
the fifty-ninth is the fact that the
the sixtieth is the fact that the
the sixty-first is the fact that the
the sixty-second is the fact that the
the sixty-third is the fact that the
the sixty-fourth is the fact that the
the sixty-fifth is the fact that the
the sixty-sixth is the fact that the
the sixty-seventh is the fact that the
the sixty-eighth is the fact that the
the sixty-ninth is the fact that the
the seventieth is the fact that the
the seventy-first is the fact that the
the seventy-second is the fact that the
the seventy-third is the fact that the
the seventy-fourth is the fact that the
the seventy-fifth is the fact that the
the seventy-sixth is the fact that the
the seventy-seventh is the fact that the
the seventy-eighth is the fact that the
the seventy-ninth is the fact that the
the eightieth is the fact that the
the eighty-first is the fact that the
the eighty-second is the fact that the
the eighty-third is the fact that the
the eighty-fourth is the fact that the
the eighty-fifth is the fact that the
the eighty-sixth is the fact that the
the eighty-seventh is the fact that the
the eighty-eighth is the fact that the
the eighty-ninth is the fact that the
the ninetieth is the fact that the
the ninety-first is the fact that the
the ninety-second is the fact that the
the ninety-third is the fact that the
the ninety-fourth is the fact that the
the ninety-fifth is the fact that the
the ninety-sixth is the fact that the
the ninety-seventh is the fact that the
the ninety-eighth is the fact that the
the ninety-ninth is the fact that the
the hundredth is the fact that the

below. This data was secured with the kind help of Mr. H. F. Rook*.

Upper pool

Low Water Datum --- 601.1 ft.

High Water Monthly Mean --- 603.64 ft.

Maximum hourly change --- $\pm$ 4.0 ft.

Lower pool

Low Water Datum --- 579.4 ft.

High Water Monthly Mean --- 583.63 ft.

High water hourly extreme --- 585.22 ft.

Lowest extreme --- 3 ft. below Low Water Datum

All of these elevations are based on the Low Water Datum at New York.

Elevation of canal Wall --- 121.00 ft.

This elevation is based on the Sault Ste Marie Canal Datum.

The relation between the two is:

Low Water Datum = 603.64 ft. at the Sault Ste Marie Canal Datum =
117.37 ft.

Depth of lock sill below Low Water Datum = 31 ft. or elev. = 570.1 ft.

Width of canal directly above upper lock gate = 80 ft. This is clear distance between bumpers which project one foot each from the sides of the canal wall.

Length of lock between inner service gates = 800 ft.

The data as it was obtained is of no use; so to put it into usable form, the elevations must be converted into differences of elevations or heights. The average difference of elevation of the upper pool and lower

* Mr. Rook was, at the time the information was obtained, Principle Engineer for the U. S. Engineer Office, and is now a Lt. Colonel in the U. S. Army Engineer Corp.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and activities. It emphasizes that proper record-keeping is essential for transparency and accountability, particularly in financial matters. The text suggests that organizations should implement robust systems to track every aspect of their operations, from procurement to sales, to ensure that all data is reliable and accessible.

2. The second section focuses on the role of technology in modern business operations. It highlights how digital tools and software can streamline processes, reduce errors, and improve overall efficiency. The author argues that embracing technology is not just a competitive advantage but a necessity for staying relevant in today's fast-paced market. Examples of various software solutions and their benefits are provided to illustrate this point.

3. The third part of the document addresses the challenges of managing a diverse workforce. It discusses the importance of effective communication and collaboration across different departments and cultures. The text offers practical advice on how to foster a positive work environment, encourage innovation, and resolve conflicts. It also touches upon the need for continuous training and development to keep the workforce up-to-date with the latest industry trends.

4. The fourth section explores the impact of external factors on business performance. It examines how economic conditions, market fluctuations, and regulatory changes can affect an organization's bottom line. The author provides strategies for risk management and contingency planning to help businesses navigate these uncertainties. It also discusses the importance of staying informed about industry news and trends to anticipate potential challenges and opportunities.

5. The final part of the document concludes with a summary of the key points discussed. It reiterates the importance of maintaining accurate records, leveraging technology, managing a diverse workforce, and staying adaptable to external changes. The author encourages organizations to adopt a proactive approach to business management, focusing on long-term growth and sustainability. The document ends with a call to action, urging readers to implement the strategies discussed and to seek professional advice when needed.

pool is 601.1 ft. less 579.4 ft. gives 21.7 feet. This is not the extreme difference; so the difference for the maximum hourly extremes of both pools will be used. This difference is found by adding both the maximum hourly change of the upper pool from the Low Water Datum and the extreme low water level from the Low Water Datum of the lower pool; thus giving $21.7 + 4.0 + 3.0$ or 28.7 feet difference. This extreme is not likely to occur as the lower pool is usually at its highest level when the upper pool is at its highest level. The reason for this is that there is a power and water level control dam above the rapids connecting the two pools other than the locks. However, the extreme conditions are possible, so they will be used in the computations.

The bruss supporting the wickets must be placed on the canal wall, so the elevation of that should be obtained. The elevation is known, but it is given on a different datum plane; so it must be converted to the Low Water Datum Plane of N. Y. The relation between the two as officially recorded is:

Low Water Datum = 603.64 at Canal Datum = 117.37.

The elevation of the canal wall = 121.00 ft. The difference between the canal wall and the reference point is $121.00 - 117.37$ or 3.63 feet. Therefore the elevation of the canal wall with reference to the Low Water Datum is $603.64 + 3.63$ or 607.27, and the difference between this and the extreme high water in the upper pool is $607.27 - (601.1 + 4.0)$ or 2.17 ft.

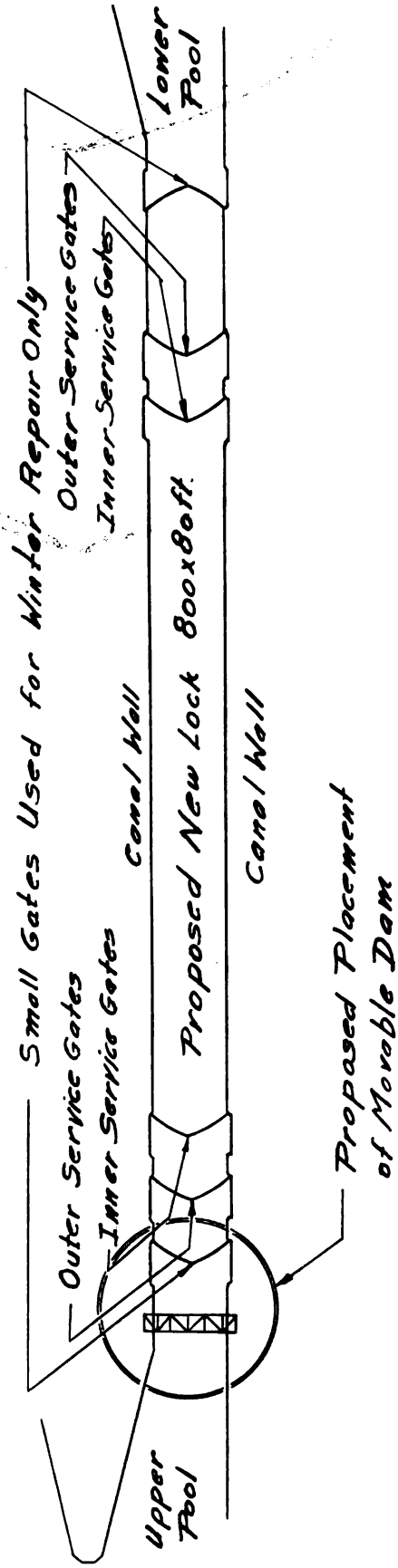
This I believe is all the conversion that needs an explanation, as the rest can readily be seen from a vertical section through the lock. However, before the vertical section is shown, a general plan of the lock will be shown with the position of the dam indicated. This will give a better understanding of what the conditions are.

the first of these is the fact that the system is not a simple one, but a complex one, involving many different factors and many different people. The second is that the system is not a static one, but a dynamic one, which is constantly changing and evolving. The third is that the system is not a closed one, but an open one, which is constantly interacting with the outside world. The fourth is that the system is not a linear one, but a non-linear one, which is characterized by feedback loops and other non-linear relationships. The fifth is that the system is not a deterministic one, but a probabilistic one, which is characterized by uncertainty and risk. The sixth is that the system is not a single one, but a multiple one, which is characterized by many different perspectives and many different interests. The seventh is that the system is not a simple one, but a complex one, which is characterized by many different factors and many different people. The eighth is that the system is not a static one, but a dynamic one, which is constantly changing and evolving. The ninth is that the system is not a closed one, but an open one, which is constantly interacting with the outside world. The tenth is that the system is not a linear one, but a non-linear one, which is characterized by feedback loops and other non-linear relationships. The eleventh is that the system is not a deterministic one, but a probabilistic one, which is characterized by uncertainty and risk. The twelfth is that the system is not a single one, but a multiple one, which is characterized by many different perspectives and many different interests.

The first of these is the fact that the system is not a simple one, but a complex one, involving many different factors and many different people. The second is that the system is not a static one, but a dynamic one, which is constantly changing and evolving. The third is that the system is not a closed one, but an open one, which is constantly interacting with the outside world. The fourth is that the system is not a linear one, but a non-linear one, which is characterized by feedback loops and other non-linear relationships. The fifth is that the system is not a deterministic one, but a probabilistic one, which is characterized by uncertainty and risk. The sixth is that the system is not a single one, but a multiple one, which is characterized by many different perspectives and many different interests. The seventh is that the system is not a simple one, but a complex one, which is characterized by many different factors and many different people. The eighth is that the system is not a static one, but a dynamic one, which is constantly changing and evolving. The ninth is that the system is not a closed one, but an open one, which is constantly interacting with the outside world. The tenth is that the system is not a linear one, but a non-linear one, which is characterized by feedback loops and other non-linear relationships. The eleventh is that the system is not a deterministic one, but a probabilistic one, which is characterized by uncertainty and risk. The twelfth is that the system is not a single one, but a multiple one, which is characterized by many different perspectives and many different interests.

General Plan of New Lock

4



of Middle Dam
 Increased Discharge

New Lane

Lower
 Level

Upper Level
 New Lane

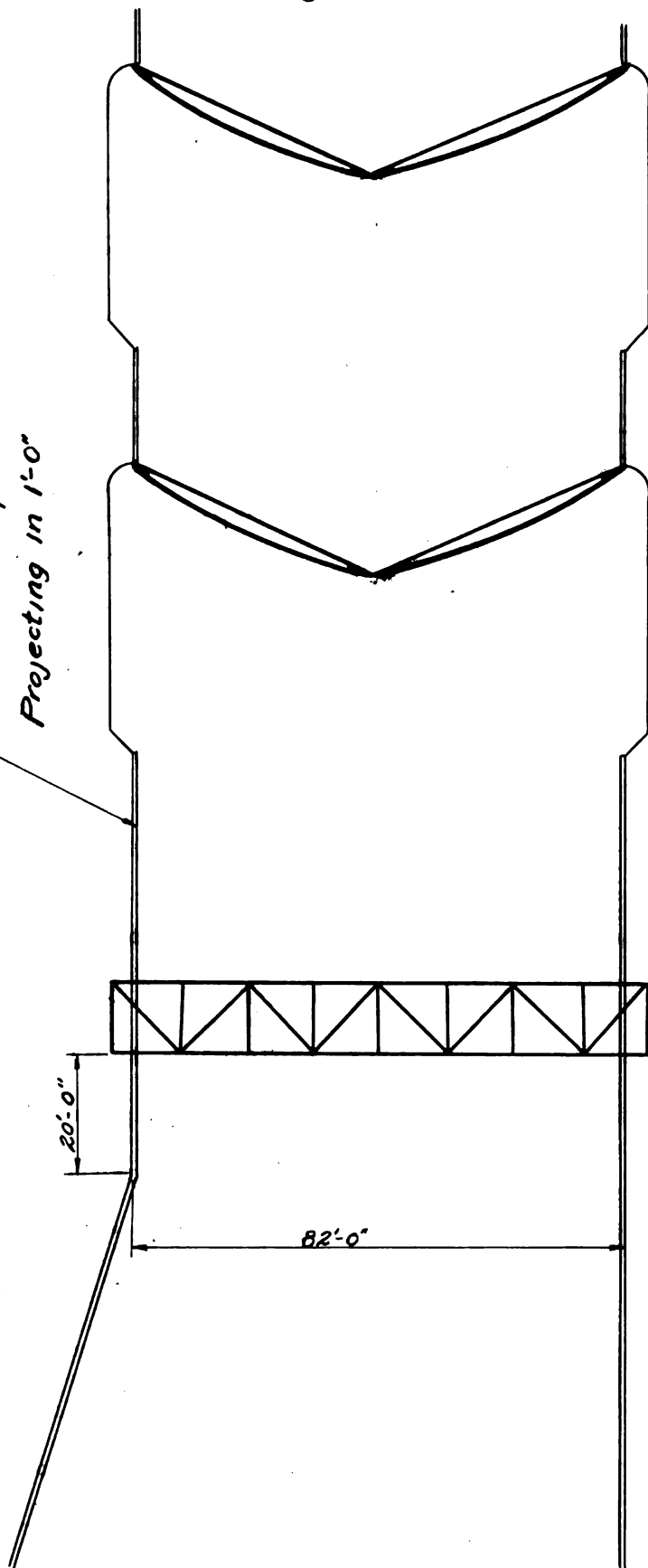
Lower Level

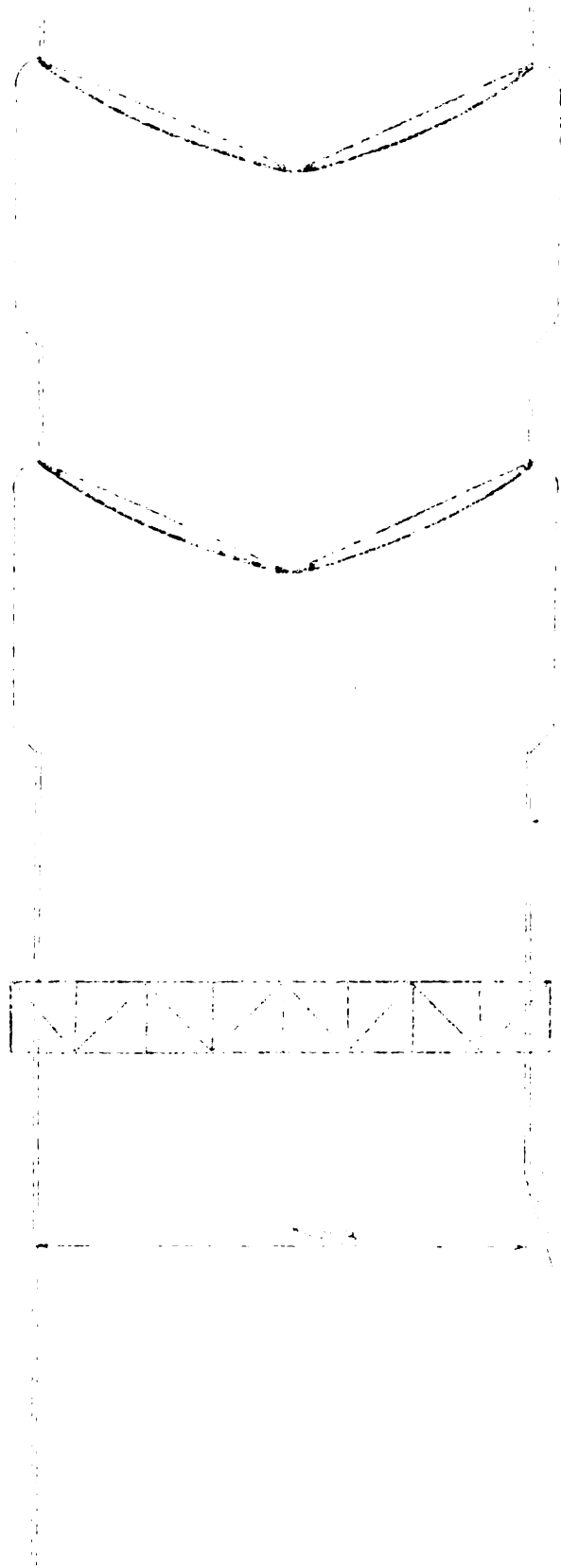
Upper Level
 New Lane

Upper Level
 New Lane

General View of New Lane

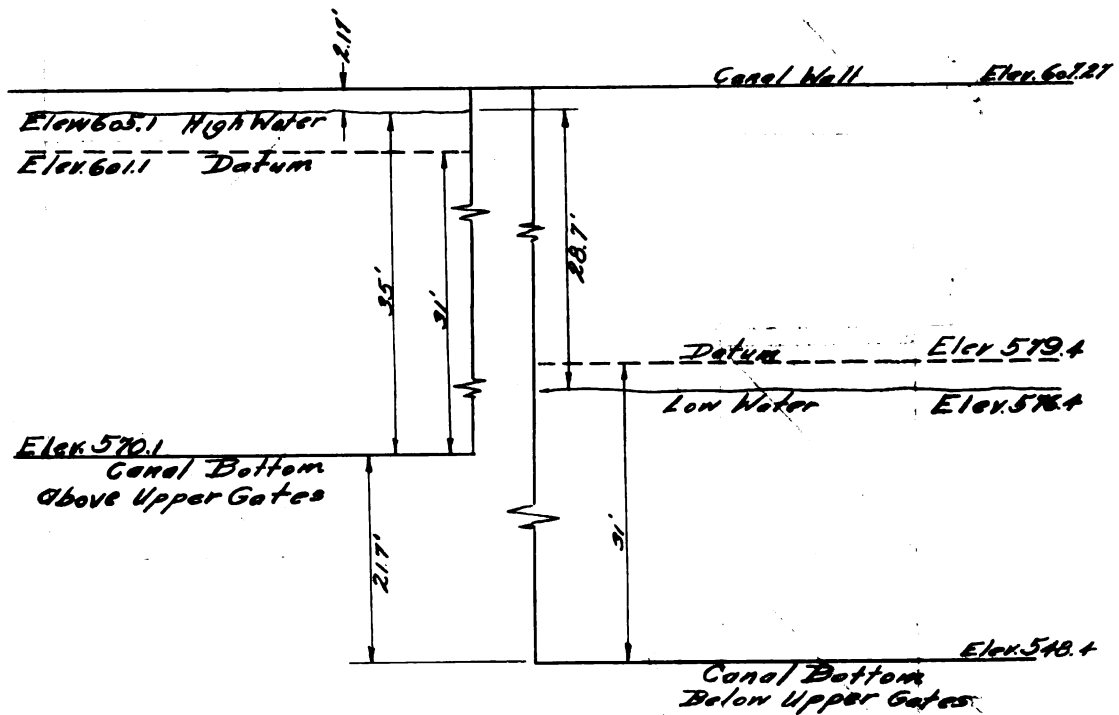
*Timber Bumper
Projecting in 1'-0"*





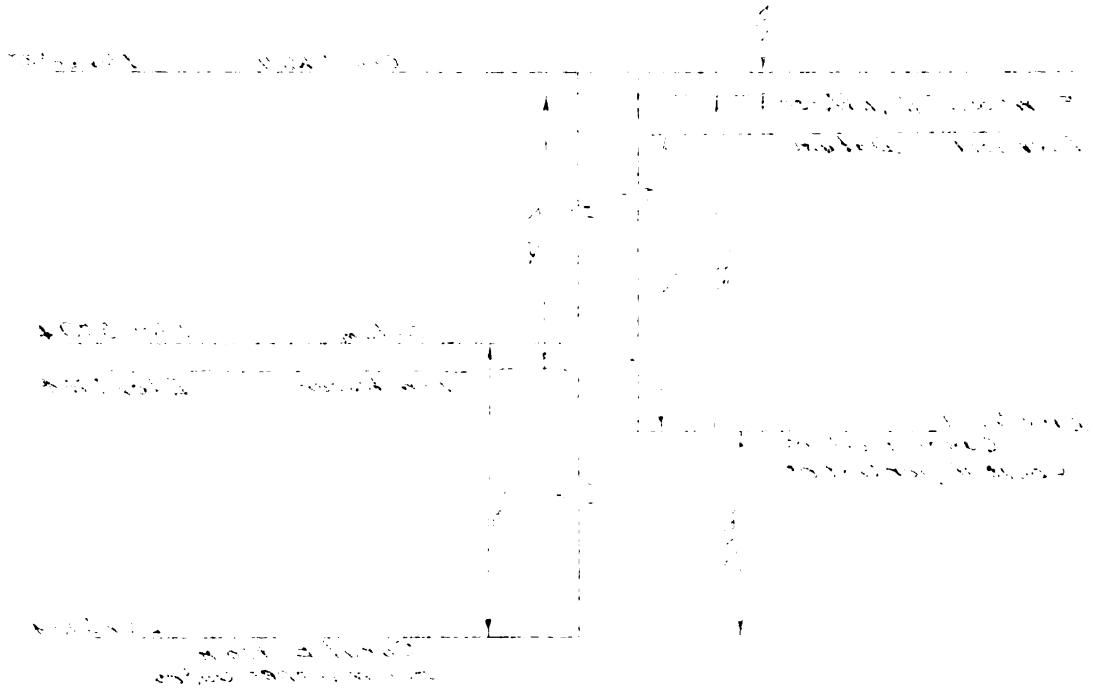
Top View
Front View

10 units



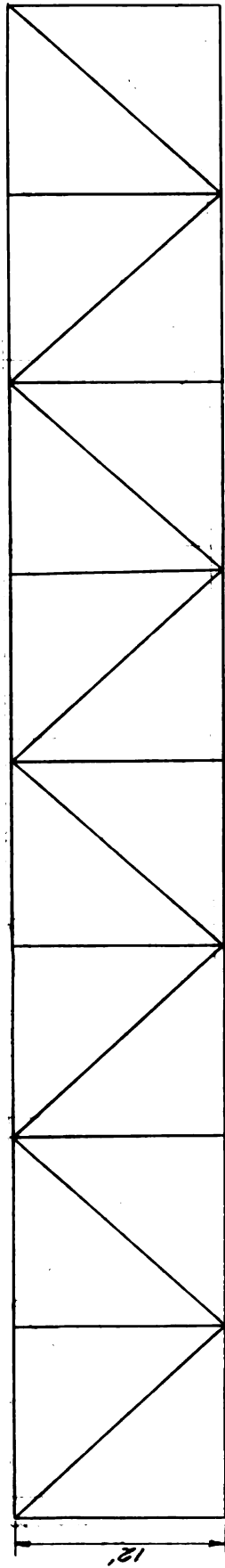
This gives the conditions that the dam must conform with or overcome. These conditions are much more severe than those for most of the movable dams designed. Therefore, this dam must be much stronger than most dams of this type. To overcome these severe conditions I have chosen the type of dam shown on the following two pages for my first trial.

The dam consists of two horizontal trusses held together with two vertical trusses. Inside of the box formed by the trusses is placed X bracing at the panel points. Then upon the upstream side of this box is hung sheet piling. This piling cantilevers down into the water to the bottom of the canal. The dam is constructed so that the truss box can be put in place first, and then the piling put in piece by piece until the whole canal is shut off.



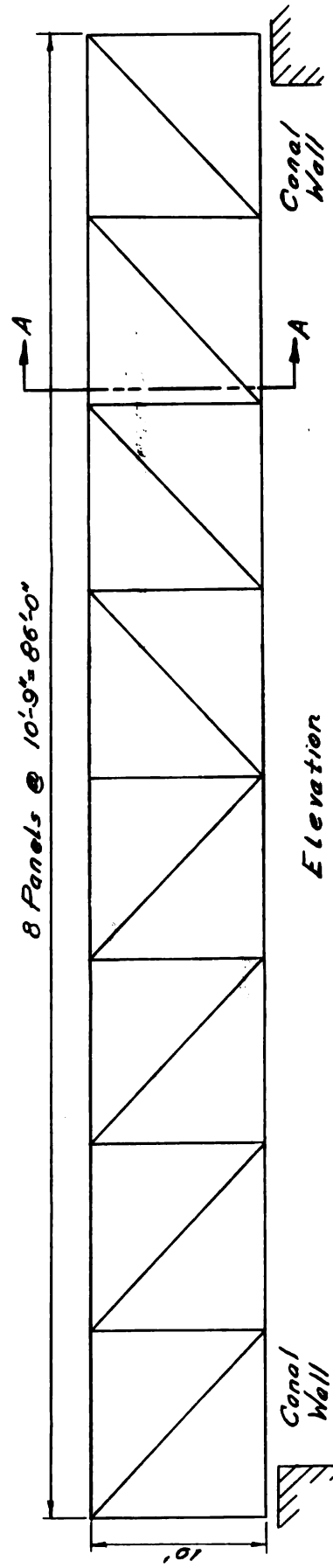
The drawing is a technical sketch of a rectangular structure, possibly a cross-section of a building or a container. It features a central rectangular area with internal lines and labels. The labels 'A', 'B', 'C', and 'D' are positioned along the top and bottom edges, while 'E' and 'F' are on the left and 'G' and 'H' are on the right. The drawing is oriented horizontally. The lines are drawn with a light pencil, and the labels are handwritten in a simple, clear font. The overall impression is that of a preliminary sketch or a conceptual drawing.

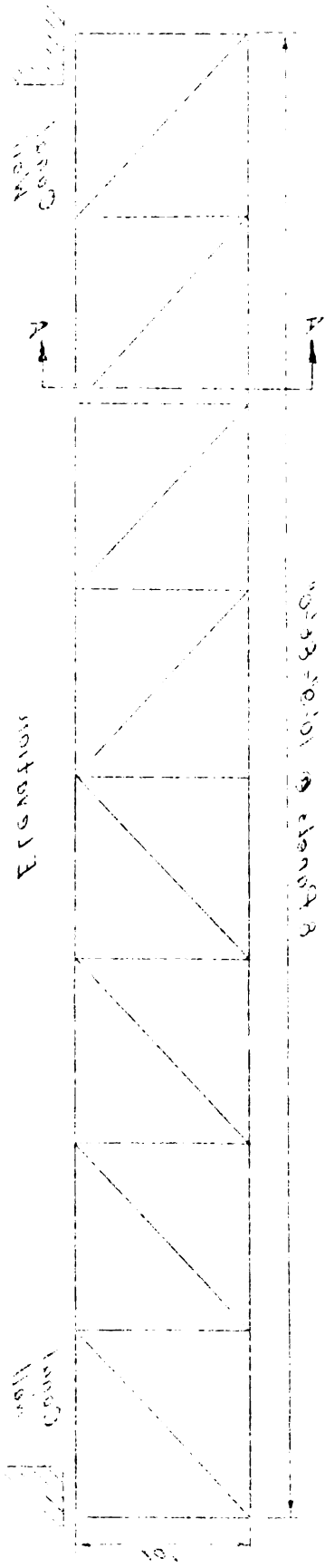
Downstream Side



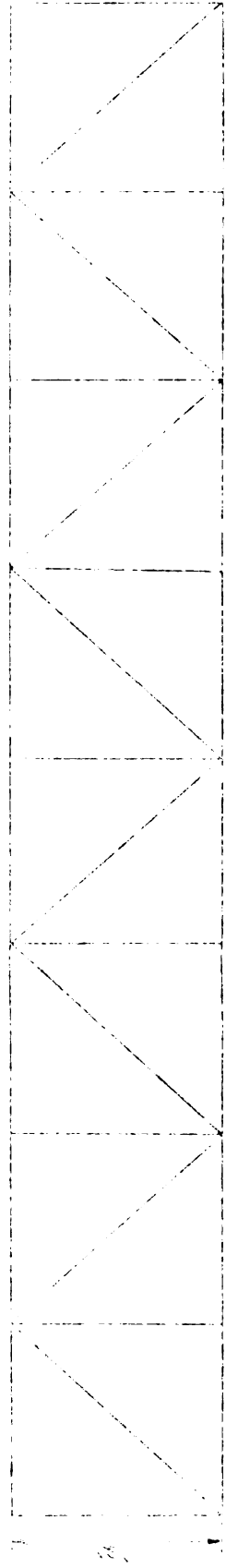
Top Truss

-7-



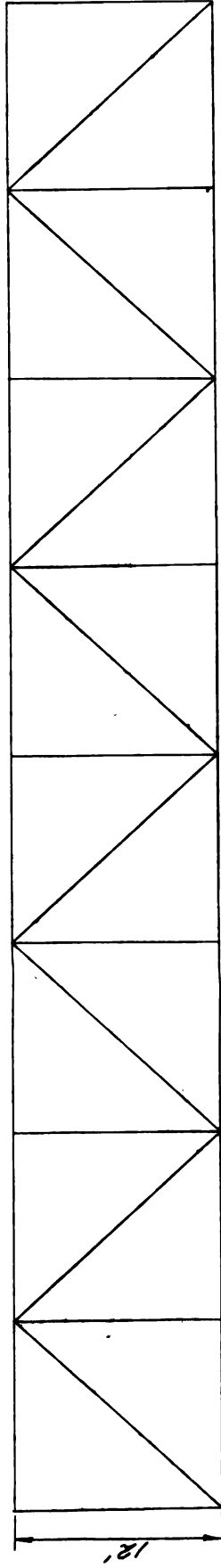


Deck section



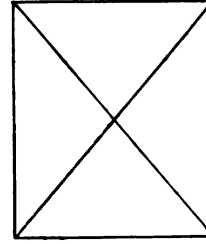
Deck section

Upstream Side



Bottom Truss

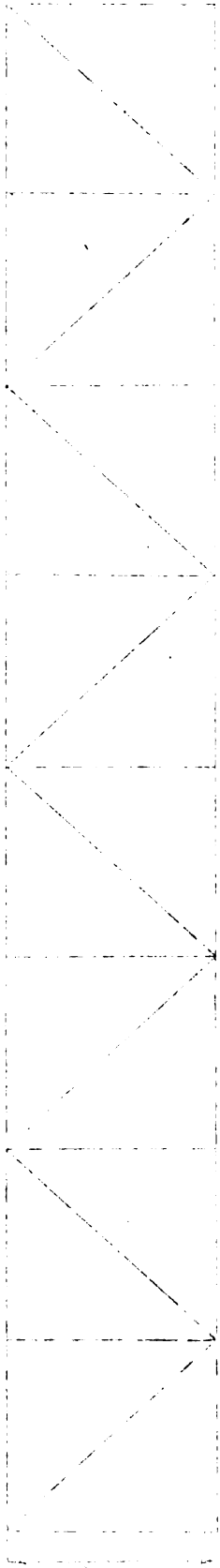
*This is the
side upon
which the
wickets are
placed or
rested*



Downstream Side

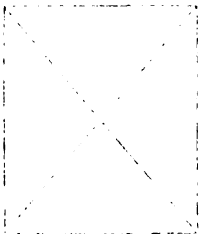
*Internal Bracing
Section A-A*

309406



2024-10-01

1901



021021

11/24/20

○
二
三

مہاراجہ صاحب

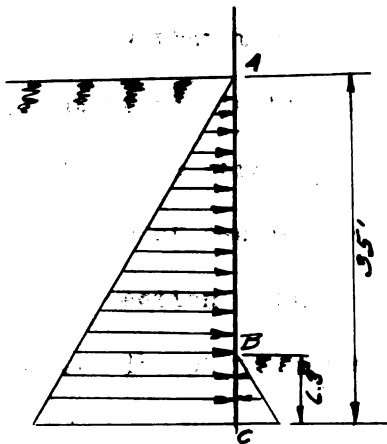
...
...
...
...
...

مکتبہ اسلامیہ

Infantry General

ア
ア
コ
ウ
ウ
ウ
ウ

The first thing to analyze is the wickets. However, before the stresses can be found, the pressure exerted by the water must be obtained. The forces of the water acting on the wickets is shown in the diagram below.



$P_{ac} = \text{height} \times \text{width} \times \text{average water pressure}$

$$P_{ac} = 35 \times 1 \times \left(\frac{62.4 \times 35}{2} \right)$$

$$P_{ac} = 38,220 \text{ \# / lin. ft.}$$

This force acts at $\frac{35}{3}$ or $11 \frac{2}{3}$ ft. from the bottom.

$$P_{bc} = 6.3 \times \left(\frac{62.4 \times 6.3}{2} \right) = 1,238 \text{ \# / lin. ft.}$$

This force acts at $\frac{6.3}{3}$ or 2.1 ft. from the bottom.

The resultant of these two forces is the difference of the two or $38,220 - 1,238$ and is equal to $36,982 \text{ \# / lin. ft.}$ The point of application of the resultant is found by Varignon's Theory which states that the moment of the resultant of two forces is equal to the sum of the moments of the two separate components. Therefore:

$$36,982 X = 38,220 \times 11.67 - 1,238 \times 2.1$$

$$X = 11.987 \text{ ft. approximately from the bottom.}$$

The point of application of the resultant from the top of the water surface equals $35 - 11.987$ or 23.013 ft.

The forces acting on the wickets could possibly be worked out by the use of velocities. However, there has as yet been no failure of the gates on any of the American locks at Sault Ste Marie, so the velocities have

The first part of the paper is devoted to the study of the properties of the function $f(x)$ defined by the equation

$$f(x) = \int_0^x \frac{1}{1+t^2} dt$$

It is shown that the function $f(x)$ is increasing and concave down on the interval $(-\infty, \infty)$. The function has a horizontal asymptote at $y = \frac{\pi}{2}$ as $x \rightarrow \pm\infty$. The function is also shown to be odd, i.e., $f(-x) = -f(x)$. The function is also shown to be continuous and differentiable on the interval $(-\infty, \infty)$. The function is also shown to be bounded on the interval $(-\infty, \infty)$. The function is also shown to be strictly increasing on the interval $(-\infty, \infty)$. The function is also shown to be strictly concave down on the interval $(-\infty, \infty)$. The function is also shown to be strictly positive on the interval $(0, \infty)$. The function is also shown to be strictly negative on the interval $(-\infty, 0)$. The function is also shown to be strictly increasing on the interval $(-\infty, \infty)$. The function is also shown to be strictly concave down on the interval $(-\infty, \infty)$. The function is also shown to be strictly positive on the interval $(0, \infty)$. The function is also shown to be strictly negative on the interval $(-\infty, 0)$.

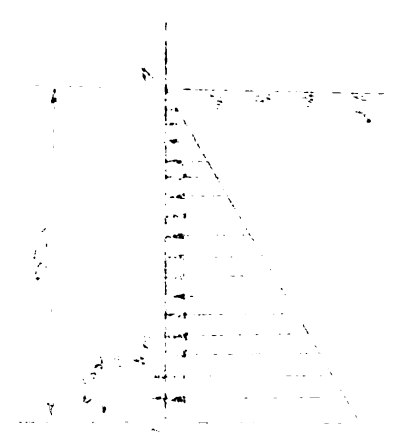


Figure 1

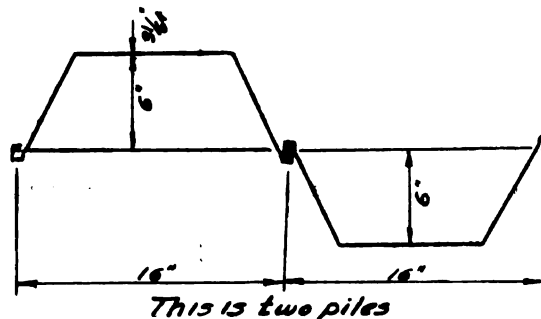
The second part of the paper is devoted to the study of the properties of the function $g(x)$ defined by the equation

$$g(x) = \int_0^x \frac{1}{1+t^4} dt$$

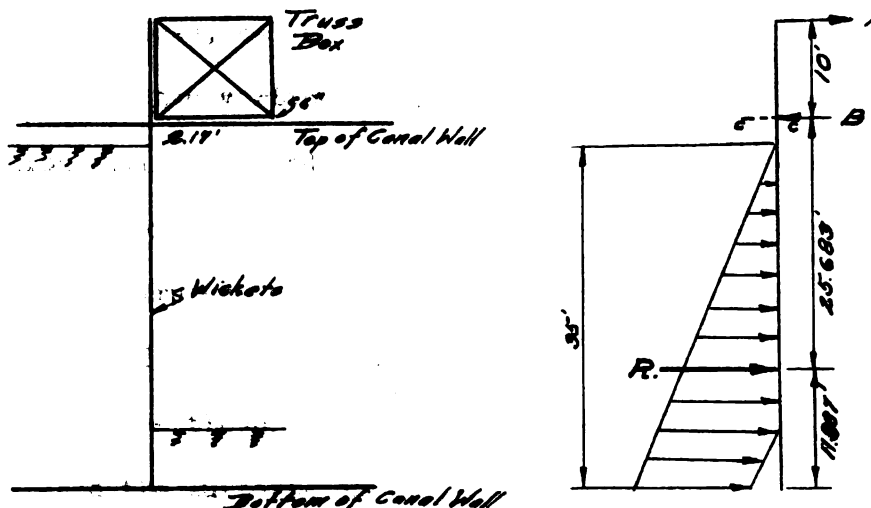
It is shown that the function $g(x)$ is increasing and concave down on the interval $(-\infty, \infty)$. The function has a horizontal asymptote at $y = \frac{\pi}{4}$ as $x \rightarrow \pm\infty$. The function is also shown to be odd, i.e., $g(-x) = -g(x)$. The function is also shown to be continuous and differentiable on the interval $(-\infty, \infty)$. The function is also shown to be bounded on the interval $(-\infty, \infty)$. The function is also shown to be strictly increasing on the interval $(-\infty, \infty)$. The function is also shown to be strictly concave down on the interval $(-\infty, \infty)$. The function is also shown to be strictly positive on the interval $(0, \infty)$. The function is also shown to be strictly negative on the interval $(-\infty, 0)$. The function is also shown to be strictly increasing on the interval $(-\infty, \infty)$. The function is also shown to be strictly concave down on the interval $(-\infty, \infty)$. The function is also shown to be strictly positive on the interval $(0, \infty)$. The function is also shown to be strictly negative on the interval $(-\infty, 0)$.

not been determined. The velocities could possibly be worked out by making use of the static head; and then from the velocities so gotten, figure the forces. This would just mean that the head was changed to velocity and velocity back to head, and as there are frictional losses the resulting head would be less. Therefore, there is no point in this type of an analysis.

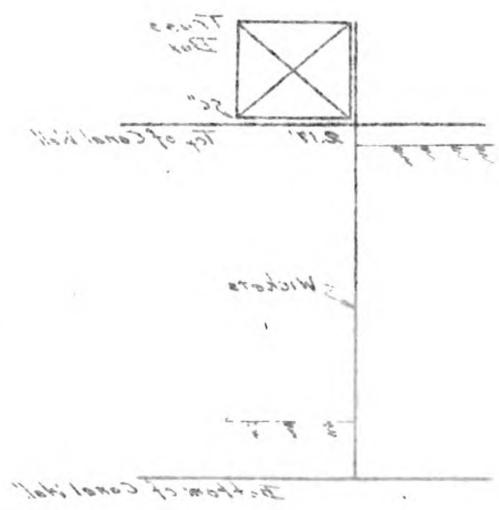
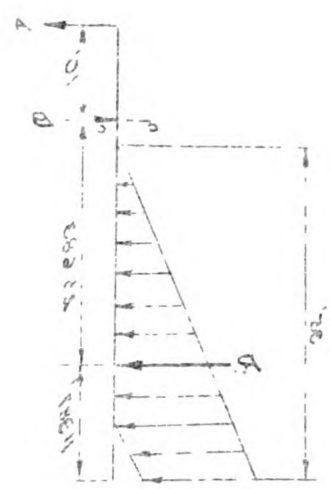
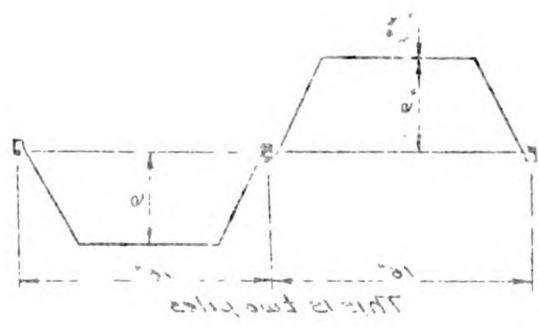
Now that the force created by the head of water is known and the point of application of the force is known, the next thing to be investigated is the stress in the wickets. These are usually made of sheet piling. The type of section that I will try is the Carnegie Section M 110 which has a section modulus of 20.54 in.^3 per piling or 15.26 in.^3 per lineal foot. The other properties are shown below.



The forces acting on the piling are shown in the two diagrams below.



The first part of the report describes the general conditions of the project and the objectives of the study. It also includes a brief history of the project and the organization responsible for its execution. The second part of the report describes the methodology used in the study, including the data collection methods and the analysis techniques. The third part of the report presents the results of the study, including the data analysis and the conclusions drawn from the study. The fourth part of the report discusses the implications of the study and the recommendations for future research.



Taking moments about the section c-c or at the bottom of the truss box, the stress in the wickets can be found as follows:

$$\text{Moment } cc = 36,982 \times 25.683 = 949,808.706 \text{ #-ft. / lin. ft.}$$

$$\text{or } 949,808.706 \div 12 = 11,397.704 \text{ #-in. / lin. ft.}$$

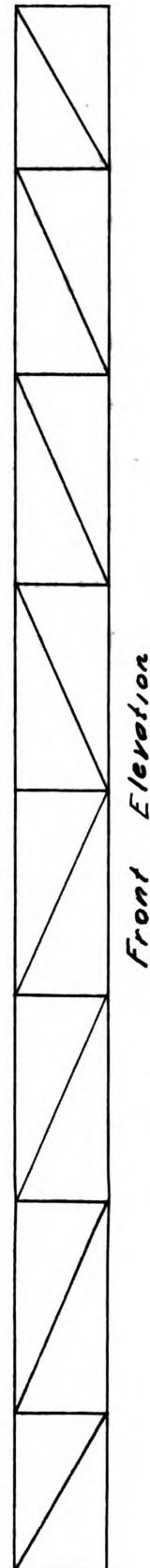
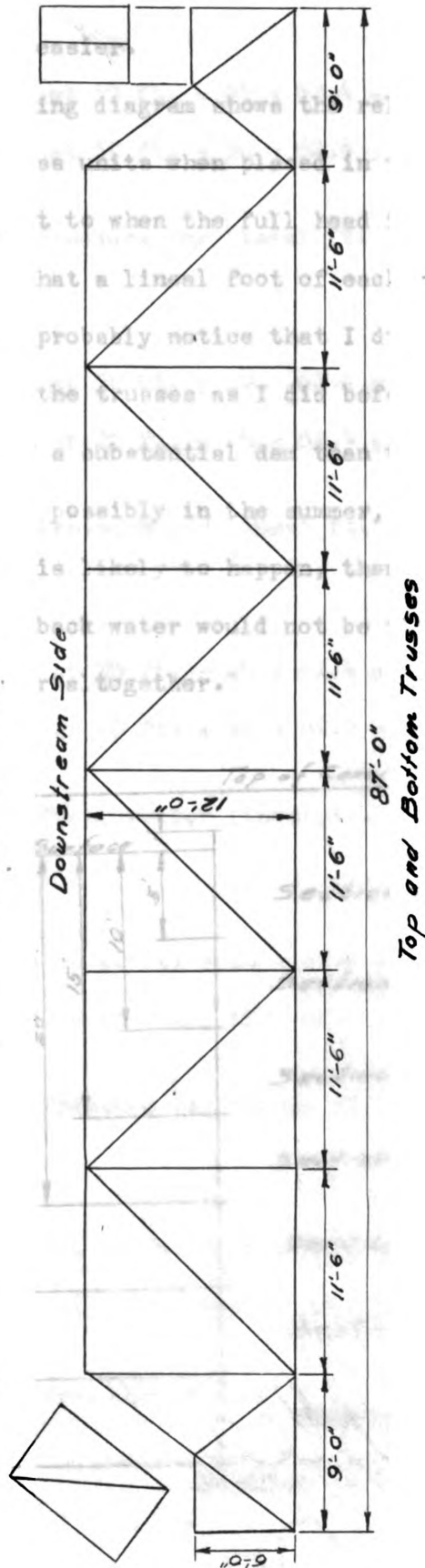
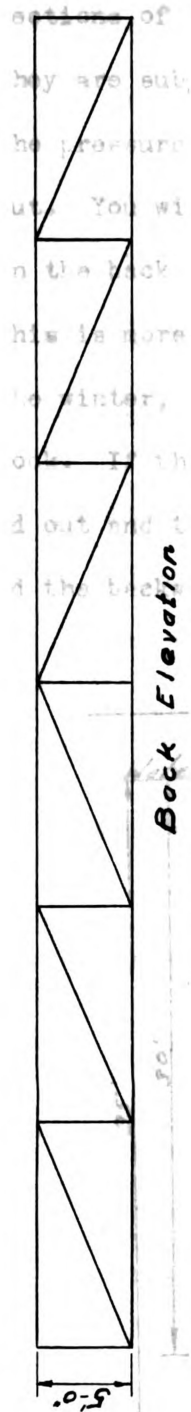
$$\text{Stress} = \frac{\text{Moment}}{\text{Section Modulus}} = \frac{11,397.704}{15.26} = 746,900 \text{ # / sq. in.}$$

This shows that with this type of arrangement, the wickets acting as pure cantilevers, the stresses in the wickets would be so large that it would be uneconomical to reinforce them enough to make them safe.

Therefore, this type of movable dam should not be used under these conditions. Also with a little bit of computation it can be shown that if the wickets rest on a support on the bottom of the canal, the stresses will still be too large. Then too, if a little more computation is done, which I haven't shown here, it can be shown that if the truss is made so that it will project down into the canal about 13.5 feet, the stresses will still be too large to be economically overcome.

With the same idea of using trusses to overcome the force of the water, I am going to try ^{to} drop sets of two horizontal trusses each into the canal. The outline of the trusses are shown on the following page. These two trusses, as can be seen from the drawing, are to be held five feet apart by two vertical trusses. Upon the truss shown as the front elevation will be placed sheet steel to hold back the water. There will have to be six of these five foot sections and one of six foot depth. And as these trusses need no center supports, they can be placed over the canal with a derrick and lowered down into the canal with cables from the sides. Because these sections would have to be slid into the water I have placed the supports on the back side of the trusses. Also I have made provision so that rollers can be used as the supports so that they

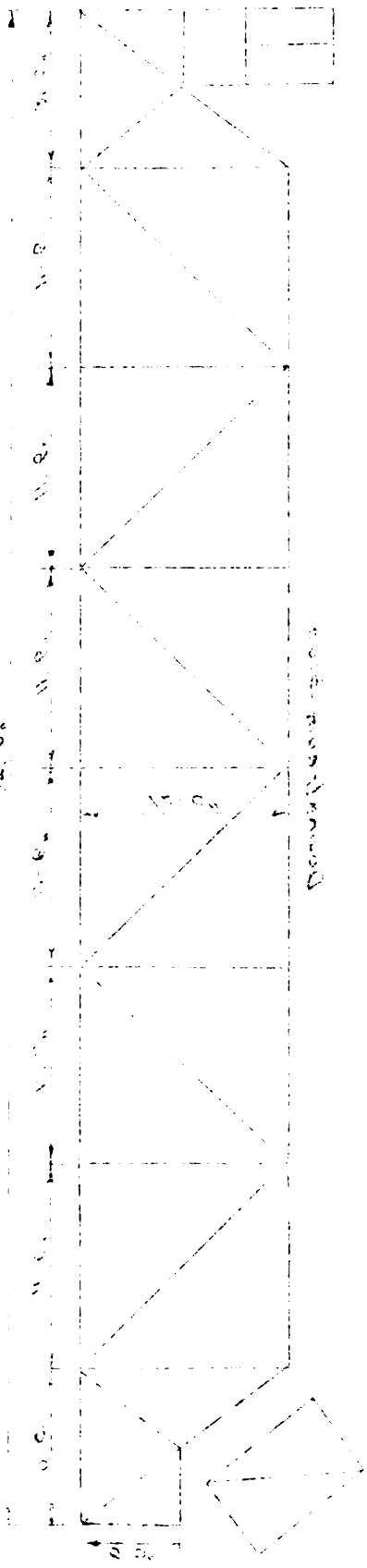
the first of these is the fact that the
the second is the fact that the
the third is the fact that the
the fourth is the fact that the
the fifth is the fact that the
the sixth is the fact that the
the seventh is the fact that the
the eighth is the fact that the
the ninth is the fact that the
the tenth is the fact that the
the eleventh is the fact that the
the twelfth is the fact that the
the thirteenth is the fact that the
the fourteenth is the fact that the
the fifteenth is the fact that the
the sixteenth is the fact that the
the seventeenth is the fact that the
the eighteenth is the fact that the
the nineteenth is the fact that the
the twentieth is the fact that the
the twenty-first is the fact that the
the twenty-second is the fact that the
the twenty-third is the fact that the
the twenty-fourth is the fact that the
the twenty-fifth is the fact that the
the twenty-sixth is the fact that the
the twenty-seventh is the fact that the
the twenty-eighth is the fact that the
the twenty-ninth is the fact that the
the thirtieth is the fact that the
the thirty-first is the fact that the
the thirty-second is the fact that the
the thirty-third is the fact that the
the thirty-fourth is the fact that the
the thirty-fifth is the fact that the
the thirty-sixth is the fact that the
the thirty-seventh is the fact that the
the thirty-eighth is the fact that the
the thirty-ninth is the fact that the
the fortieth is the fact that the
the forty-first is the fact that the
the forty-second is the fact that the
the forty-third is the fact that the
the forty-fourth is the fact that the
the forty-fifth is the fact that the
the forty-sixth is the fact that the
the forty-seventh is the fact that the
the forty-eighth is the fact that the
the forty-ninth is the fact that the
the fiftieth is the fact that the
the fifty-first is the fact that the
the fifty-second is the fact that the
the fifty-third is the fact that the
the fifty-fourth is the fact that the
the fifty-fifth is the fact that the
the fifty-sixth is the fact that the
the fifty-seventh is the fact that the
the fifty-eighth is the fact that the
the fifty-ninth is the fact that the
the sixtieth is the fact that the
the sixty-first is the fact that the
the sixty-second is the fact that the
the sixty-third is the fact that the
the sixty-fourth is the fact that the
the sixty-fifth is the fact that the
the sixty-sixth is the fact that the
the sixty-seventh is the fact that the
the sixty-eighth is the fact that the
the sixty-ninth is the fact that the
the seventieth is the fact that the
the seventy-first is the fact that the
the seventy-second is the fact that the
the seventy-third is the fact that the
the seventy-fourth is the fact that the
the seventy-fifth is the fact that the
the seventy-sixth is the fact that the
the seventy-seventh is the fact that the
the seventy-eighth is the fact that the
the seventy-ninth is the fact that the
the eightieth is the fact that the
the eighty-first is the fact that the
the eighty-second is the fact that the
the eighty-third is the fact that the
the eighty-fourth is the fact that the
the eighty-fifth is the fact that the
the eighty-sixth is the fact that the
the eighty-seventh is the fact that the
the eighty-eighth is the fact that the
the eighty-ninth is the fact that the
the ninetieth is the fact that the
the ninety-first is the fact that the
the ninety-second is the fact that the
the ninety-third is the fact that the
the ninety-fourth is the fact that the
the ninety-fifth is the fact that the
the ninety-sixth is the fact that the
the ninety-seventh is the fact that the
the ninety-eighth is the fact that the
the ninety-ninth is the fact that the
the hundredth is the fact that the



12 000 1/2 1/2 000



12 000 1/2 1/2 000



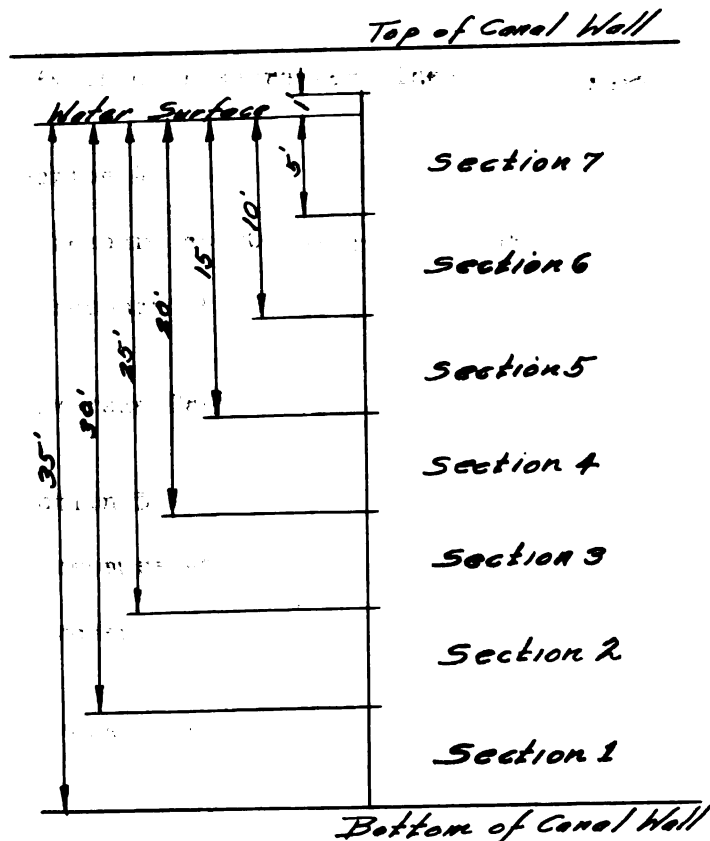
12 000 1/2 1/2 000



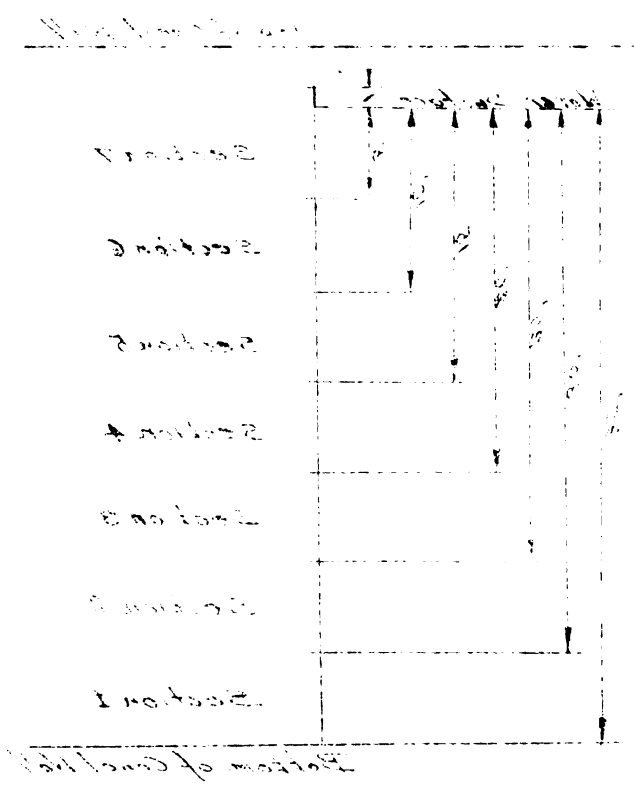
can b
secti
they
the :
out.
on t
this
t'e v
look
ed o
ed t

can be lowered easier.

The following diagram shows the relative positions of the different sections of truss units when placed in the canal and the depths to which they are subject to when the full head is obtained. From this diagram the pressures that a lineal foot of each section is to take was worked out. You will probably notice that I did not use the 6.3 feet of water on the back of the trusses as I did before. The reason for this is; this is more of a substantial dam than the other and may be used more in the winter, and possibly in the summer, for making minor repairs on the lock. If this is likely to happen, then the lock would probably be drained out and the back water would not be there. Therefore, I have disregarded the backwater altogether.



Sect
 Fr
 Fr
 Av
 Sect
 Pr
 Pr
 A
 Sec



Section 1

$$\text{Pressure at 35 ft.} = 35 \times 62.4 = 2184 \#$$

$$\text{Pressure at 30 ft.} = 30 \times 62.4 = \frac{1872}{4056} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{4056}{2} \times 5 = 10,140 \# / \text{lin. ft.}$$

Section 2

$$\text{Pressure at 30 ft.} = 30 \times 62.4 = 1872 \#$$

$$\text{Pressure at 25 ft.} = 25 \times 62.4 = \frac{1560}{3432} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{3432}{2} \times 5 = 8580 \# / \text{lin. ft.}$$

Section 3

$$\text{Pressure at 25 ft.} = 25 \times 62.4 = 1560 \#$$

$$\text{Pressure at 20 ft.} = 20 \times 62.4 = \frac{1248}{2808} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{2808}{2} \times 5 = 7020 \# / \text{lin. ft.}$$

Section 4

$$\text{Pressure at 20 ft.} = 20 \times 62.4 = 1248 \#$$

$$\text{Pressure at 15 ft.} = 15 \times 62.4 = \frac{936}{2184} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{2184}{2} \times 5 = 5460 \# / \text{lin. ft.}$$

Section 5

$$\text{Pressure at 15 ft.} = 15 \times 62.4 = 936 \#$$

$$\text{Pressure at 10 ft.} = 10 \times 62.4 = \frac{624}{1560} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{1560}{2} \times 5 = 3900 \# / \text{lin. ft.}$$

... ..
... ..
... ..

... ..
... ..
... ..

... ..
... ..
... ..

... ..
... ..
... ..

... ..
... ..
... ..
... ..

... ..
... ..
... ..

... ..
... ..
... ..
... ..
... ..
... ..

... ..
... ..
... ..

... ..
... ..
... ..
... ..
... ..

... ..
... ..
... ..

Panel

4

Lo

Re

Section 6

$$\text{Pressure at 10 ft.} = 10 \times 62.4 = 624 \#$$

$$\text{Pressure at 5 ft.} = 5 \times 62.4 = \frac{312}{936} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{936}{2} \times 5 = 2340 \# / \text{lin. ft.}$$

Section 7

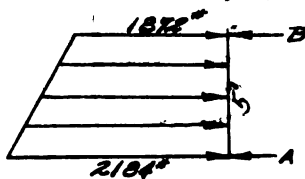
$$\text{Pressure at 5 ft.} = 5 \times 62.4 = 312 \#$$

$$\text{Pressure at top} = 0 \times 62.4 = \frac{000}{312} \#$$

$$\text{Average Pressure per lineal ft.} = \frac{312}{2} \times 5 = 780 \# / \text{lin. ft.}$$

From these loads per lineal ft. for each section are found the panel loads for each section, that is for each truss in each section.

Section 1



This diagram show how the load is distributed over the 5 ft. section. To obtain A and B, the load was broken up as shown.

$$A + B = 5 \times 1872 \# \text{ also } A = B$$

$$2A = 9360 \text{ or } A = 4680 \# \text{ also } B = 4680 \#$$

$$\text{Sum } M_B = 0$$

$$5 A = \frac{312}{2} \times 5 \times \frac{2}{3} \times 5 \text{ or } A = 520 \#$$

$$\text{Sum } M_A = 0$$

$$5 B = \frac{312}{2} \times 5 \times \frac{1}{3} \times 5 \text{ or } B = 260 \#$$

Load on top truss -- per long panel

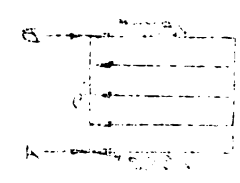
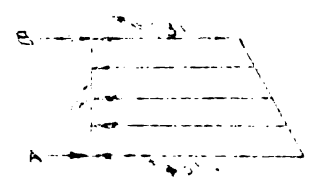
$$\text{Reaction B} = 4680 + 260 = 4940 \# / \text{lin. ft.}$$

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial data. This includes not only sales and purchases but also expenses and income. The text suggests that a systematic approach to record-keeping is essential for the success of any business.

The second part of the document provides a detailed explanation of the accounting cycle. It outlines the ten steps involved in the process, from identifying the business transactions to preparing the financial statements. Each step is described in detail, with examples provided to illustrate the concepts. The text stresses that following the accounting cycle is crucial for ensuring that the financial records are accurate and reliable.

The third part of the document discusses the importance of internal controls. It explains how internal controls help to prevent fraud and errors, and how they can be used to improve the efficiency of the business. The text provides a list of common internal controls and explains how they should be implemented. It also discusses the role of the internal control system in the overall management of the business.

The fourth part of the document discusses the importance of budgeting. It explains how a budget can be used to plan for the future, to control costs, and to measure performance. The text provides a step-by-step guide to developing a budget, and discusses the importance of reviewing and updating the budget regularly. It also discusses the role of the budget in the overall management of the business.



The fifth part of the document discusses the importance of financial statements. It explains how financial statements provide a summary of the business's financial performance over a period of time. The text discusses the three main types of financial statements: the balance sheet, the income statement, and the cash flow statement. It explains how each statement is prepared and how they are used to make business decisions.

The sixth part of the document discusses the importance of tax planning. It explains how tax planning can help to reduce the business's tax liability and improve its cash flow. The text provides a list of common tax planning strategies and explains how they should be implemented. It also discusses the role of the tax planner in the overall management of the business.

The seventh part of the document discusses the importance of risk management. It explains how risk management helps to identify and mitigate the risks that the business faces. The text provides a list of common risks and explains how they can be managed. It also discusses the role of the risk manager in the overall management of the business.

The eighth part of the document discusses the importance of human resources management. It explains how human resources management helps to attract, develop, and retain the best talent for the business. The text provides a list of common human resources management practices and explains how they should be implemented. It also discusses the role of the human resources manager in the overall management of the business.

The ninth part of the document discusses the importance of marketing. It explains how marketing helps to promote the business and increase its sales. The text provides a list of common marketing strategies and explains how they should be implemented. It also discusses the role of the marketer in the overall management of the business.

The tenth part of the document discusses the importance of operations management. It explains how operations management helps to ensure that the business is running efficiently and effectively. The text provides a list of common operations management practices and explains how they should be implemented. It also discusses the role of the operations manager in the overall management of the business.

Panel load = $4940 \times 11.5 = 56,810 \text{ \#}$

Load on top truss -- per short panel

Panel load = $4940 \times 9 = 44,460 \text{ \#}$

Load on lower truss -- per long panel

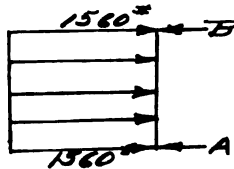
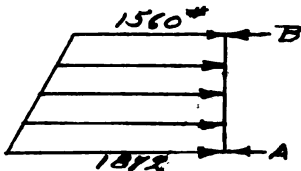
Reaction A = $4680 \div 520 = 5,200 \text{ \# / lin. ft.}$

Panel load = $5,200 \times 11.5 = 59,800 \text{ \#}$

Load on lower truss -- per short panel

Panel load = $5,200 \times 9 = 51,260 \text{ \#}$

Section 2



To obtain the reaction A and B, the load was broken up the same as in Section 1.

$A \neq B = 5 \times 1650 \text{ \#}$ also $A = B$

$2A = 7800$ or $A = 3900 \text{ \#}$ also $B = 3900 \text{ \#}$

Sum. $M_B = 0$

$5A = \frac{312}{2} \times 5 \times \frac{2}{3} \times 5$ or $A = 520 \text{ \#}$

Sum. $M_A = 0$

$5B = \frac{312}{2} \times 5 \times \frac{1}{3} \times 5$ or $B = 260 \text{ \#}$

Load on top truss -- per long panel

Reaction B = $3900 \div 260 = 4,160 \text{ \# / lin. ft.}$

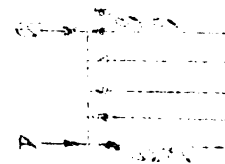
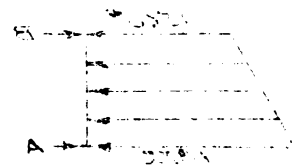
Panel load = $4,160 \times 11.5 = 47,840 \text{ \#}$

Load on top truss -- per short panel

Panel load = $4,160 \times 9 = 37,440 \text{ \#}$

Load on lower truss -- per long panel

Reaction A = $3900 \div 520 = 4,420 \text{ \# / lin. ft.}$



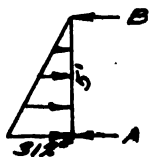
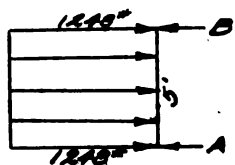
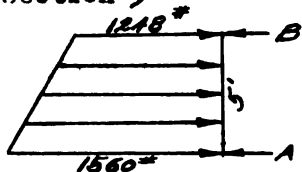
To
up. Fro
ft. each

Panel load = $4,420 \times 11.5 = 50,830 \text{ \#}$

Load on lower truss -- per short panel

Panel load = $4,420 \times 9 = 39,780 \text{ \#}$

Section 3



To obtain the reactions A and B, the load was broken up the same as in Sections 1 and 2.

$A + B = 5 \times 1,248$ also $A = B$

$2A = 6,240 \text{ \#}$

$A = 3,120 \text{ \#}$ and $B = 3,120 \text{ \#}$

Sum. $M_B = 0$

$5 A = \frac{312}{2} \times 5 \times \frac{2}{3} \times 5$ or $A = 520 \text{ \#/lin. ft.}$

Sum. $M_A = 0$

$5 B = \frac{312}{2} \times 5 \times \frac{1}{3} \times 5$ or $B = 260 \text{ \#/lin. ft.}$

Load on top truss -- per long panel

Reaction B = $3,120 + 260 = 3,380 \text{ \# / lin. ft.}$

Panel load = $3,380 \times 11.5 = 38,870 \text{ \#}$

Load on top truss -- per short panel

Panel load = $3,380 \times 9 = 30,420 \text{ \#}$

Load on lower truss -- per long panel

Reaction A = $3,120 - 520 = 3,640 \text{ \# / lin. ft.}$

Panel load = $3,640 \times 11.5 = 41,860 \text{ \#}$

Load on lower truss -- per short panel

Panel load = $3,640 \times 9 = 32,760 \text{ \#}$

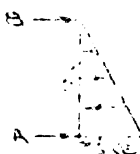
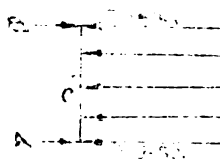
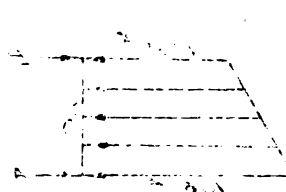
To simplify the work of figuring the panel loads, a ratio was set up. From this ratio we find that the reaction B reduces by $780 \text{ \# / lin. ft.}$ each time and the reaction A reduces by the same amount, $780 \text{ \# / lin.}$

ft.

panel

the

sect.



ft. Also the long panel loads reduce by 8,970 # each time and the short panel loads reduce by 7,020 # each time. With the use of these ratios the rest of the truss panel loads can be worked out. That is, all but section 7, which is a special case as it is six feet deep.

Section 4

$$\text{Reaction B} = 3,380 - 780 = 3600 \# / \text{lin. ft.}$$

$$\text{Reaction A} = 3,640 - 780 = 2,860 \# / \text{lin. ft.}$$

Load on top truss -- per long panel

$$\text{Panel load} = 38,870 - 8,970 = 29,900 \#$$

Load on top truss -- per short panel

$$\text{Panel load} = 30,420 - 7,020 = 23,400 \#$$

Load on lower truss -- per long panel

$$\text{Panel load} = 41,860 - 8,970 = 32,890 \#$$

Load on lower truss -- per short panel

$$\text{Panel load} = 32,760 - 7,020 = 25,740 \#$$

Section 5

$$\text{Reaction A} = 2,860 - 780 = 2,080 \# / \text{lin. ft.}$$

$$\text{Reaction B} = 2,600 - 780 = 1,820 \# / \text{lin. ft.}$$

Load on top truss -- per long panel

$$\text{Panel load} = 29,900 - 8,970 = 20,930 \#$$

Load on top truss -- per short panel

$$\text{Panel load} = 23,400 - 7,020 = 16,380 \#$$

Load on lower truss -- per long panel

$$\text{Panel load} = 32,890 - 8,970 = 23,920 \#$$

Load on lower truss -- per short panel

$$\text{Panel load} = 25,740 - 7,020 = 18,720 \#$$

1. The first step is to identify the problem or question that needs to be answered.

2. The second step is to gather relevant information and data.

3. The third step is to analyze the information and data to identify patterns and trends.

4. The fourth step is to develop a hypothesis or a proposed solution.

5. The fifth step is to test the hypothesis or solution through experiments or observations.

6. The sixth step is to evaluate the results of the tests and observations.

7. The seventh step is to draw conclusions based on the evaluation.

8. The eighth step is to communicate the findings and conclusions to others.

9. The ninth step is to reflect on the process and identify areas for improvement.

10. The tenth step is to apply the findings and conclusions to other situations.

11. The eleventh step is to continue to learn and grow from the experience.

12. The twelfth step is to share the knowledge and skills gained with others.

13. The thirteenth step is to stay up-to-date on the latest developments in the field.

14. The fourteenth step is to seek out new challenges and opportunities.

15. The fifteenth step is to maintain a positive attitude and a growth mindset.

16. The sixteenth step is to be open to feedback and criticism.

17. The seventeenth step is to be persistent and resilient in the face of setbacks.

18. The eighteenth step is to be collaborative and work well with others.

19. The nineteenth step is to be curious and ask questions.

20. The twentieth step is to be organized and manage time effectively.

21. The twenty-first step is to be flexible and adapt to change.

22. The twenty-second step is to be proactive and take initiative.

23. The twenty-third step is to be a team player and support others.

24. The twenty-fourth step is to be a lifelong learner and stay motivated.

25. The twenty-fifth step is to be a positive influence on others.

26. The twenty-sixth step is to be a good listener and understand others.

27. The twenty-seventh step is to be a good communicator and express ideas clearly.

28. The twenty-eighth step is to be a good problem solver and think creatively.

29. The twenty-ninth step is to be a good decision maker and weigh options carefully.

30. The thirtieth step is to be a good leader and inspire others.

Section 6

$$\text{Reaction A} = 2,080 - 730 = 1,300 \text{ \# / lin. ft.}$$

$$\text{Reaction B} = 1,820 - 780 = 1,040 \text{ \# / lin. ft.}$$

Load on top truss -- per long panel

$$\text{Panel load} = 20,930 - 8,970 = 11,960 \text{ \#}$$

Load on top truss -- per short panel

$$\text{Panel load} = 16,380 - 7,020 = 9,360 \text{ \#}$$

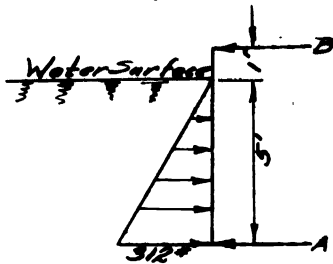
Load on lower truss -- per long panel

$$\text{Panel load} = 23,920 - 8,970 = 14,950 \text{ \#}$$

Load on lower truss -- per short panel

$$\text{Panel load} = 18,720 - 7,020 = 11,700 \text{ \#}$$

Section 7



This section must be worked separate from the rest of the others because it is six feet in depth, and is only holding back five feet of water.

$$\text{Sum. } M_B = 0$$

$$6 A = \frac{312}{2} \times 5 \times \left(\frac{2 \times 5}{3} + 1 \right)$$

$$A = 563 \frac{1}{3} \text{ \# / lin. ft.}$$

$$\text{Sum. } M_A = 0$$

$$6 B = \frac{312}{2} \times 5 \times \frac{1}{3} \times 5$$

$$B = 216 \frac{2}{3} \text{ \# / lin. ft.}$$

Load on top truss -- per long panel

$$\text{Panel load} = 216 \frac{2}{3} \times 11 \frac{1}{2} = \frac{14,950}{6} = 2,491 \frac{2}{3} \text{ \#}$$

Load on top truss -- per short panel

$$\text{Panel load} = 216 \frac{2}{3} \times 9 = 1,950 \text{ \#}$$

Load on lower truss -- per long panel

$$\text{Panel load} = 563 \frac{1}{3} \times 11 \frac{1}{2} = \frac{38,870}{6} = 6,478 \frac{1}{3} \text{ \#}$$

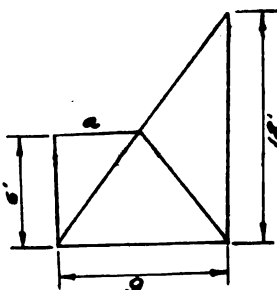
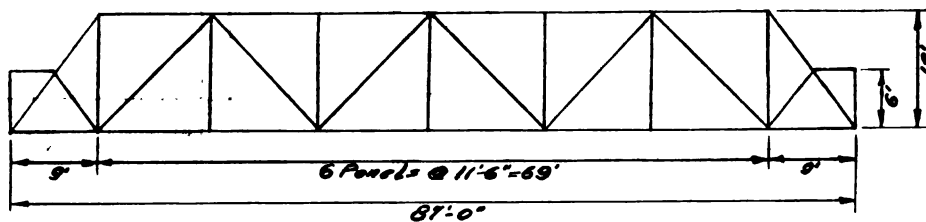
Load on lower truss -- per short panel

$$\text{Panel load} = 563 \frac{1}{3} \times 9 = 5,070 \text{ \#}$$

Now that the panel loads have been obtained, the exact dimensions of the diagonals of the truss must be worked out so that the stresses or loads in the truss members can be computed. These loads will be computed algebraically and also graphically. The graphic solution is used only as a check upon the algebraic work.

The graphic solutions are drawn to a fairly small scale. This was done because the stresses in the members are so large that in the larger stressed ones the difference of 500 pounds will not mean much in computing the area of steel needed. Therefore, I believe that the small scale is justified.

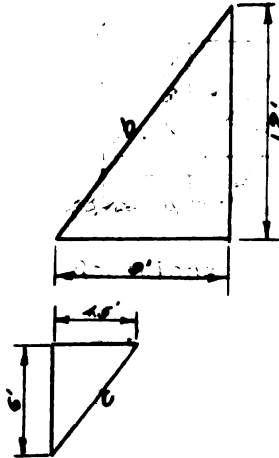
Below are shown the computations for the lengths of the members.



This diagram shows the end diagonals that must be figured. This is most easily done by breaking it down into simple triangles.

The side "a" can be shown to equal 4.5 feet by simple geometry, so it will not be

proven here.

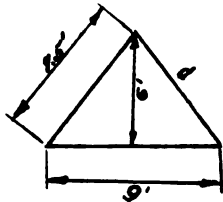


$$b^2 = 9^2 + 12^2$$

$$b = \sqrt{81 + 144} = 15 \text{ ft.}$$

$$c^2 = 4.5^2 + 6^2$$

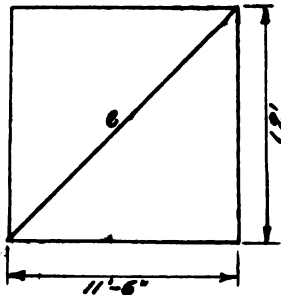
$$c = \sqrt{20.25 + 36} = 7.5 \text{ ft.}$$



The diagonal "d" really is the same as the diagonal "c", but turned around in a slightly different position. Therefore:

$$d = 7.5 \text{ ft.}$$

The computations for the main diagonal is the same for all of them so only one is shown here.



$$e^2 = 12^2 + 11.5^2$$

$$e = \sqrt{144 + 132.25} = 16.62074 \text{ ft.}$$

This is a very awkward number to use, so the last three figures will be dropped

off. This can be done as it will only cause an error of less than one tenth of one per cent.

The algebraic solution of one truss is show below. This same method was run through for each truss, but as it is exactly the same, except for the answers and figures, only the answers are given.

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

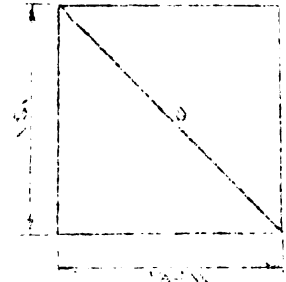
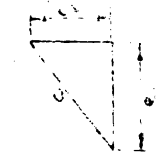
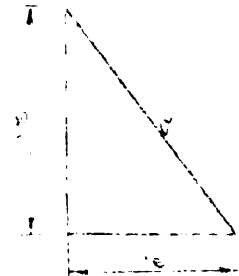
$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$



$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

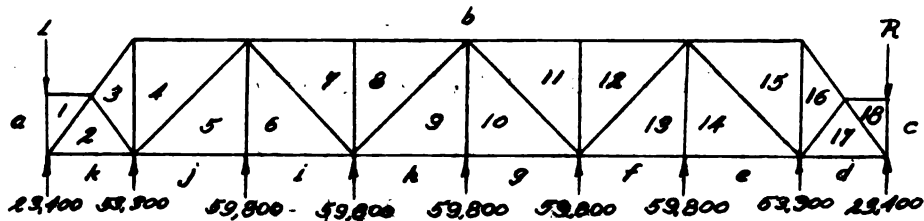
$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

$$T = \frac{1}{2} \pi \sqrt{\frac{m}{k}}$$

Section 1 -- Bottom truss



Reactions

$$\text{Sum. } M_L = 0$$

$$87 R - (23,400 \times 0 + 53,300 \times 9 + 59,800 \times 20.5 + 59,800 \times 30 + 59,800 \times 43.5 + 59,800 \times 55 + 59,800 \times 66.5 + 53,300 \times 78 + 23,400 \times 87) = 0$$

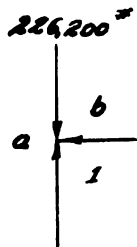
$$R = 226,200 \#$$

$$\text{Sum. } M_R = 0$$

$$87 L - (23,400 \times 0 + 53,300 \times 9 + 59,800 \times 20.5 + 59,800 \times 30 + 59,800 \times 43.5 + 59,800 \times 55 + 59,800 \times 66.5 + 53,300 \times 78 + 23,400 \times 87) = 0$$

$$L = 226,200 \#$$

Joint a-b-l



$$\text{Sum. } F_h = 0$$

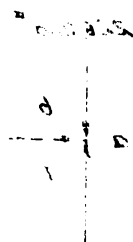
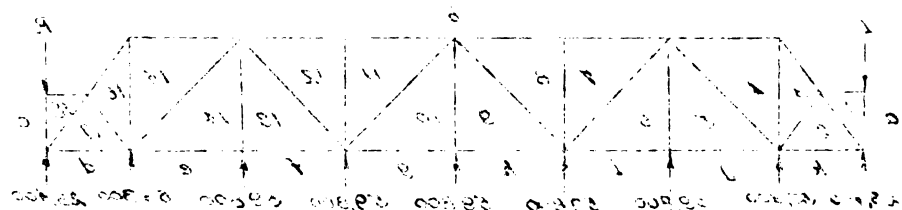
$$(1-b) - 0 = 0$$

$$(1-b) = 0 \#$$

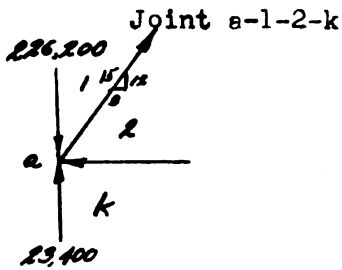
$$\text{Sum. } F_v = 0$$

$$(1-a) - 226,200 = 0$$

$$(1-a) = 226,200 \# \text{ comp.}$$



-23-



$$\text{Sum. } F_v = 0$$

$$(1-2)_v - 226,200 + 23,400 = 0$$

$$(1-2)_v = 202,800 \quad (1-2) = 202,800 \frac{15}{12}$$

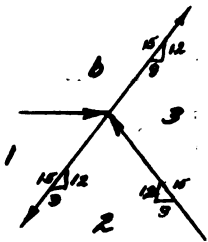
$$(1-2) = 253,500 \# \text{ Ten.}$$

$$\text{Sum. } F_h = 0$$

$$(1-2)_h - (2-k) = 0$$

$$(2-k) = 253,500 \frac{9}{15} = 152,100 \# \text{ Comp.}$$

Joint b-3-2-1



$$\text{Sum. } F_h = 0$$

$$(1-b) - (1-2)_h + (3-b)_h - (2-3)_h = 0$$

$$0 - 152,100 + (3-b) \frac{9}{15} - (2-3) \frac{9}{15} = 0$$

$$(3-b) = \left[(2-3) \frac{9}{15} + 152,100 \right] \frac{15}{9}$$

$$\text{Sum. } F_v = 0$$

$$- (1-2)_v + (3-b)_v + (2-3)_v = 0$$

$$- 202,800 + (3-b) \frac{12}{15} + (2-3) \frac{12}{15} = 0$$

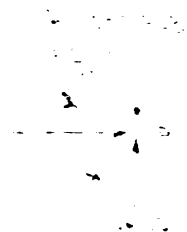
$$- 202,800 + \left[(2-3) \frac{9}{15} + 152,100 \right] \frac{15}{9} + \frac{12}{15} + (2-3) \frac{12}{15} = 0$$

$$(2-3) \frac{12}{15} + (2-3) \frac{12}{15} = 0$$

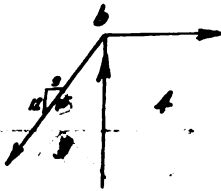
$$(2-3) = 0 \#$$

$$(3-b) = 0 + 152,100 + \frac{15}{9}$$

$$(3-b) = 253,500 \# \text{ Ten.}$$



Joint b-4-3



$$\sum F_v = 0$$

$$-(2-b)_v + (3-4) = 0$$

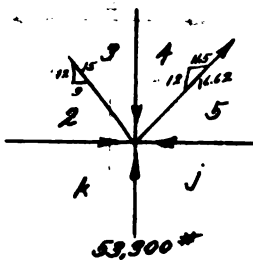
$$(3-4) = -(3-b)_v = 253,500 \frac{12}{15} = 2-2,800 \text{ \# Comp.}$$

$$\sum F_h = 0$$

$$-(3-b)_h + (4-b) = 0$$

$$(4-b) = (3-b)_h = 253,500 \frac{9}{15} = 152,100 \text{ \# Ten.}$$

Joint 2-3-4-5-j-k



$$\sum F_v = 0$$

$$(4-5)_v - (3-4) + 53,300 = 0$$

$$(4-5)_v = 2-2,800 - 53,300 = 149,500$$

$$(4-5) = 149,500 \frac{16.62}{12} = 207,058 \text{ \# Ten.}$$

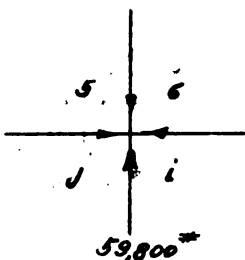
$$\sum F_h = 0$$

$$(2-k) + (4-5) - (5-j) = 0$$

$$(5-j) = 152,100 + 207,058 \frac{11.5}{16.62}$$

$$(5-j) = 295,371 \text{ \# Comp.}$$

Joint 5-6-1-j



$$\sum F_v = 0$$

$$(1-j) - (5-6) = 0$$

$$(5-6) = 53,800 \text{ \# Comp.}$$

$$\sum F_h = 0$$

$$(5-j) - (6-1) = 0$$

$$(6-1) = 295,371 \text{ \# Comp.}$$

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be carefully documented to ensure the integrity of the financial data.

2. The second part of the document outlines the various methods used to collect and analyze data. It describes how different types of information are gathered and how they are then processed to identify trends and patterns.

3. The third part of the document provides a detailed overview of the results of the analysis. It includes a summary of the key findings and a discussion of their implications for the overall project.

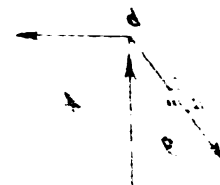


Figure 1: Vector diagram showing the relationship between P and Q.

4. The fourth part of the document discusses the challenges faced during the data collection process. It highlights the difficulties of obtaining accurate data from various sources and the steps taken to overcome these challenges.

5. The fifth part of the document provides a detailed analysis of the data collected. It includes a breakdown of the data by category and a discussion of the factors that influence the results.

6. The sixth part of the document provides a summary of the findings and a conclusion. It states that the data collected is consistent with the initial hypothesis and that the results have significant implications for the field.

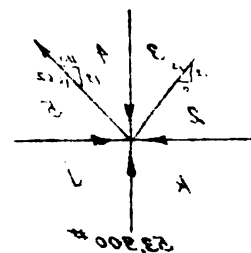
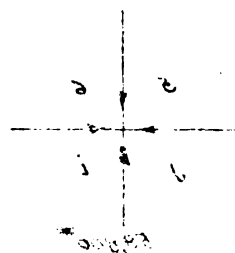


Figure 2: Vector diagram showing the relationship between P and Q.

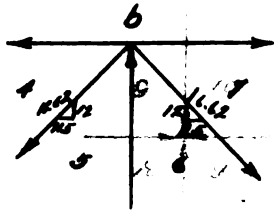
7. The seventh part of the document discusses the future directions of the research. It outlines the next steps in the project and the goals that the researchers hope to achieve.

8. The eighth part of the document provides a detailed overview of the results of the analysis. It includes a summary of the key findings and a discussion of their implications for the overall project.

9. The ninth part of the document provides a summary of the findings and a conclusion. It states that the data collected is consistent with the initial hypothesis and that the results have significant implications for the field.



Joint 4-5-6-7-b



$$\text{Sum. } F_v = 0$$

$$(6-7)_v + (5-6) - (4-5)_v = 0$$

$$(6-7)_v = 149,500 - 59,800 = 89,700$$

$$(6-7) = 89,700 \frac{16.62}{12} = 124,235 \text{ \# Comp.}$$

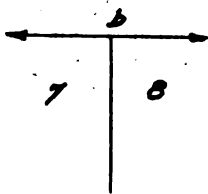
$$\text{Sum. } F_h = 0$$

$$(7-b) - (6-7)_h - (4-5)_h = 0$$

$$(7-b) = 152,100 + 143,271 + 124,235 \frac{11.5}{16.62}$$

$$(7-b) = 381,333 \text{ \# Ten.}$$

Joint 7-8-b



$$\text{Sum. } F_v = 0$$

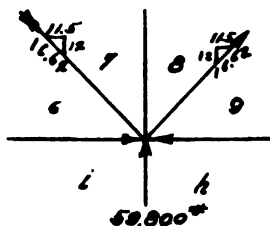
$$(7-8) = 0$$

$$\text{Sum. } F_h = 0$$

$$(8-b) - (7-b) = 0$$

$$(8-b) = 381,333 \text{ \# Ten.}$$

Joint 6-7-8-9-h-1



$$\text{Sum. } F_v = 0$$

$$(8-9)_v - (6-7)_v + 59,800 = 0$$

$$(8-9)_v = 89,700 - 59,800 = 29,900$$

$$(8-9) = 29,900 \frac{16.62}{12} = 41,412 \text{ \# Ten.}$$

$$\text{Sum. } F_h = 0$$

$$(6-1) + (6-7)_h + (8-9)_h - (9-h) = 0$$

$$(9-h) = 295,371 + 85,962 + 41,412 \frac{11.5}{16.62}$$

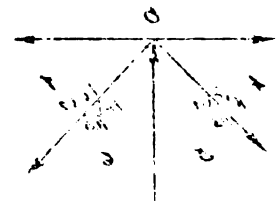
$$(9-h) = 409,988 \text{ \# Comp.}$$

[illegible]

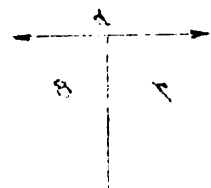
• **Prevalence** = the proportion of a population that has a disease at a particular point in time

... ..

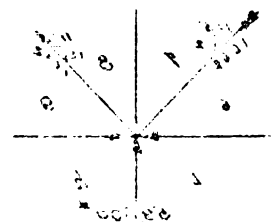
100



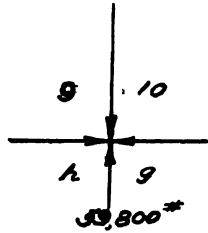
1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 26



9. *Chlorophyll a* and *Chlorophyll b* were determined by the method of Lichtenthaler (1987).



Joint 9-10-g-h



$$\text{Sum. } F_h = 0$$

$$(9-h) - (10-g) = 0$$

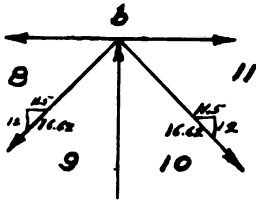
$$(10-g) = 409,988 \text{ # Comp.}$$

$$\text{Sum. } F_v = 0$$

$$(g-h) - (9-10) = 0$$

$$(9-10) = 59,800 \text{ # Comp.}$$

Joint 8-9-10-11-b



$$\text{Sum. } F_v = 0$$

$$(9-10) - (8-9)_v - (10-11)_v = 0$$

$$(10-11)_v = (9-10) - (8-9)_v$$

$$(10-11)_v = 59,800 - 29,900 = 29,900$$

$$(10-11) = 29,900 \frac{15.62}{12} = 41,412 \text{ # Ten.}$$

$$\text{Sum. } F_h = 0$$

$$(11-b) + (10-11)_h - (8-9)_h + (8-b) = 0$$

$$(11-b) = -41,412 \frac{11.5}{16.62} + 41,412 \frac{11.5}{16.62} + 381,333$$

$$(11-b) = 381,333 \text{ # Ten.}$$

1. The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial data. This includes not only sales and purchases but also expenses and income.

2. The second part of the document focuses on the classification of these transactions. It suggests that each entry should be categorized into specific accounts, such as 'Sales', 'Purchases', 'Expenses', and 'Income'. This classification is crucial for generating meaningful financial statements and for analyzing the company's performance over time.

3. The third part of the document addresses the issue of reconciling the books. It explains that regular reconciliation is necessary to identify and correct any discrepancies between the recorded transactions and the actual bank statements or other external records. This process helps in detecting errors and preventing fraud.

4. The fourth part of the document discusses the importance of maintaining proper documentation for all transactions. It advises that every transaction should be supported by a valid receipt or invoice, which should be kept on file for future reference. This documentation is essential for auditing purposes and for resolving any disputes that may arise.

Figure 1: A simple diagram illustrating the flow of transactions between different accounts.

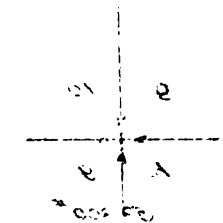
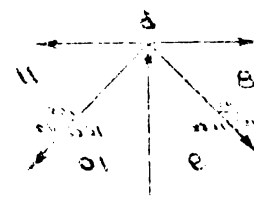


Figure 2: A more complex diagram showing the relationship between various financial accounts and their respective transactions.



5. The fifth part of the document discusses the importance of maintaining proper documentation for all transactions. It advises that every transaction should be supported by a valid receipt or invoice, which should be kept on file for future reference. This documentation is essential for auditing purposes and for resolving any disputes that may arise.

6. The sixth part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial data. This includes not only sales and purchases but also expenses and income.

7. The seventh part of the document focuses on the classification of these transactions. It suggests that each entry should be categorized into specific accounts, such as 'Sales', 'Purchases', 'Expenses', and 'Income'. This classification is crucial for generating meaningful financial statements and for analyzing the company's performance over time.

8. The eighth part of the document addresses the issue of reconciling the books. It explains that regular reconciliation is necessary to identify and correct any discrepancies between the recorded transactions and the actual bank statements or other external records. This process helps in detecting errors and preventing fraud.

9. The ninth part of the document discusses the importance of maintaining proper documentation for all transactions. It advises that every transaction should be supported by a valid receipt or invoice, which should be kept on file for future reference. This documentation is essential for auditing purposes and for resolving any disputes that may arise.

10. The tenth part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry, no matter how small, should be recorded to ensure the integrity of the financial data. This includes not only sales and purchases but also expenses and income.

	Type	Section 1	Section 2		Section 3	
	of	Top Truss	Bottom Truss	Top Truss	Bottom Truss	Top Truss
	Stress	Stress	Stress	Stress	Stress	Stress
(1-b)		0	0	0	0	0
(1-a)	Comp.	214,890	192,270	180,680	158,340	147,030
(1-2)	Ten.	240,825	215,475	202,800	177,450	164,775
(2-k)	Comp.	144,495	129,285	121,680	106,095	89,865
(2-3)		0	0	0	0	0
(3-b)	Ten.	240,825	215,475	202,800	177,450	164,775
(3-4)	Comp.	192,660	172,380	162,240	141,960	131,820
(4-b)	Ten.	144,495	129,285	121,680	106,095	89,865
(4-5)	Ten.	196,621	175,999	165,646	144,857	134,587
(5-j)	Comp.	280,602	251,065	236,297	206,385	191,991
(5-6)	Comp.	56,810	50,830	47,840	41,860	38,870
(6-1)	Comp.	280,602	251,065	236,297	206,385	191,991
(6-7)	Comp.	118,023	105,599	99,388	86,964	80,752
(7-b)	Ten.	362,266	324,762	305,067	266,888	247,867
(7-8)		0	0	0	0	0
(8-b)	Ten.	362,266	324,762	305,067	266,888	247,867
(8-9)	Ten.	39,341	35,200	33,129	38,988	26,917
(9-h)	Comp.	389,487	349,072	327,990	286,619	266,492
(9-10)	Comp.	56,810	50,830	47,840	41,860	38,870
(10-g)	Comp.	389,487	349,072	327,990	286,619	266,492
(10-11)	Ten.	39,341	35,200	33,129	28,988	26,917
(11-b)	Ten.	362,266	324,762	305,067	266,888	247,867

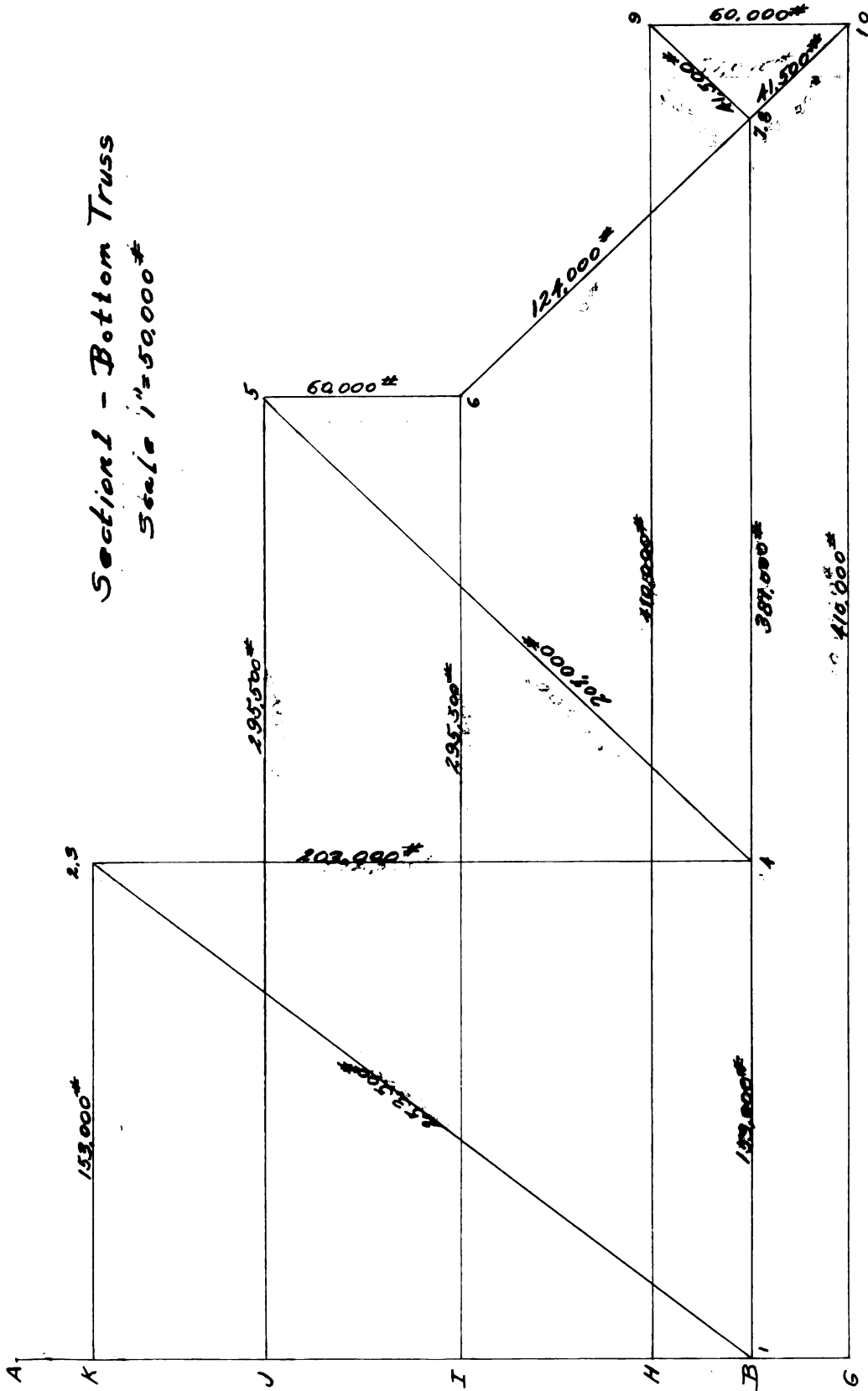
Member	Type	Section 4		Section 5	
	of	Bottom Truss	Top Truss	Bottom Truss	Top Truss
Stress		Stress	Stress	Stress	Stress
(1-b)		0	0	0	0
(1-a)	Comp.	124,410	113,100	90,480	79,170
(1-2)	Ten.	111,540	126,750	101,400	88,725
(2-k)	Comp.	83,605	76,050	60,840	53,235
(2-3)		0	0	0	0
(3-b)	Ten.	139,425	126,750	101,400	88,725
(3-4)	Comp.	111,540	101,400	81,120	70,930
(4-b)	Ten.	83,605	76,050	60,840	53,235
(4-5)	Ten.	113,382	103,529	82,823	72,470
(5-j)	Comp.	162,405	147,685	118,148	103,380
(5-6)	Comp.	32,890	29,900	23,920	20,930
(6-1)	Comp.	162,405	147,635	118,148	103,380
(6-7)	Comp.	68,327	62,117	49,794	43,482
(7-b)	Ten.	209,703	190,600	152,533	133,457
(7-8)		0	0	0	0
(8-b)	Ten.	209,703	190,600	152,533	133,457
(8-9)	Ten.	22,776	20,706	16,565	14,482
(9-h)	Comp.	225,464	204,927	163,995	143,479
(9-10)	Comp.	32,890	29,900	23,920	20,930
(10-g)	Comp.	225,464	204,927	163,995	143,479
(10-11)	Ten.	22,776	20,706	16,565	14,482
(11-b)	Ten.	209,703	190,600	152,533	133,457

Member	Type	Section 6		Section 7	
	of	Bottom Truss	Top Truss	Bottom Truss	Top Truss
Stress		Stress	Stress	Stress	Stress
(1-b)		0	0	0	0
(1-a)	Comp.	56,550	45,240	24,504	9,426
(1-2)	Ten.	63,375	50,700	27,461	10,464
(2-k)	Comp.	38,025	30,420	16,477	6,338
(2-3)		0	0	0	0
(3-b)	Ten.	63,375	50,700	27,461	10,464
(3-4)	Comp.	50,700	40,560	21,969	8,541
(4-b)	Ten.	38,025	30,420	16,477	6,338
(4-5)	Ten.	51,764	41,412	22,430	8,627
(5-j)	Comp.	73,843	59,074	31,997	12,308
(3-6)	Comp.	14,950	11,960	6,478	2,492
(6-1)	Comp.	73,843	59,074	31,997	12,308
(6-7)	Comp.	31,039	24,847	13,458	5,177
(7-b)	Ten.	95,334	76,266	41,309	15,890
(7-8)		0	0	0	0
(8-b)	Ten.	95,334	76,266	41,309	15,890
(1-9)	Ten.	10,353	8,282	4,486	1,726
(9-h)	Comp.	102,501	81,997	44,413	17,084
(9-10)	Comp.	14,950	11,960	6,478	2,492
(10-g)	Comp.	102,501	81,997	44,413	17,084
(10-11)	Ten.	10,353	8,282	4,486	1,726
(11-b)	Ten.	95,334	76,266	41,309	15,890

In section No. 7 the panel loads on the longer panels came out to fractions of a pound. These fractions were dropped off if they were less than a half of a pound and added if over a half. This was done as the small fractions would not effect the stresses enough to make them worth while to carry in the computations.

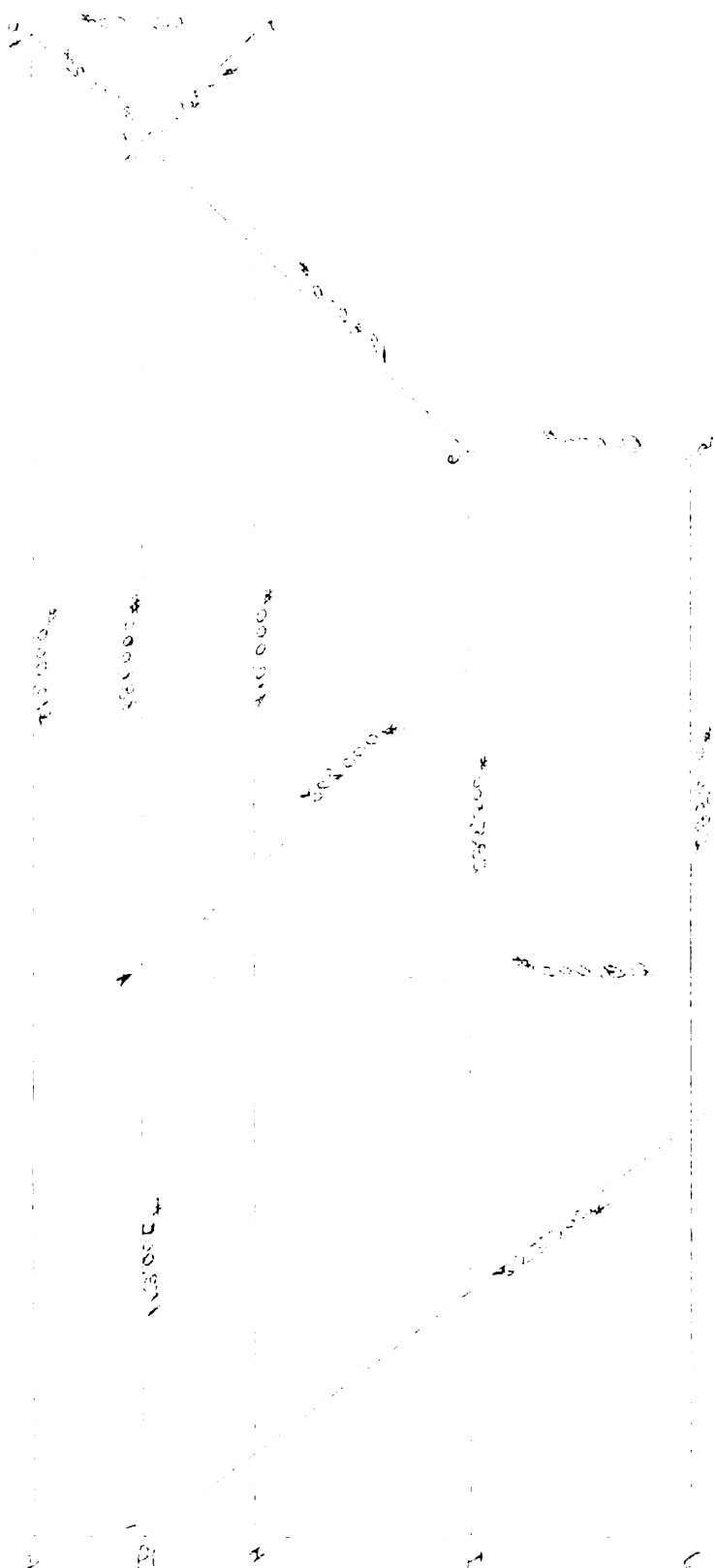
On the following fourteen pages is shown the graphical solution of the trusses, as was explained previously. Along with the stress diagrams is shown one diagram of the truss. This diagram was used to make all of the stress diagrams.

Section 1 - Bottom Truss
Scale 1"=50,000'

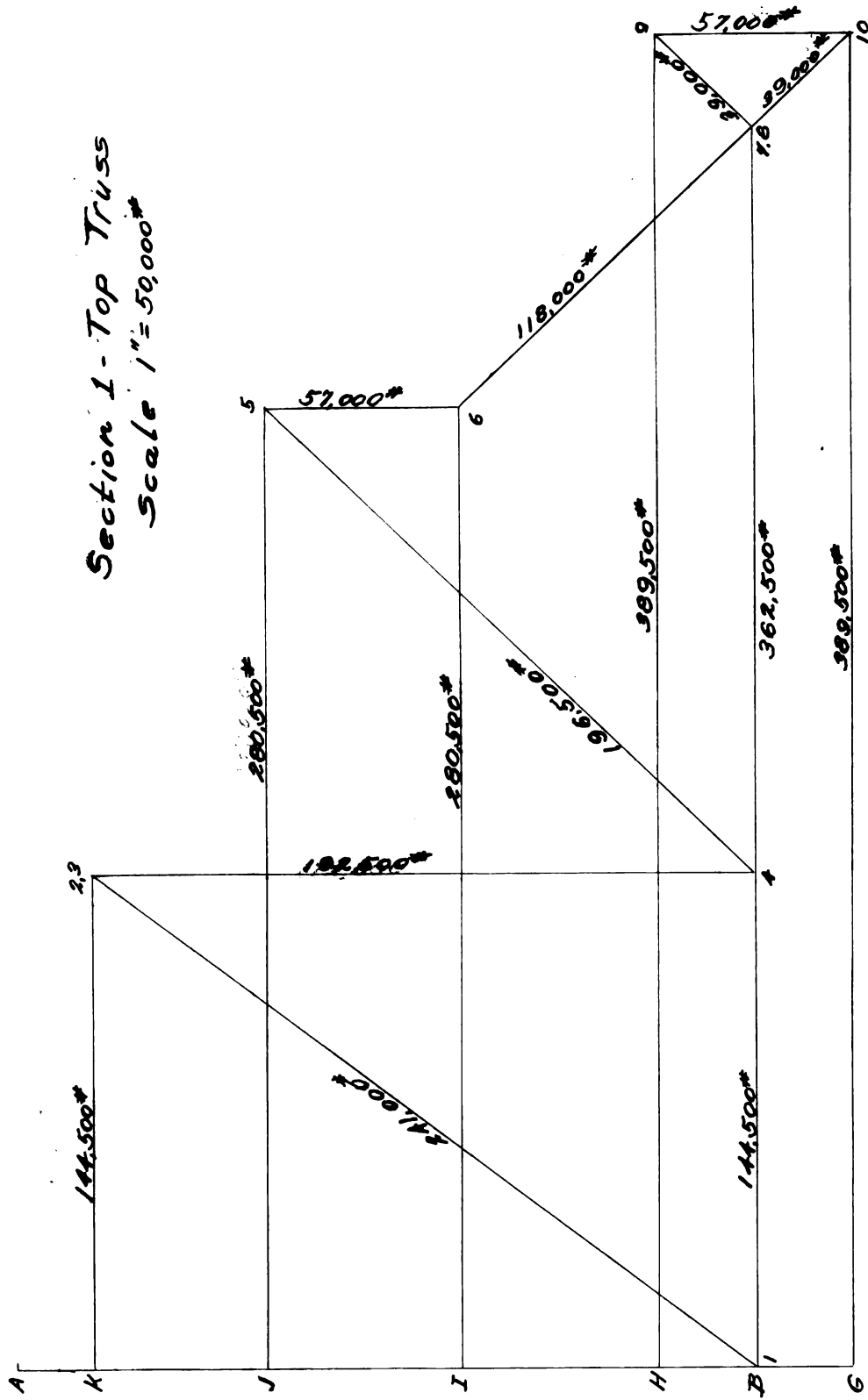


2001 1011061 - 1011062

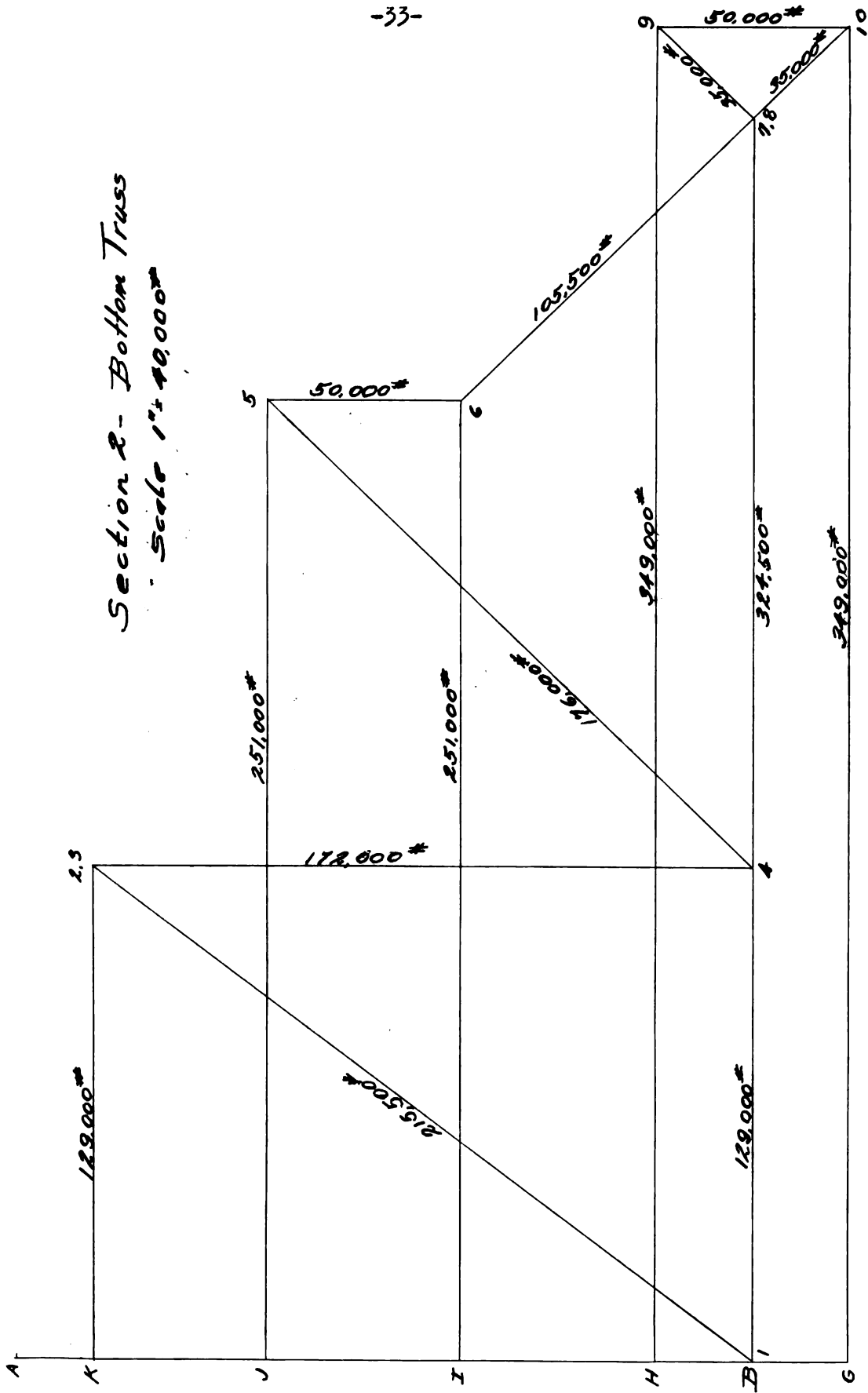
1000000 = 1 1000000

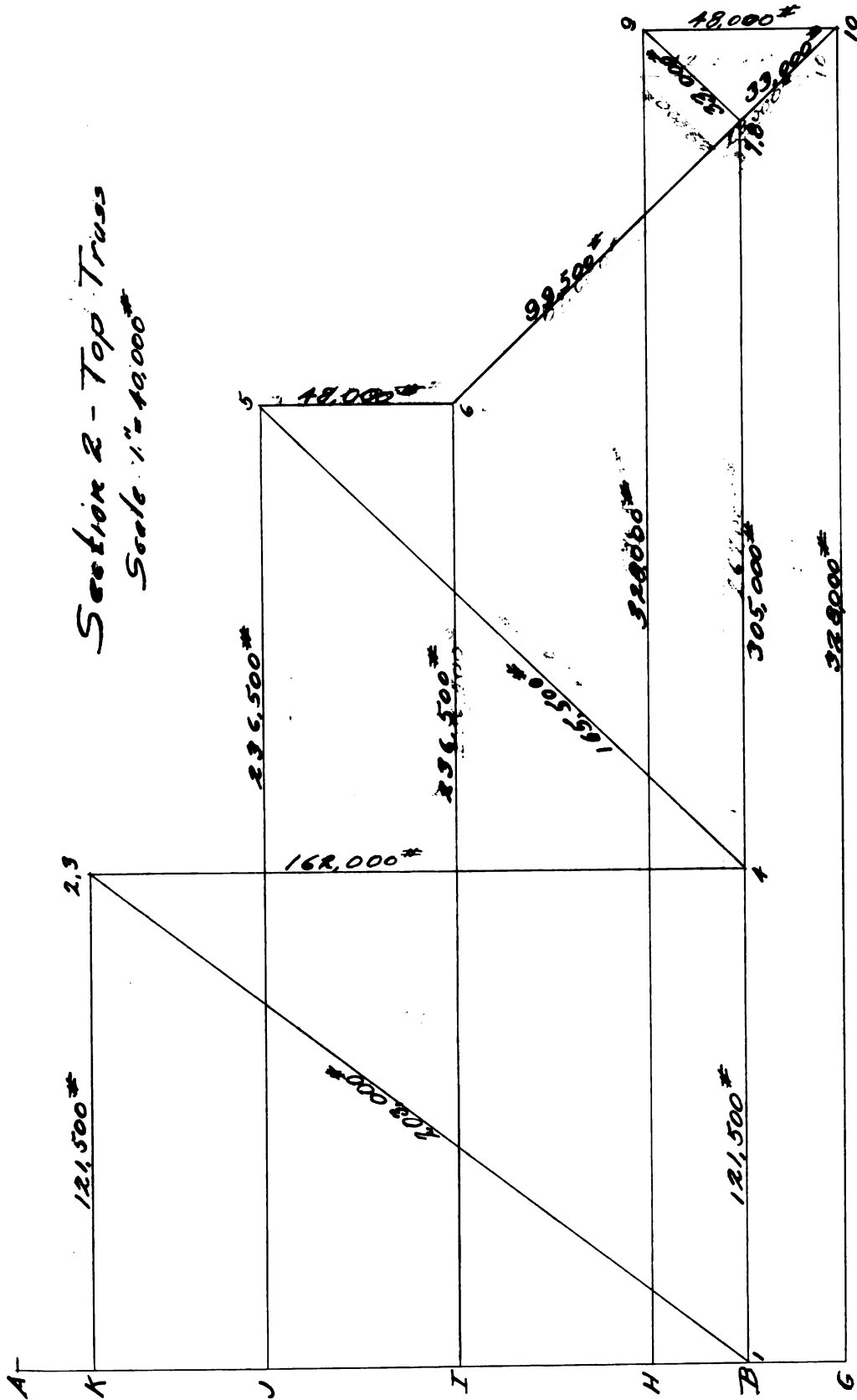


Section 1 - Top Truss
Scale 1" = 50,000'

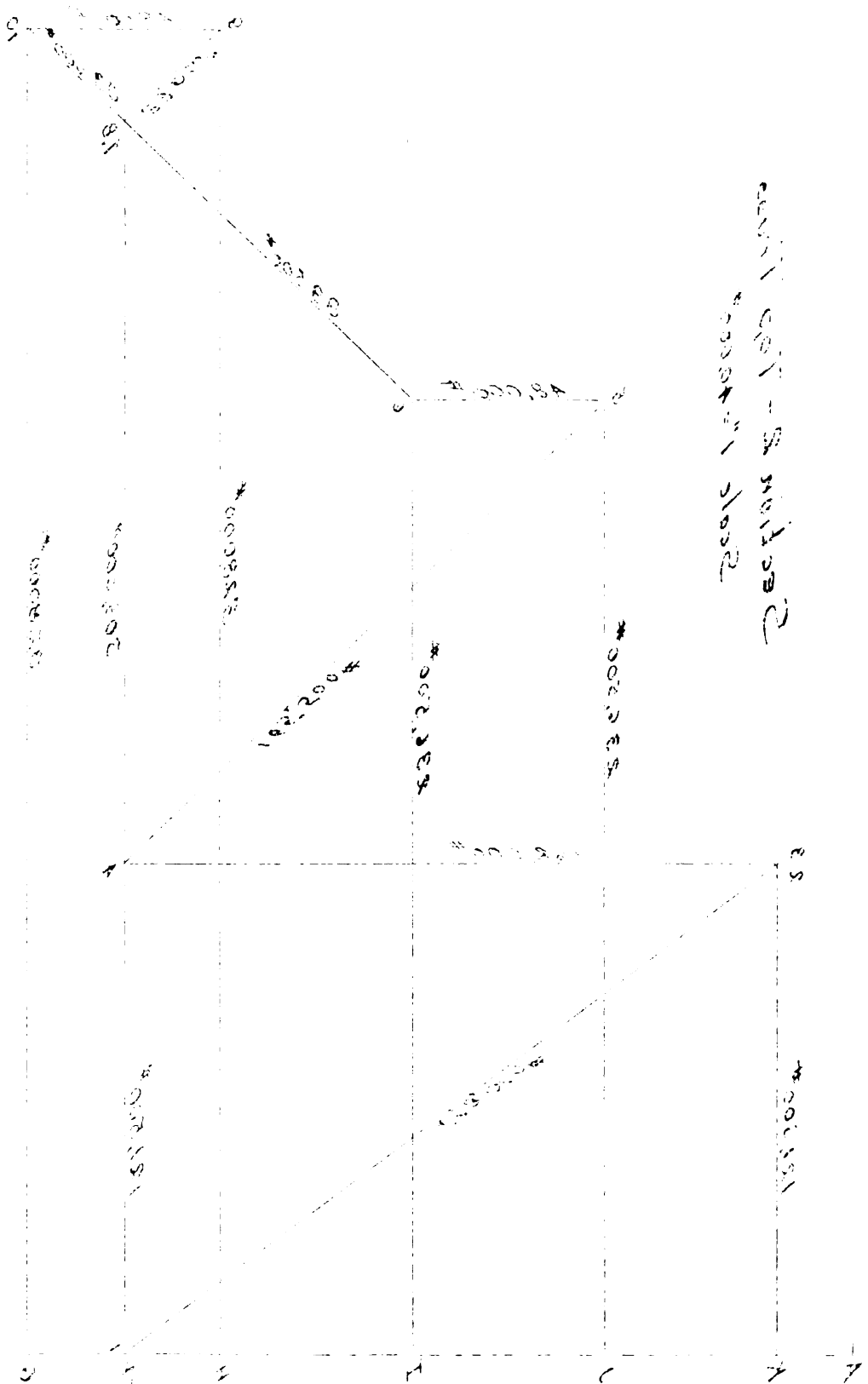


Section 2 - Bottom Truss
Scale 1" = 40,000"

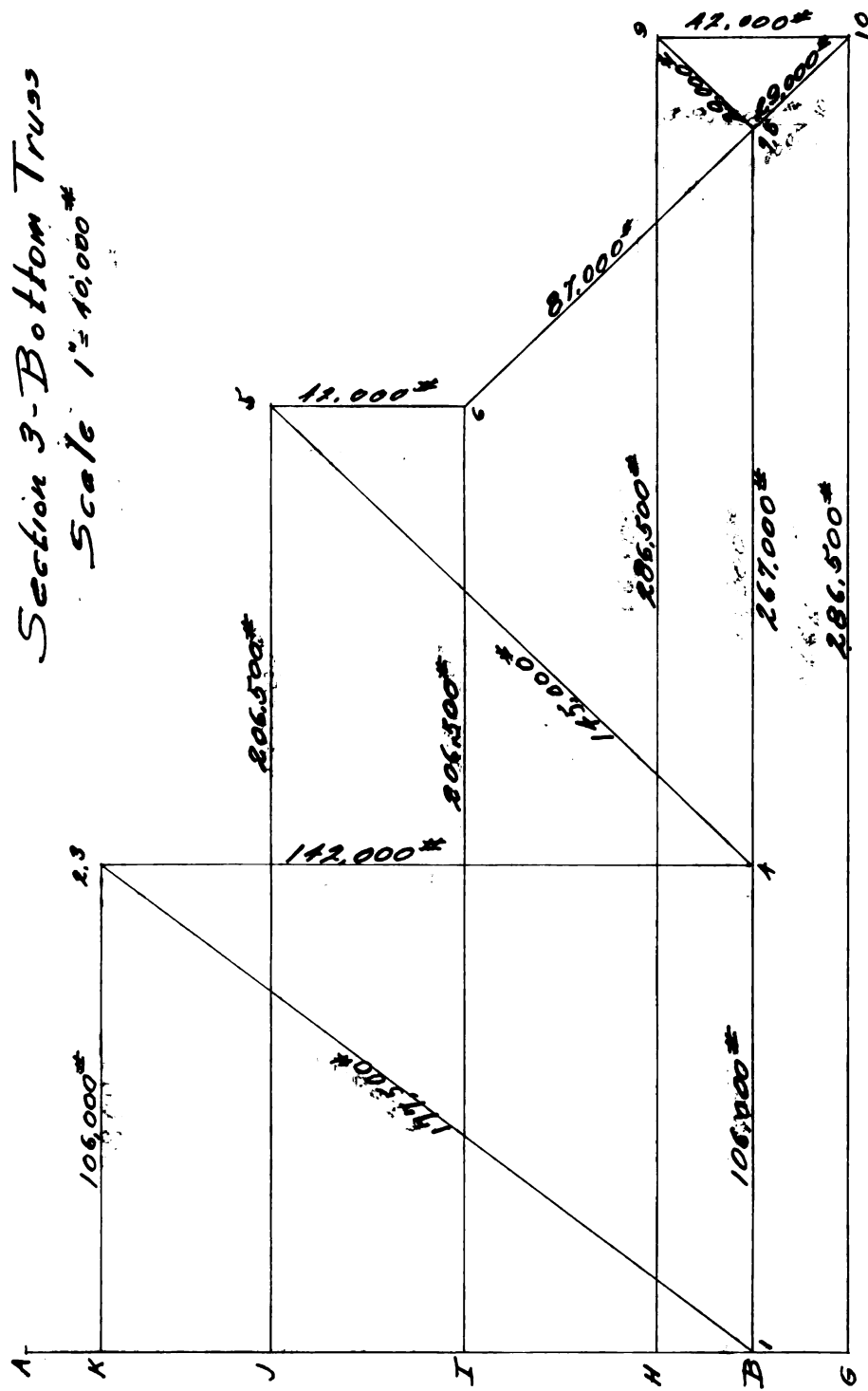




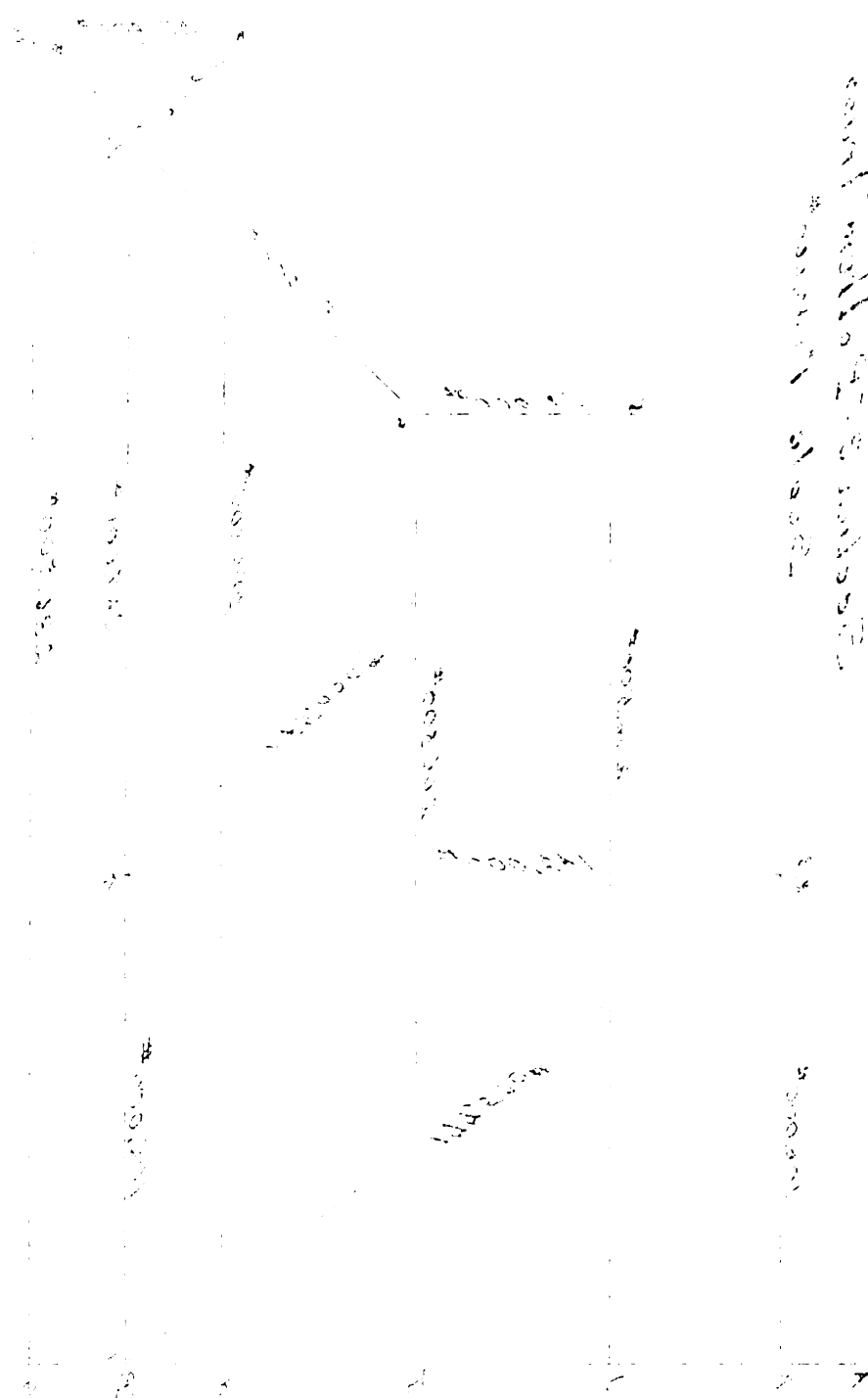
2001 061 - 801332
 20000000 2000



Section 3-Bottom Truss
Scale 1"=10,000'

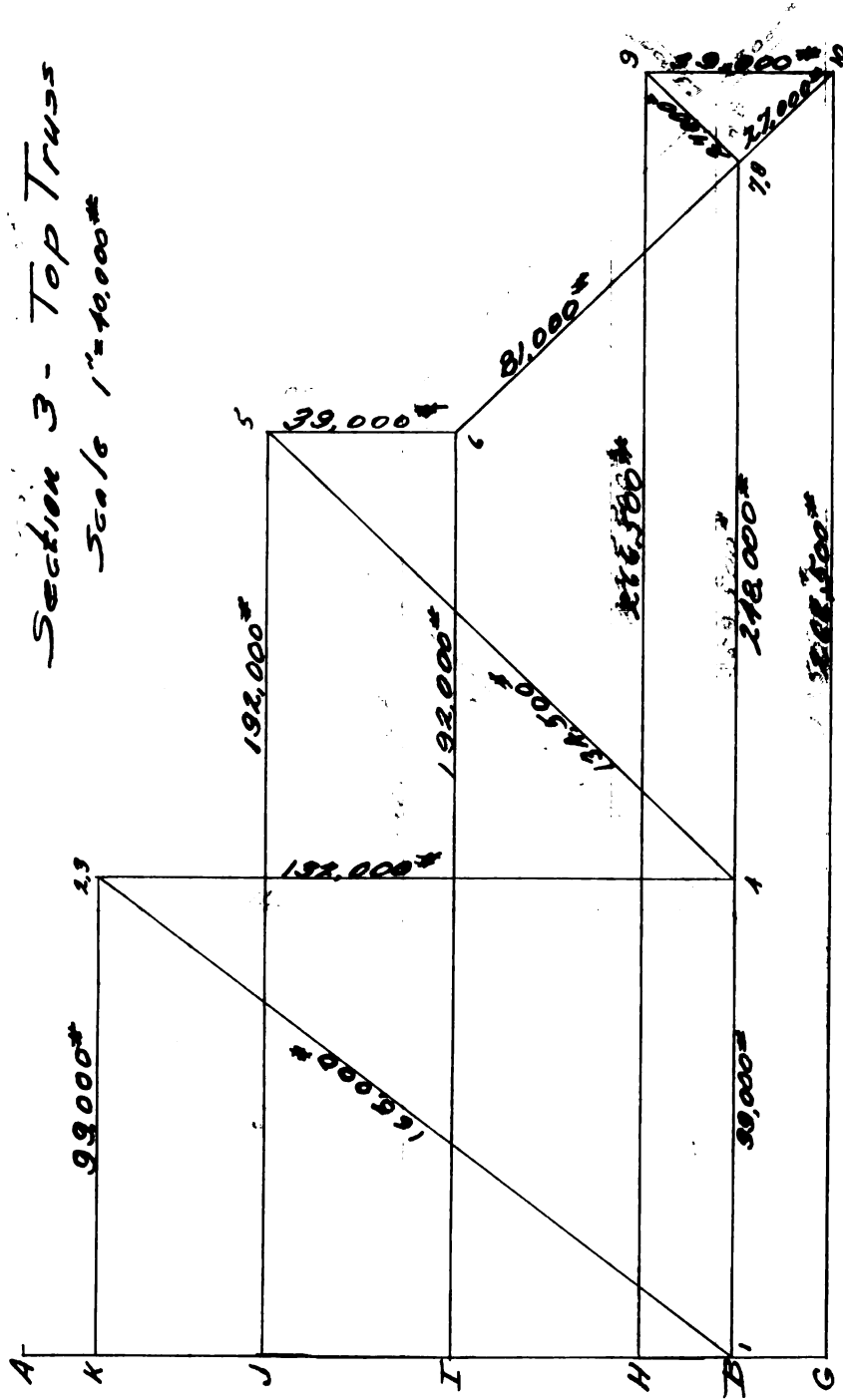


1000 1000 1000
 1000 1000 1000
 1000 1000 1000

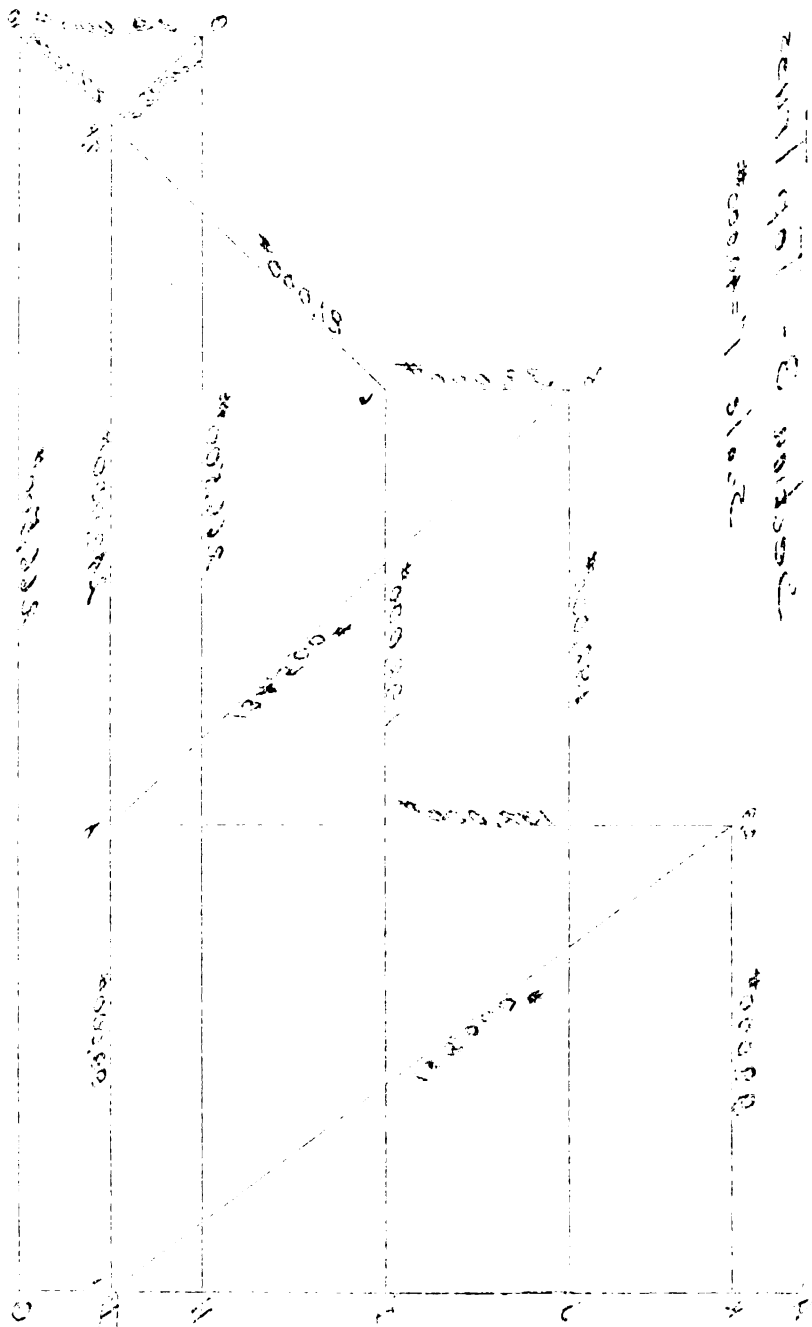


Section 3 - Top Truss

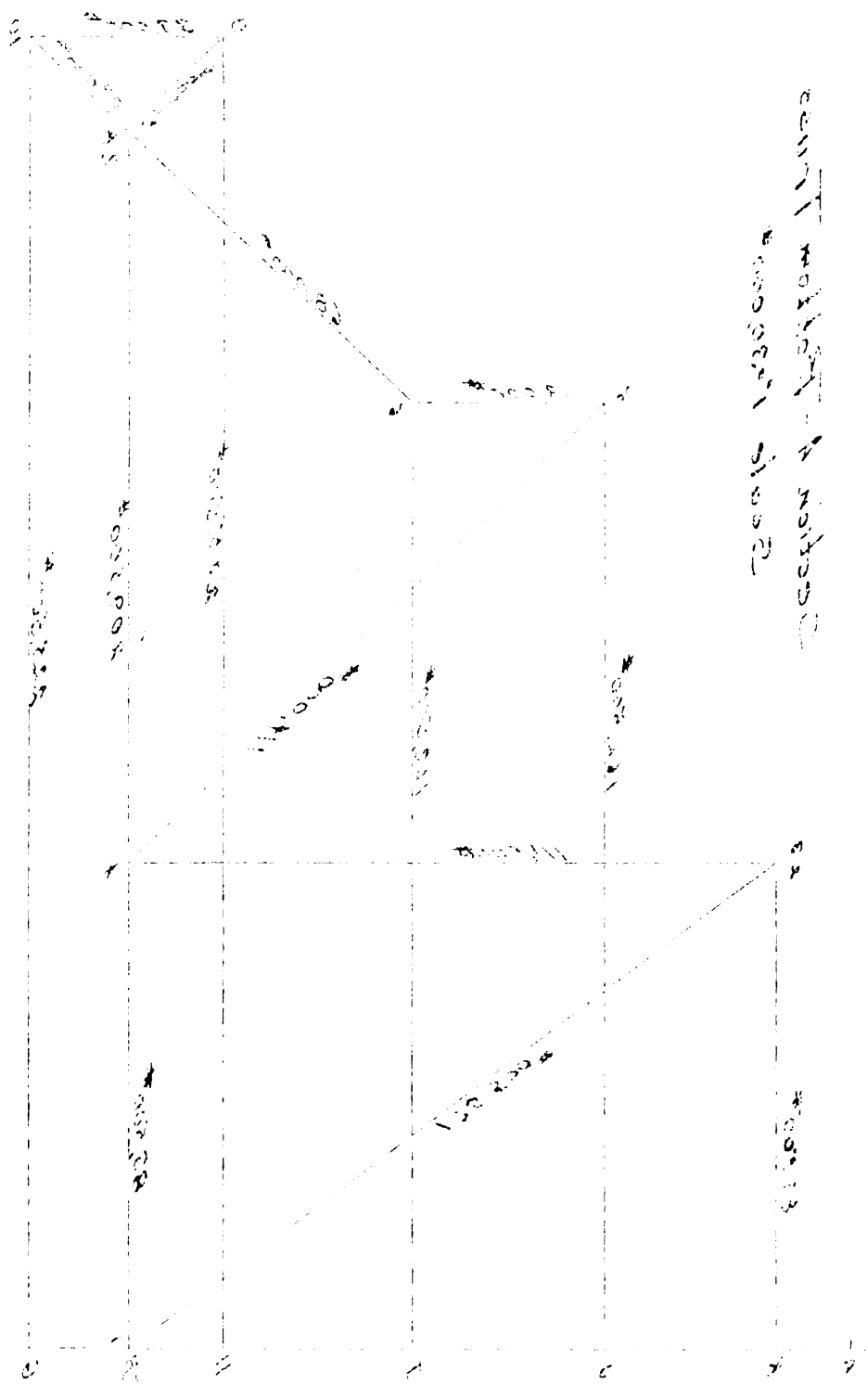
Scale 1"=40,000'



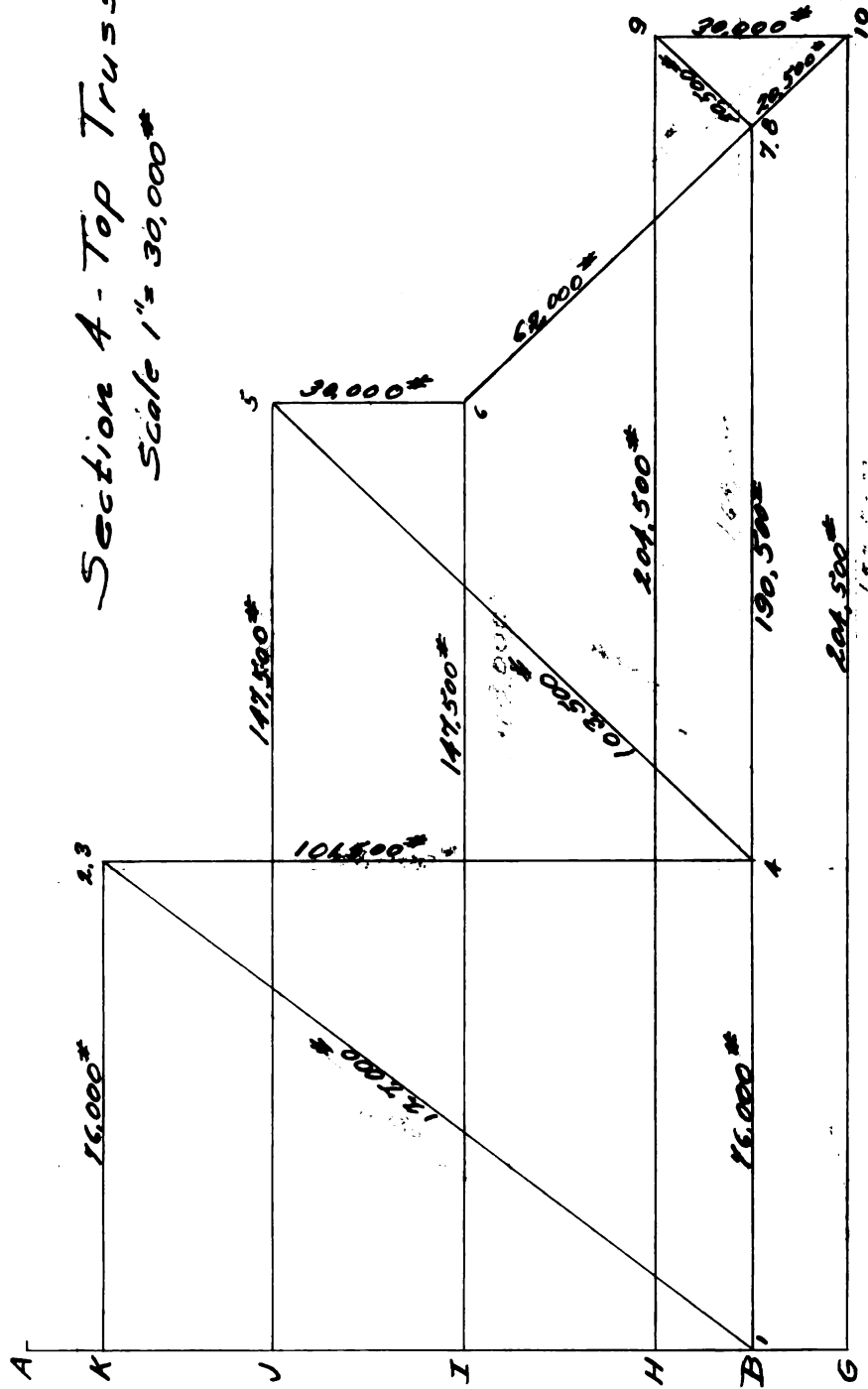
2000/0001 - 00000000
 00000000 00000000



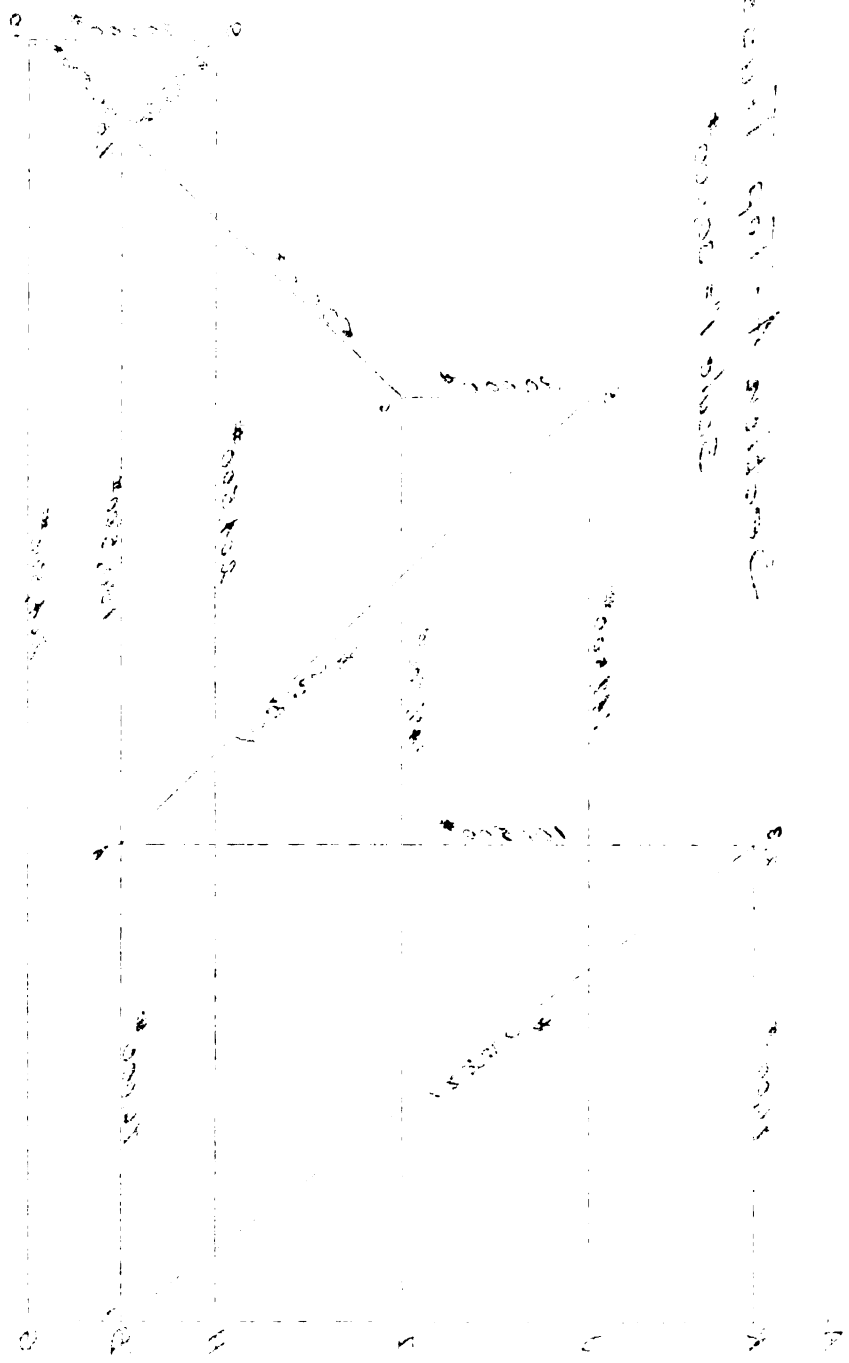
[Illegible handwritten notes]



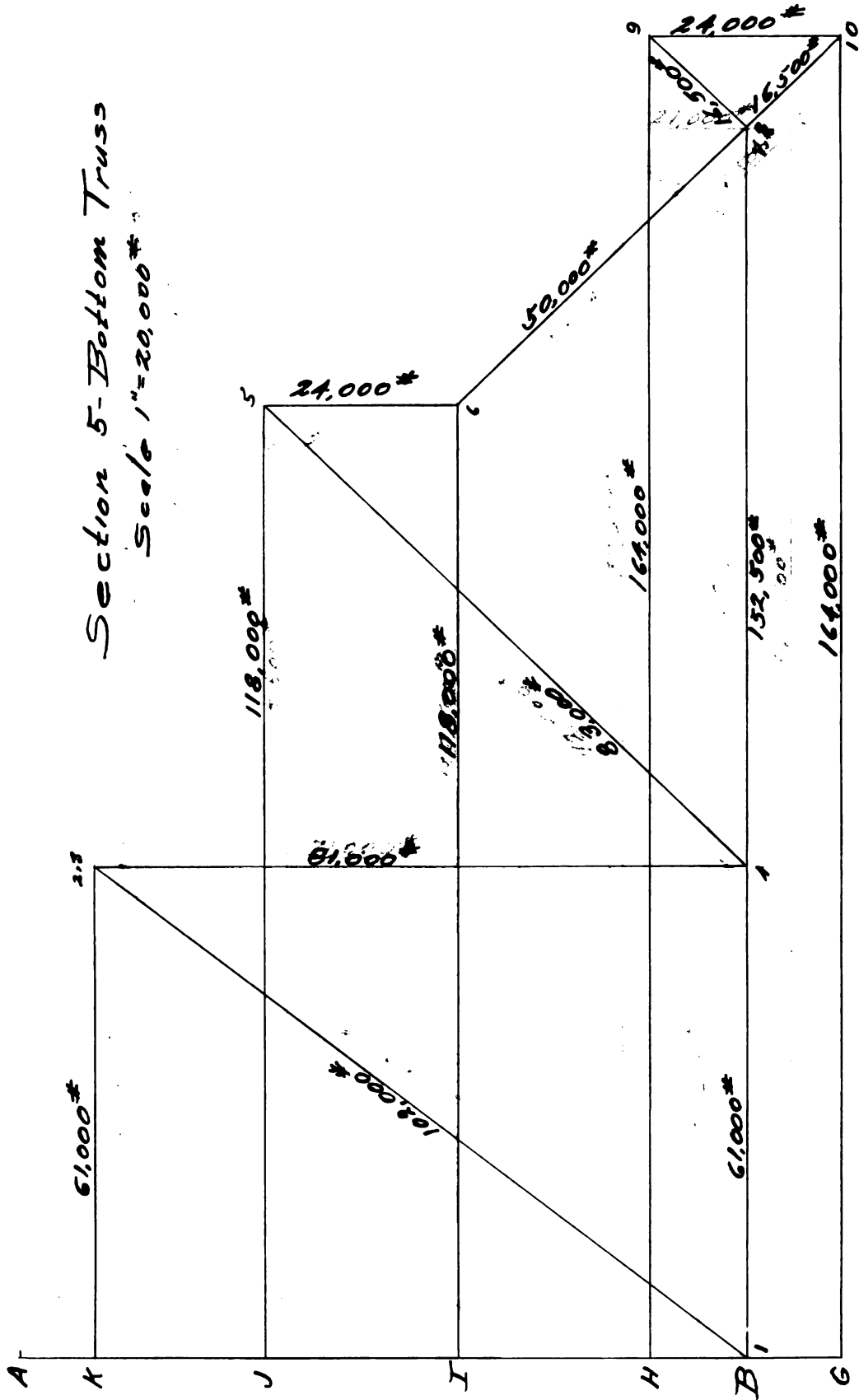
Section 4 - Top Truss
Scale 1" = 30,000'

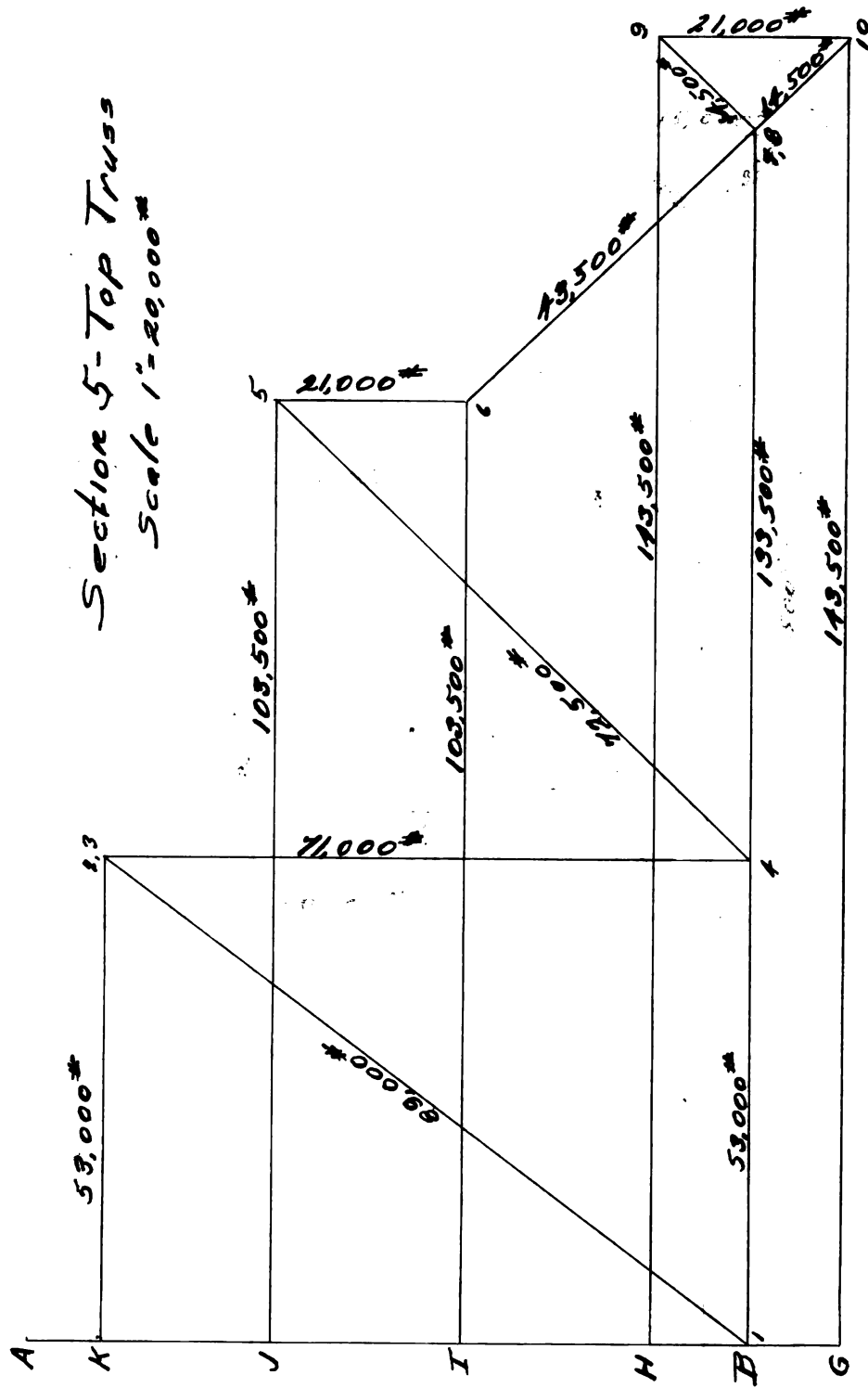


2000 ft. - 1000 ft.
 1000 ft. - 0 ft.

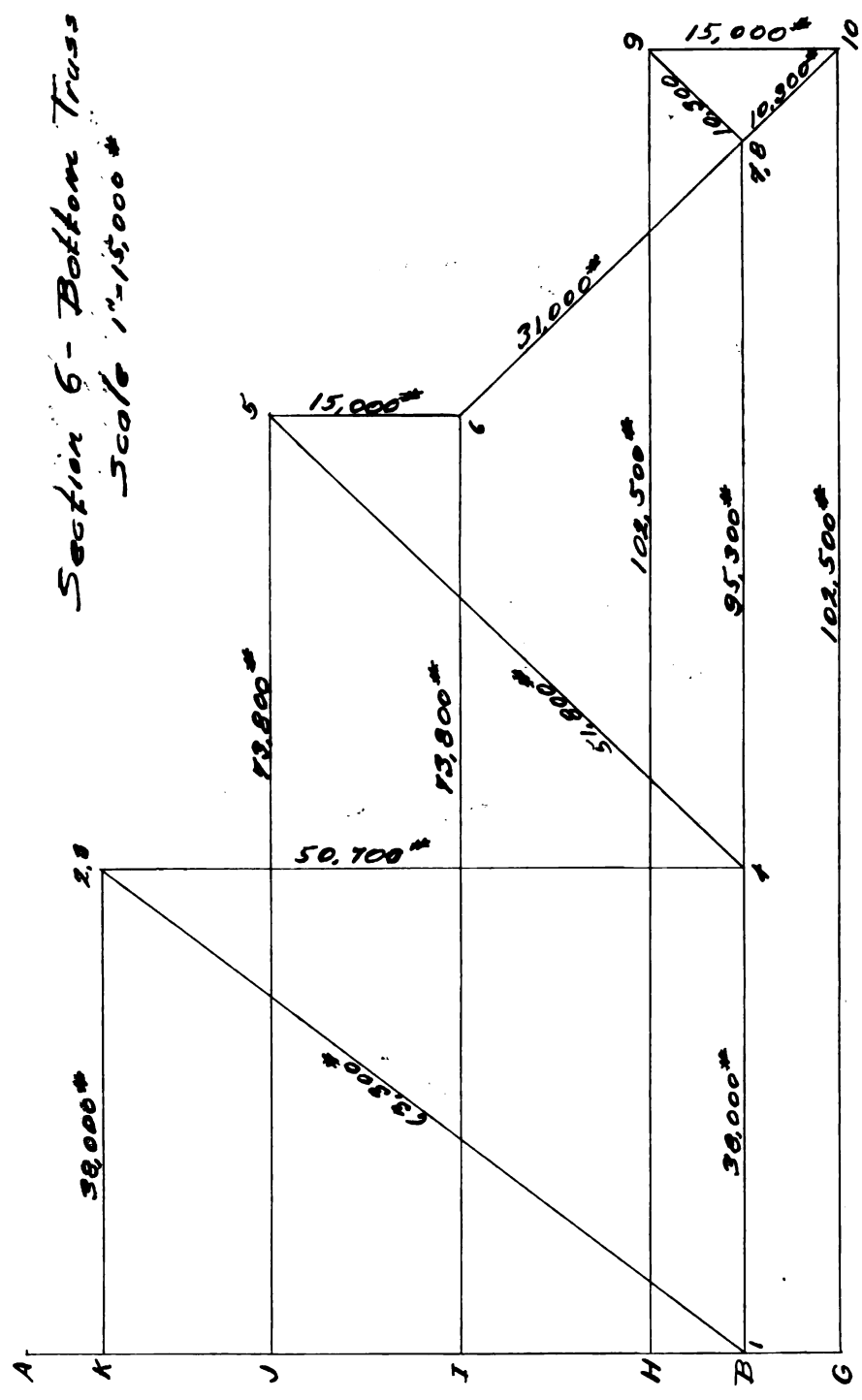


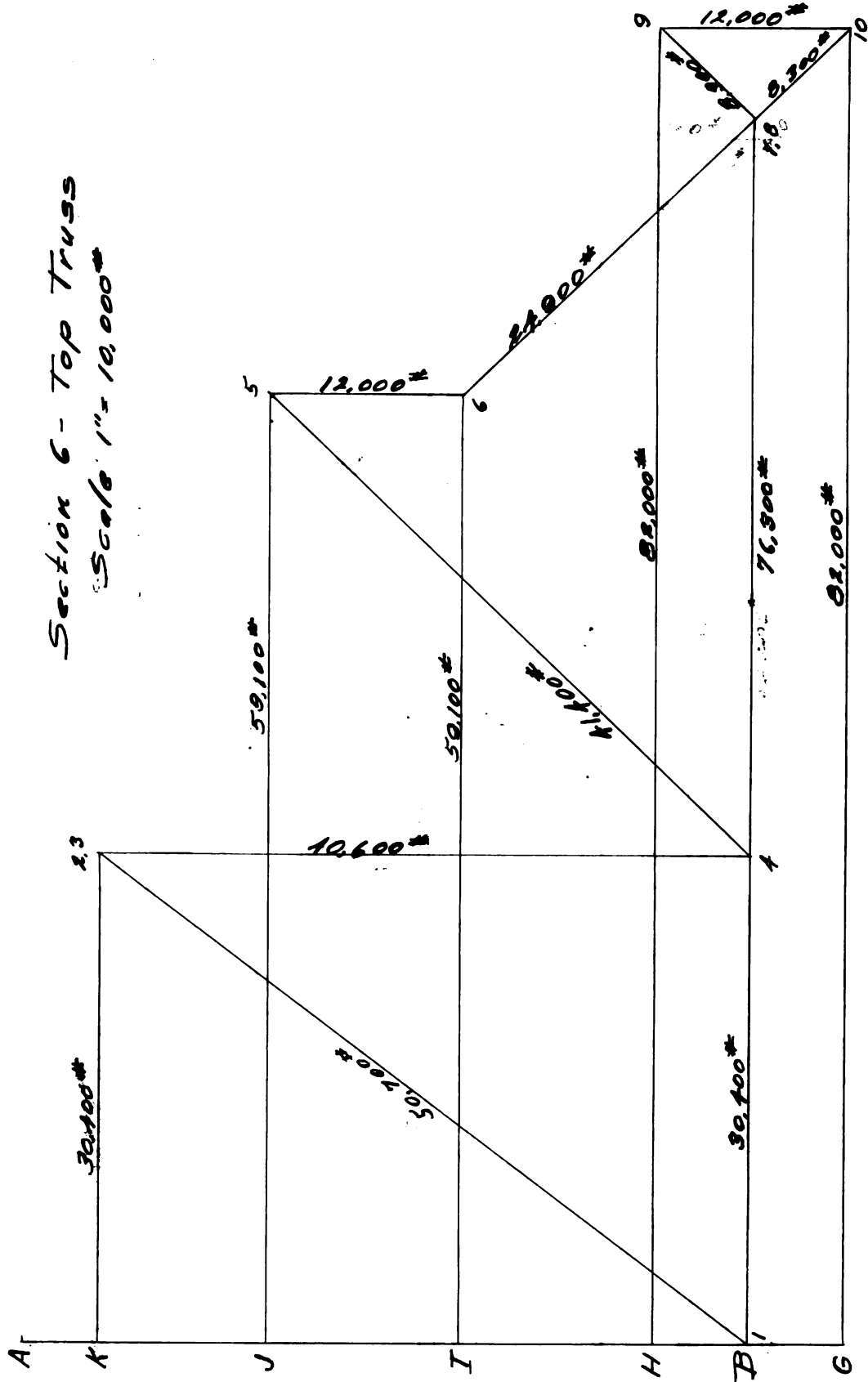
Section 5-Bottom Truss
Scale 1"=20,000'





Section 6 - Bottom Truss
Scale 1"=15,000'



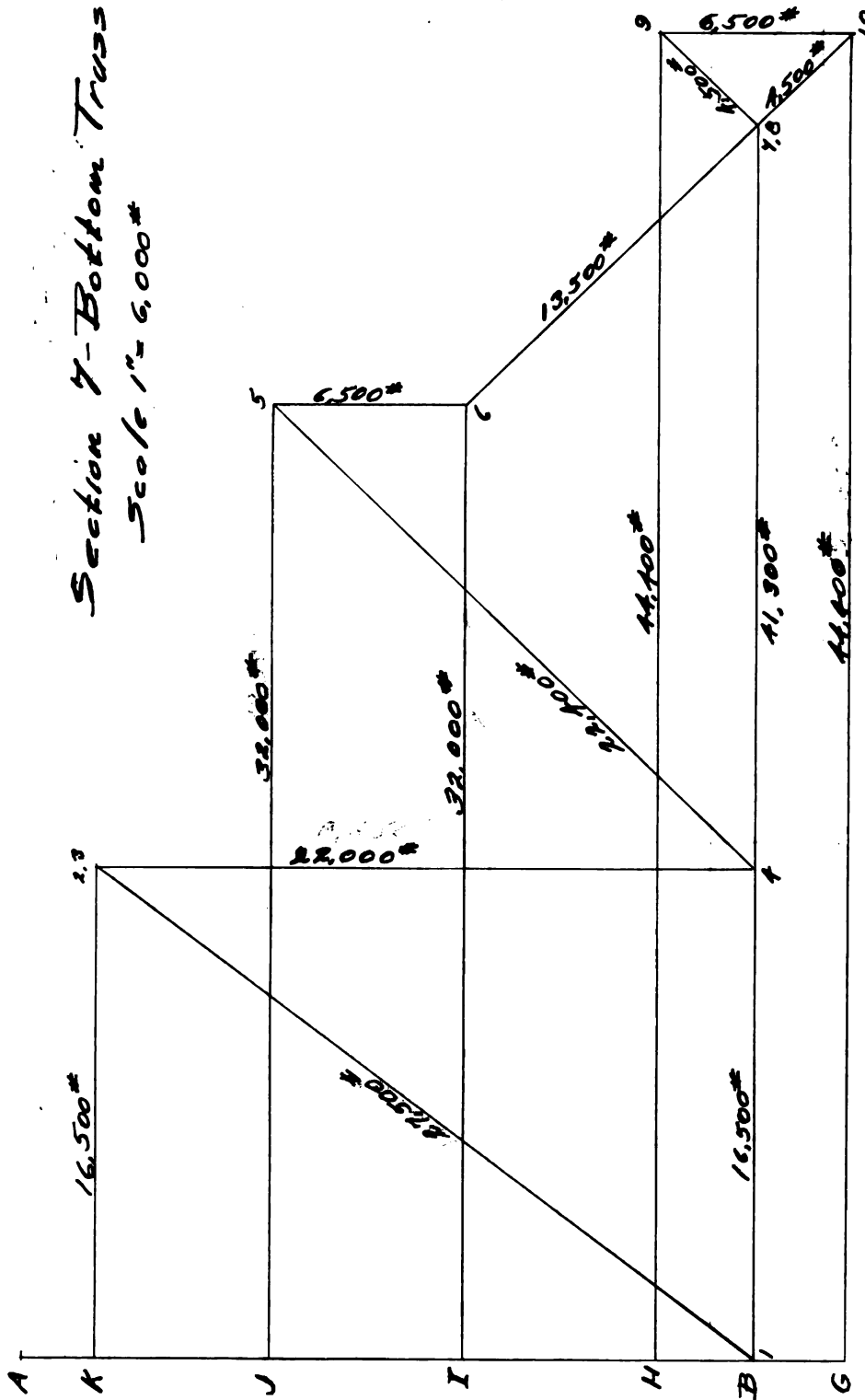


[illegible]

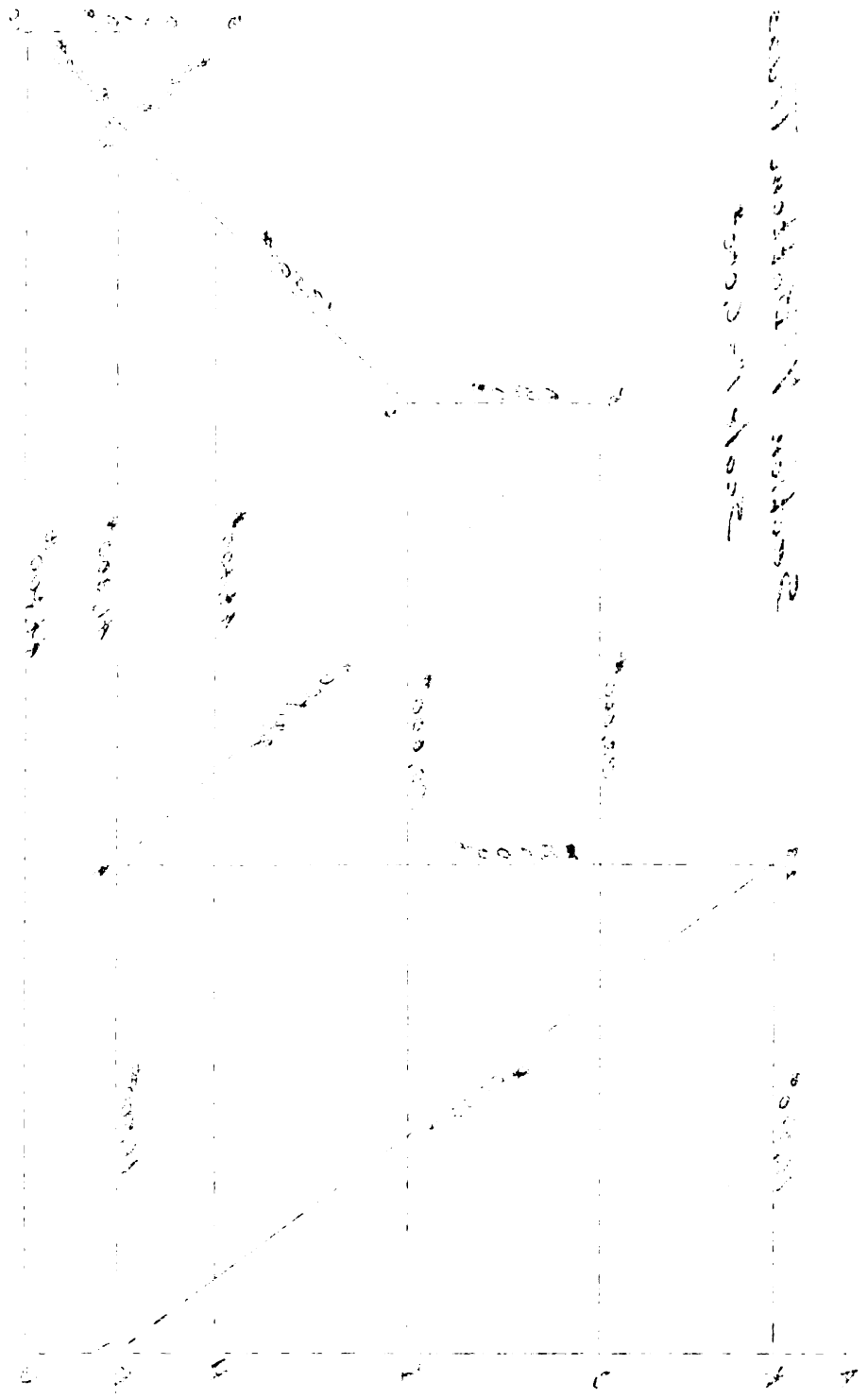
٢٠٠

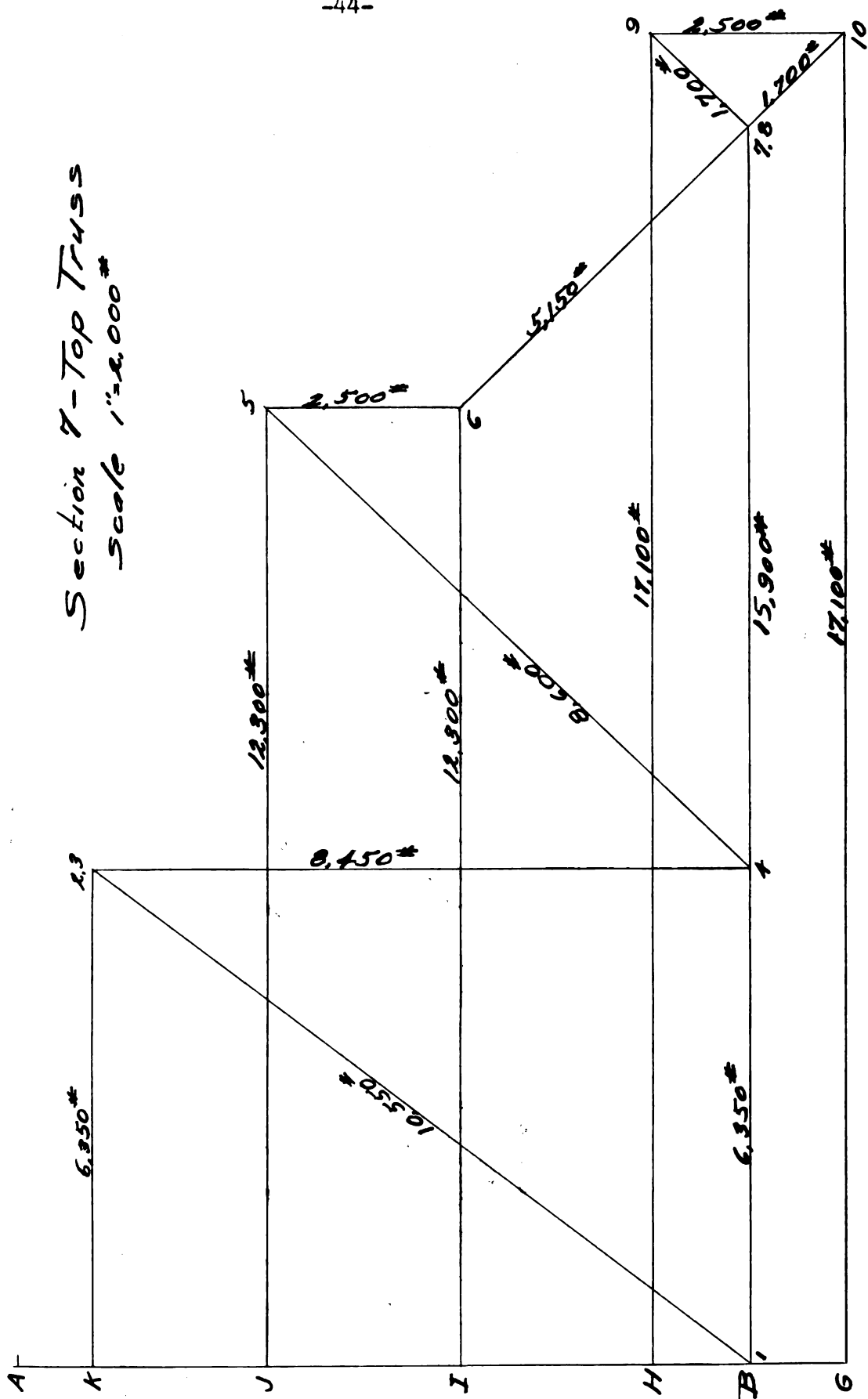
226

Section 7-Bottom Truss
Scale 1" = 6,000'

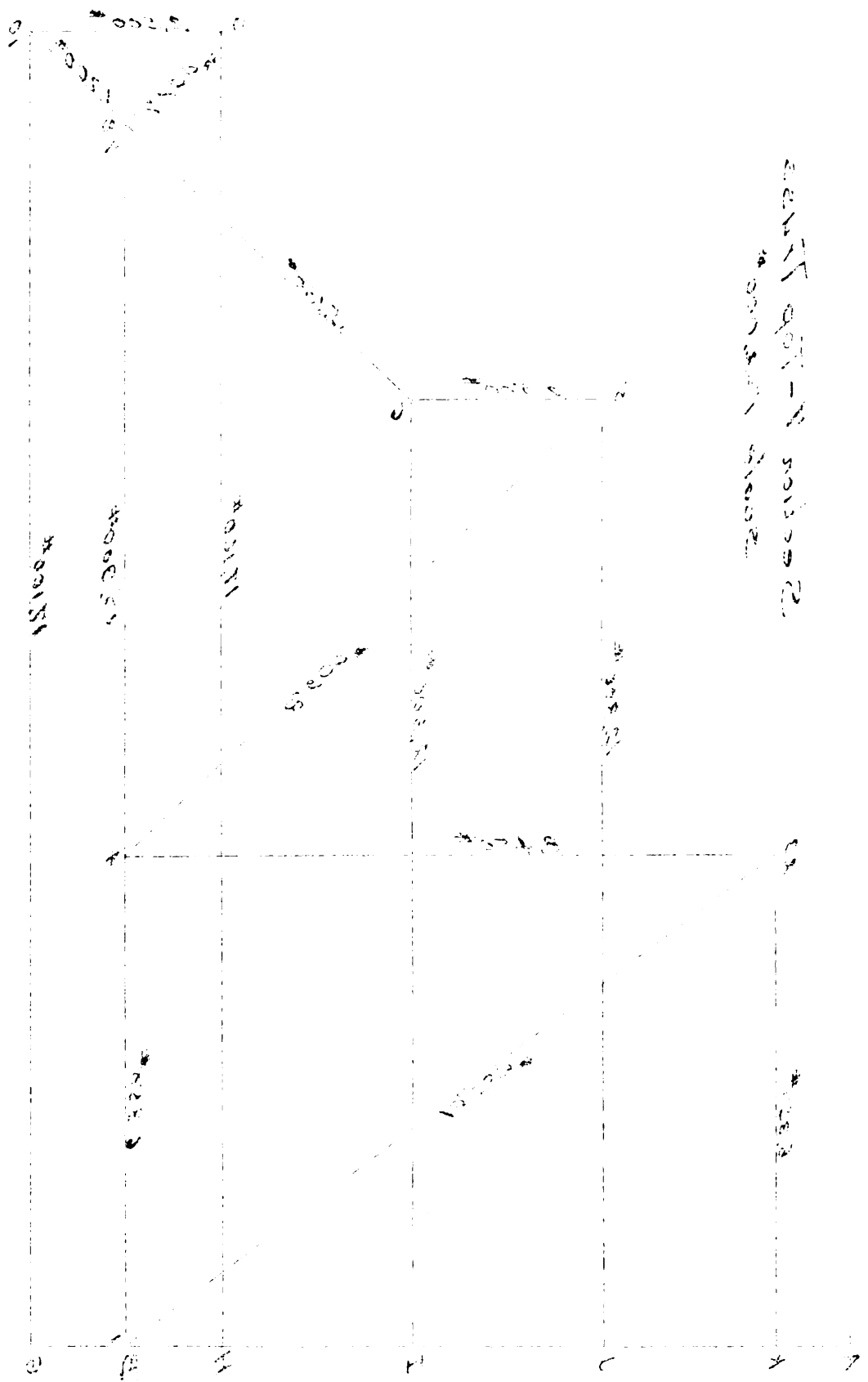


2004 10 0000
 2004 10 0000
 2004 10 0000

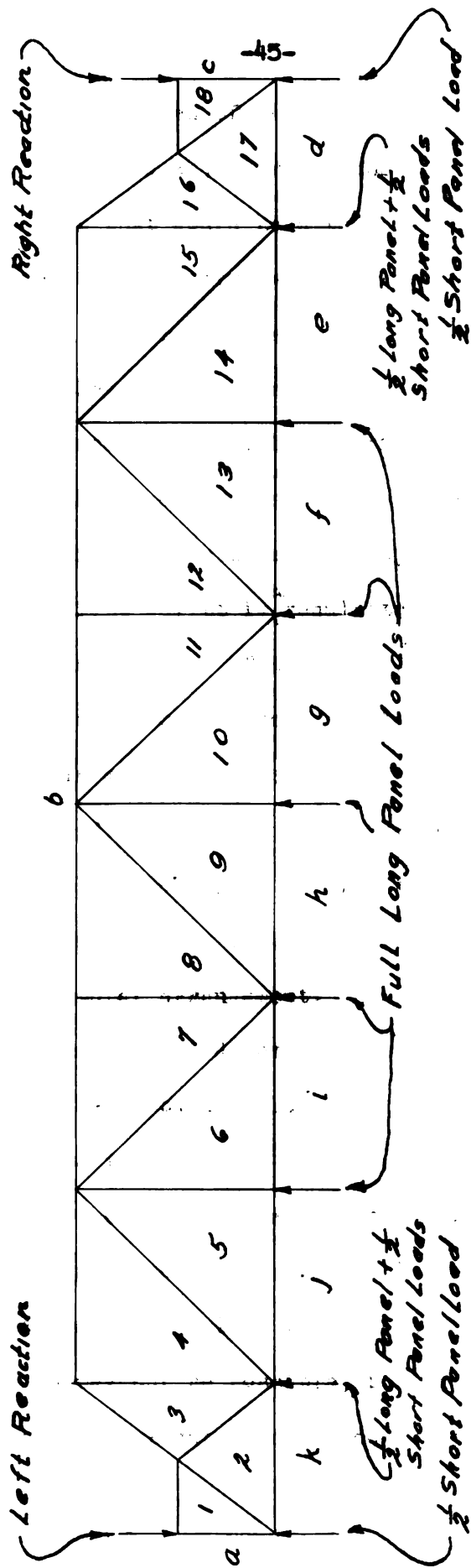




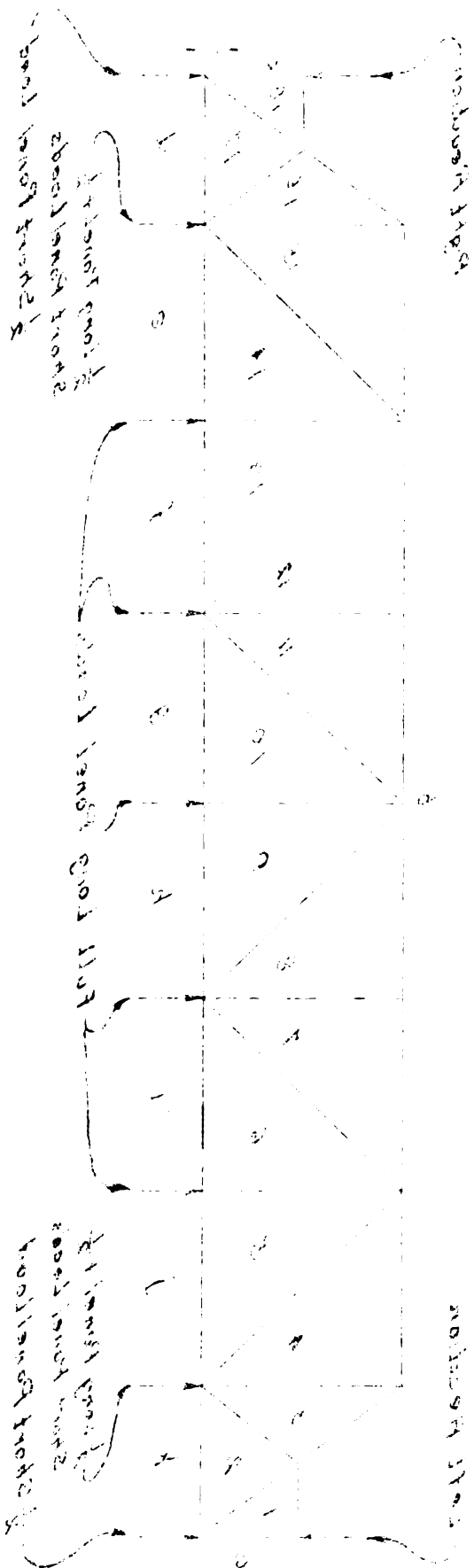
2000000
 2000000
 2000000



Horizontal Truss



2205 1000000000



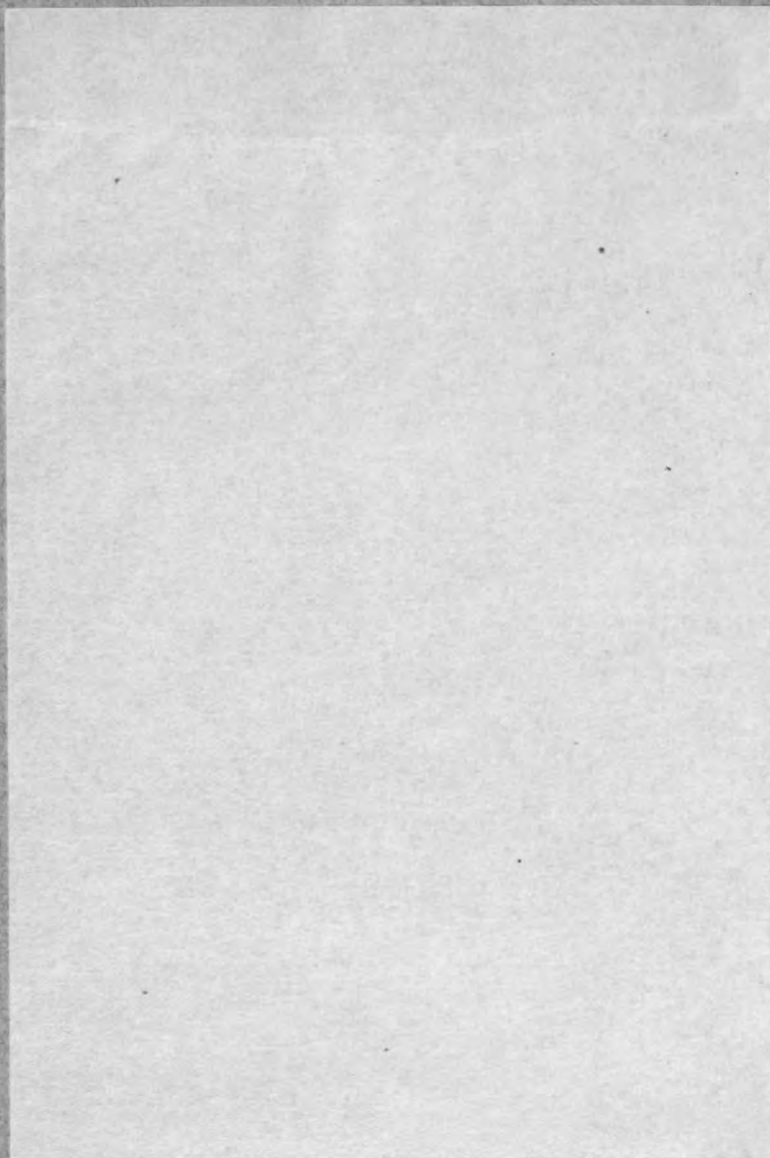
By having the stresses of the different members of each truss compiled, as on pages 27 to 29, there is one thing that is very obvious. The amount of steel that would have to be used to construct a movable dam of this type would be very large. This conclusion is drawn by checking in the compression members. These have the largest stresses of any of the members. As they are compression members, the unit stresses in the members may be reduced to as little as 16,000 # / sq. in. This would make the size of these members very large, and the weight a large amount. With this large weight, I believe the project would be economically impracticable; as light weight is ^a requisite of this type of dam.

Therefore, another type of dam should be tried. The only other type of dam that I can think of is one where the members would be mostly tension members. This would be something like a folding drum dam. That is, all of the dam would be placed under water until put in use. When it is put in use, the folds would pull up from the bottom of the canal. The folds, of course, would have to be anchored to the bottom of the canal by ties or some similar arrangement. However, the objection that I have to this type is that it could not be easily inspected. In fact the only way that it could be checked would be to raise it into the position that it would be in when in use.

In conclusion, about all that I can say is that more research must be done on different types of dams for this canal until some one is found that is more economically suited to the conditions than the ones that I have tried. This may not be possible, but it should be tried. Further investigation and experimentation has not been done here as time does not permit it.

the first of these is the fact that the
the second is the fact that the
the third is the fact that the
the fourth is the fact that the
the fifth is the fact that the
the sixth is the fact that the
the seventh is the fact that the
the eighth is the fact that the
the ninth is the fact that the
the tenth is the fact that the
the eleventh is the fact that the
the twelfth is the fact that the
the thirteenth is the fact that the
the fourteenth is the fact that the
the fifteenth is the fact that the
the sixteenth is the fact that the
the seventeenth is the fact that the
the eighteenth is the fact that the
the nineteenth is the fact that the
the twentieth is the fact that the
the twenty-first is the fact that the
the twenty-second is the fact that the
the twenty-third is the fact that the
the twenty-fourth is the fact that the
the twenty-fifth is the fact that the
the twenty-sixth is the fact that the
the twenty-seventh is the fact that the
the twenty-eighth is the fact that the
the twenty-ninth is the fact that the
the thirtieth is the fact that the
the thirty-first is the fact that the
the thirty-second is the fact that the
the thirty-third is the fact that the
the thirty-fourth is the fact that the
the thirty-fifth is the fact that the
the thirty-sixth is the fact that the
the thirty-seventh is the fact that the
the thirty-eighth is the fact that the
the thirty-ninth is the fact that the
the fortieth is the fact that the
the forty-first is the fact that the
the forty-second is the fact that the
the forty-third is the fact that the
the forty-fourth is the fact that the
the forty-fifth is the fact that the
the forty-sixth is the fact that the
the forty-seventh is the fact that the
the forty-eighth is the fact that the
the forty-ninth is the fact that the
the fiftieth is the fact that the
the fifty-first is the fact that the
the fifty-second is the fact that the
the fifty-third is the fact that the
the fifty-fourth is the fact that the
the fifty-fifth is the fact that the
the fifty-sixth is the fact that the
the fifty-seventh is the fact that the
the fifty-eighth is the fact that the
the fifty-ninth is the fact that the
the sixtieth is the fact that the
the sixty-first is the fact that the
the sixty-second is the fact that the
the sixty-third is the fact that the
the sixty-fourth is the fact that the
the sixty-fifth is the fact that the
the sixty-sixth is the fact that the
the sixty-seventh is the fact that the
the sixty-eighth is the fact that the
the sixty-ninth is the fact that the
the seventieth is the fact that the
the seventy-first is the fact that the
the seventy-second is the fact that the
the seventy-third is the fact that the
the seventy-fourth is the fact that the
the seventy-fifth is the fact that the
the seventy-sixth is the fact that the
the seventy-seventh is the fact that the
the seventy-eighth is the fact that the
the seventy-ninth is the fact that the
the eightieth is the fact that the
the eighty-first is the fact that the
the eighty-second is the fact that the
the eighty-third is the fact that the
the eighty-fourth is the fact that the
the eighty-fifth is the fact that the
the eighty-sixth is the fact that the
the eighty-seventh is the fact that the
the eighty-eighth is the fact that the
the eighty-ninth is the fact that the
the ninetieth is the fact that the
the ninety-first is the fact that the
the ninety-second is the fact that the
the ninety-third is the fact that the
the ninety-fourth is the fact that the
the ninety-fifth is the fact that the
the ninety-sixth is the fact that the
the ninety-seventh is the fact that the
the ninety-eighth is the fact that the
the ninety-ninth is the fact that the
the hundredth is the fact that the

ROOM USE ONLY



MICHIGAN STATE UNIVERSITY LIBRARIES



3 1293 03168 8819