

CARLYLE C. WALTZ



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A TEST OF THE IPAN FLOOR
IN FLEXTURE

THESIS FOR THE DEGREE OF B. S.
Carlyle C. Waltz
1932

THESIS

Floors

Civil engineering Structural engineering

**A Test of the IPAN Floor
in Flexure**

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

By

Carlyle C. Waltz

**Candidate for the Degree of
Bachelor of Science**

June 1932

THESIS

The writer wishes to acknowledge his sincere thanks to Mr. H. W. Schick for the materials used to carry out this test. He also wishes to thank Mr. C. L. Allen and Mr. W. E. Reuling for suggestions and constructive criticisms.

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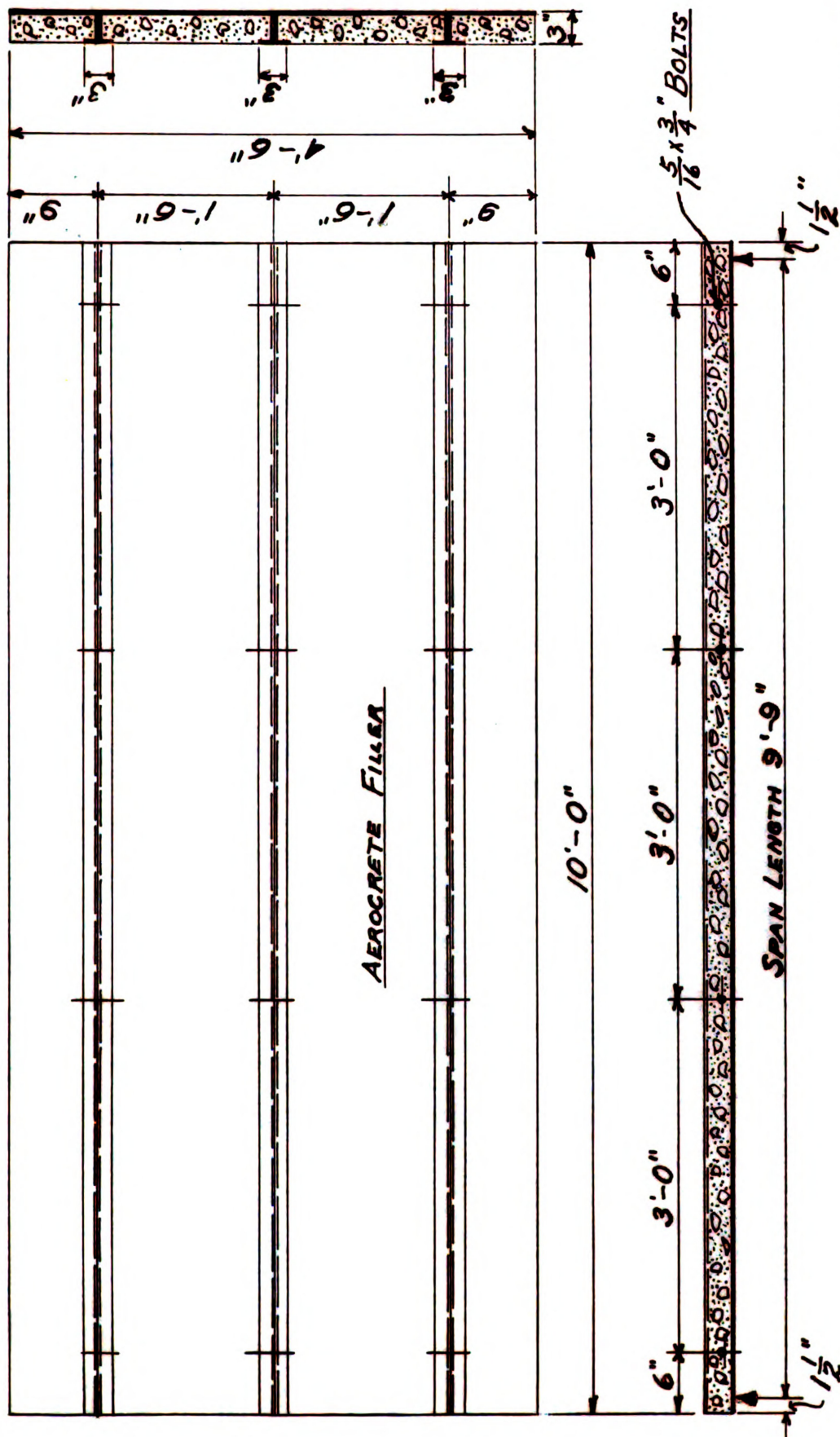
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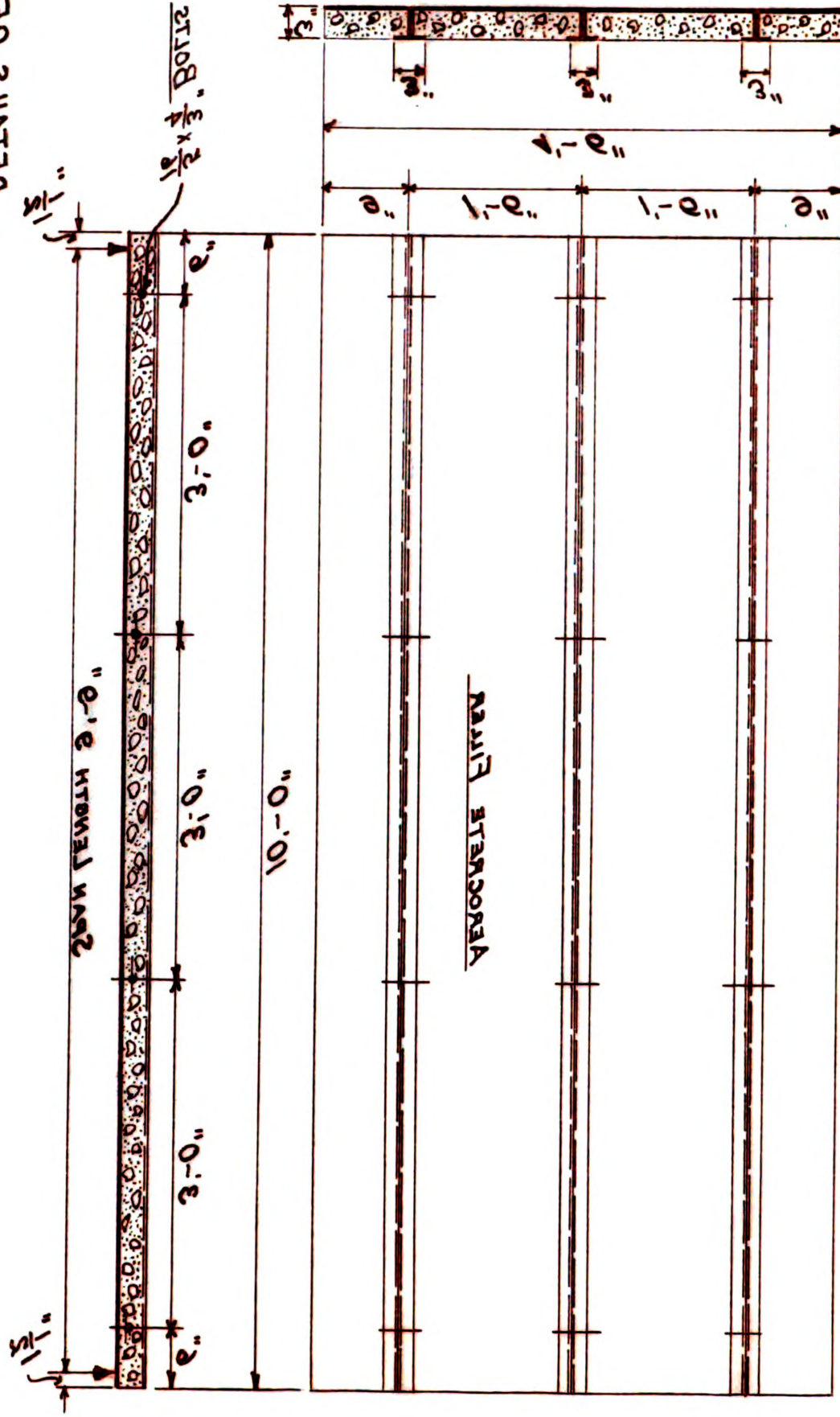


**DETAILS OF
THE IPAN FLOOR
TESTED**

NOTE:
ALL SECTIONS MADE OF #12 GAGE STRUCTURAL STEEL

NOTE: ALL SECTIONS MADE OF 1/2" GALV STEEL

TESTED
THE IRON FLOOR
DETAILS OF





THE TEST APPARATUS WITH FLOOR SLAB

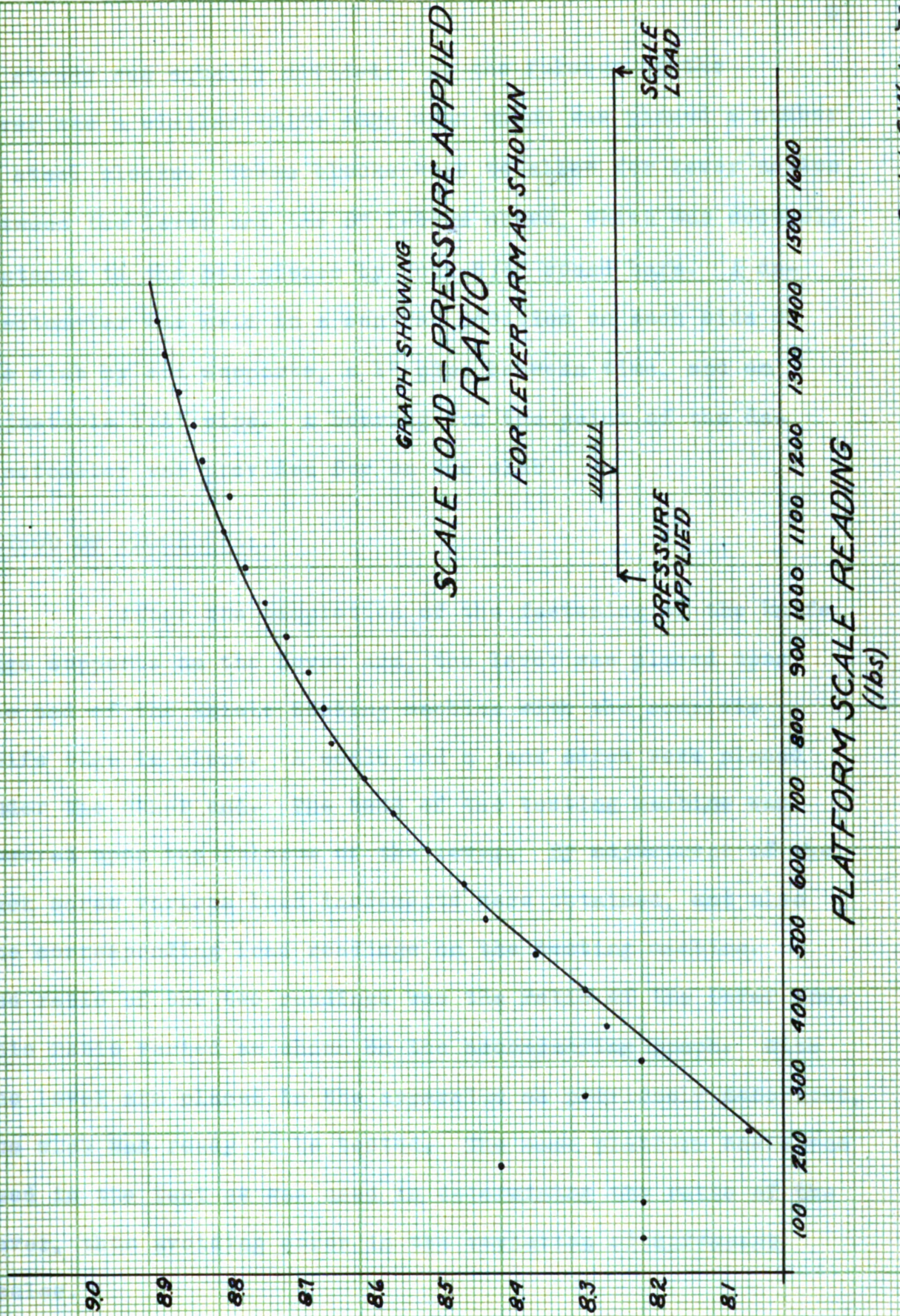
OBJECT:

The object of this test is twofold: first, to measure the deflection for various loads, and, second, to determine the permanent set which would occur by repeated loading. The determination of these points by the use of a representative sample of the IPAN floor can easily be used as subject matter for comparison with similar floors of different lengths of span and depths.

THE TEST APPARATUS:

The type of loading chosen was what is known as the two-point loading. The loads were applied at the one-third points. By referring to the photograph it will be seen how the test apparatus was constructed. Two 12" channels formed bed pieces upon which two 8" I-beams were placed crosswise on 9'-9" centers. Two 1/2" round bars, placed upon these I-beams, formed the supports, upon which the floor slab was placed. The load was applied by a simple lever and a jack screw. The lever was supported at one end by a knife edge upon the jack screw, which was placed upon a platform scale. The other end also rested upon a knife edge placed upon a specially constructed structure. This structure consisted of two 6" I-beams 4'-6" long bolted to two similar beams such that the former were 3'-3" on centers. On the under surface there were spot welded two 1/2" round bars. The knife edge was so located on the structure that the flow

$$\text{CONSTANT} = \frac{\text{LOAD APPLIED}}{\text{SCALE RDG}}$$



Carlyle C. Walitz 32

of stress was equally divided. At the fulcrum of the lever was a similar knife edge upon which was placed a number of steel blocks. These blocks were to allow for lever action between the lever and the 8" I-beam above, which was securely fastened to the bed pieces by four $3/4$ " round bars. A deflectometer was held in a central position on each side of the slab by end supports, a 1" pipe between time, and an adjustable $1/4$ " pipe. A bearing for the point of the deflectometer was provided for on the slab.

METHOD OF PROCEDURE:

After the completion of the fastening of the knife edge supports on the lever arm, the lever was placed upon the bed of the Rhiele testing machine with the complete knife edge in place. A scale and a jack screw were placed under the other end. The head of the testing machine was lowered upon the fulcrum of the lever. By adjustment of the jack screw various load increments were obtained, and also the corresponding load readings on the testing machine. The ratio of the two readings was the ratio of the lever arm. This ratio varied as shown on the accompanying graph. With the lever arm placed in the apparatus as previously described, the slab was ready to be tested. The same platform scale was used in the test as was used in determining the ratio of the lever, thus avoiding error in the variation of different scales.

Before each load was applied, the initial reading of the deflectometers was recorded. The first load increment was applied on the scale by the jack screw, and the deflectometer readings recorded. The load was completely removed and the deflectometer readings again recorded. Each load increment was applied and completely removed ten times as described above. Load increments varied by 50 lbs. from 200 lbs. up to 950 lbs., when the deflection became too great to be recorded on the deflectometers. At this time the gages were removed and an increasing load applied until the maximum was obtained. When all data was taken, the apparatus was dismantled.

RESULTS:

Platform Scale Rdg. (lbs)	Ratio of lever (from graph)	Total Live Load Applied (lbs) (Q + 250)	Equivalent Live Load (lbs per sq.ft.)	Total Load Equivalent (lbs. per sq.ft.)	Average Deflection (1/1000")	Average Set (1/1000")
200	8.05	1860	56.6	77.4	142.0	.8
250	8.11	2280	69.3	89.9	182.7	.4
300	8.17	2700	82.1	102.7	222.7	.2
350	8.23	3130	95.3	115.9	270.5	.0
400	8.29	3570	108.5	129.1	329.9	.8
450	8.35	4010	121.8	142.4	350.3	.4
500	8.40	4450	135.3	155.9	394.5	.4
550	8.46	4900	148.9	169.5	435.6	.1
600	8.50	5350	162.5	183.1	476.3	.1
650	8.55	5810	176.5	197.1	516.6	.6
700	8.59	6270	190.7	211.3	550.5	.2
750	8.63	6720	204.3	224.9	592.4	.9
800	8.66	7170	217.8	238.4	640.2	5.1
850	8.69	7630	232.0	252.6	684.0	1.4
900	8.72	8100	246.0	266.6	732.0	1.1
950	8.74	8560	260.0	280.6	769.5	3.0
1200	8.84	10850	330.0	350.6	-----	---

DATA:

MECHANICAL ENGINEERING LABORATORY
MICHIGAN STATE COLLEGE

Running Log of Lever Arm to measure in floor slab test
 ()

Observers { W. J. White } { } Date 5-8, 1932

Scale Testing
 1000 1000 1000
 1000 1000 1000
 1000 1000 1000
 1000 1000 1000

No.	A	B
1	500	410 8.20
2	1000	820 8.20
3	1500	1260 8.40
4	2000	1610 8.05
5	2500	2070 8.27
6	3000	2460 8.20
7	3500	2890 8.25
8	4000	3300 8.20
9	4500	3720 8.25
10	5000	4210 8.42
11	5500	4650 8.45
12	6000	5100 8.50
13	6500	5550 8.55
14	7000	6010 8.61
15	7500	6470 8.64
16	8000	6920 8.65
17	8500	7370 8.67
18	9000	7830 8.70
19	9500	8290 8.72
20	10000	8720 8.76
21	10500	9200 8.77
22	11000	9650 8.77
23	11500	10130 8.78
24	12000	10610 8.79
25	12500	11060 8.80

13000/1220 8.61
 13500/12510 8.79

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of *Experiments - 1 Test of IPAN Floor & Roof Construction in Flexure*

Observers {

Date *10/10/33*, 193 *33*

No.

1	1	0	74	75	
2		200	14 147	1	146 133
3	2	0	24	75	
4		200	14 146	1	147 143
5	3	0	24	74	
6		200	14 146	1	147 143
7	4	0	25	74	
8		200	14 145	1	148 141
9	5	0	25	74	
10		200	14 147	1	148 142
11	6	0	27	75	
12		200	23 140	1	146 143
13	7	0	27	74	
14		200	22 137	1	145 142
15	8	0	27	75	
16		200	22 137	1	146 141
17	9	0	25	72	
18		200	22 137	1	144 143
19	10	0	21	74	
20		200	25 146	1	147 146
21		0	14	72	

22

23

24

25

Derivative of strain
with respect to
flexure

Remarks:

Derivative of strain
with respect to
flexure

MECHANICAL ENGINEERING LABORATORY
MICHIGAN STATE COLLEGE

Running Log of Experimental Test of 10-11 Floor and Foot
Construction in Flare

Observers { Waltz }

Date 5-11, 1932

No.	Trial No	Load at M (165)	Readings at Dial Indicator									
			Page 1	Page 2	Page 3	Page 4	Page 5	Page 6	Page 7	Page 8	Page 9	Page 10
1	1	0	34		93							
2		250	1	45	121	1	13	170	124	2		
3	2	0	31		92							
4		250	1	45	126	1	13	179	182	0		
5	3	0	32		92							
6		250	1	45	127	1	14	178	182	1		
7	4	0	31		91							
8		250	1	44	127	1	13	178	182	0		
9	5	0	31		91							
10		250	1	42	128	1	12	179	180	1		
11	6	0	29		91							
12		250	1	44	125	1	13	178	181	0		
13	7	0	31		92							
14		250	1	44	127	1	14	178	182	0		
15	8	0	31		91							
16		250	1	42	129		13	177	184	0		
17	9	0	32		91							
18		250	1	41	191	1	12	179	185	0		
19	10	0	32		91							
20		250	1	46	126	1	13	175	182	0		
21		0	31		91							
22	1	0	33		92							
23		300	2	3	225	2	70	222	223	1		
24	2	0	32		91							
25		300	2	3	224	2	70	221	222	0		

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of Experimental Test of 1 1/2" V. Fibre and Steel
Construction

Observers { W. H. H. } { W. H. H. } Date 5-11, 1932

Separating of Scales and

No.	Trial No	Load	Reading	Reading	Reading	Reading	Reading	Reading	Reading
1	3	0							
2		300	2	8	225	2	71	219	222 0
3	4	0		32			80		
4		300	2	6	226	2	71	219	222 1
5	5	0		30			90		
6		300	2	3	227	2	71	219	223 0
7	6	0		25			80		
8		300	2	7	226	2	69	221	223 0
9	7	0		32			90		
10		300	2	7	226	2	71	219	222 0
11	8	0		33			90		
12		300	2	6	227	2	69	221	222 0
13	9	0		33			90		
14		300	2	6	221	2	69	221	224 0
15	10	0		35			90		
16		300	2	10	225	2	70	220	222 0
17		0		35			90		
18	11	0		37			10		
19		300	2	32	219	2	80	227	222 0
20	2	0		41			15		
21		300	2	35	216	2	80	225	210
22	3	0		41			15		0
23		300	2	35	216	2	80	225	210
24	4	0		41			15		0
25		300	2	38	272	2	82	223	210 0

Remarks:

Observers { Wol-2 } { } Date Oct 11, 1937

No.	Trail No	Load at M (lbs)	Reaction A	Reaction B	Reaction C	Reaction D	Reaction E	Reaction F	Reaction G	Reaction H	Reaction I	Reaction J	Reaction K	Reaction L	Reaction M	Reaction N	Reaction O	Reaction P	Reaction Q	Reaction R	Reaction S	Reaction T	Reaction U	Reaction V	Reaction W	Reaction X	Reaction Y	Reaction Z
1	5	0		41																								
2		300	2	62	279	2	62	275	272	0																		
3	6	0		41																								
4		300	2	62	279	2	62	268	271	0																		
5	7	0		41																								
6		300	2	62	279	2	62	278	272	0																		
7	8	0		41																								
8		300	2	62	279	2	62	269	272	0																		
9	9	0		41																								
10		300	2	62	279	2	62	271	273	X ⁰																		
11	10	0		40																								
12		300	2	60	278	2	60	271	272	0																		
13		0		41																								
14	1	0		41																								
15		400	3	62	307	3	62	307	307	1																		
16	2	0		40																								
17		400	3	62	315	3	62	317	316	0																		
18	3	0		42																								
19		400	3	62	301	3	62	302	304	1																		
20	4	0		42																								
21		400	3	60	332	3	60	334	333	2																		
22	5	0		40																								
23		400	3	96	344	3	96	326	341	3																		
24	6	0		30																								
25		400	3	8	326	3	50	338	302	0																		

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of

Exhaustion Test of Mild Steel
Compression in Fibers

Observers

Waltz

Date 5-12, 1932

No.	Trial No	Load at (lbs)	Gage Reading at Deflectometer							
			Gage A				Gage B			
			Zero	Reading	Revol.	Revol.	Zero	Reading	Mean	Deflection
			1000	1000	1000	1000	1000	1000	(1000)	
1	7	0		41			38			
2		400	3	333	3	334	334	334	0	
3	8	0		40			37			
4		400	1	340	3	341	335	337	1	
5	9	0		39			36			
6		400	3	337	3	338	334	337	0	
7	10	0		37			36			
8		400	3	342	5	350	336	337	0	
9		0		37			86			
10	1	450		1			96			
11		450	3	350	3	351	350	351	1	
12	2	0		5			95			
13		450	3	351	3	352	347	351	0	
14	3	0		3			17			
15		450	3	347	3	350	347	350	1	
16	4	0		7			96			
17		450	3	345	3	348	348	355	0	
18	5	0		9			38			
19		450	3	345	3	351	347	351	0	
20	6	0		6			97			
21		450	3	345	3	355	344	352	1	
22	7	0		4			97			
23		450	3	350	3	354	354	354	0	
24	8	0		7			97			
25		450	3	350	3	355	355	355	0	

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of

Observers

Date 5-12, 1932

No.

Trial No

Load 47
(145)

<Sage Reading at 10:10 AM>

<Sage 4 x 1000>

1	9	0	2	12				
2		450	3	46	353	357	1	
3	10	0	7	97				
4		450	3	48	359	364	0	
5		0	6	97				
6	11	0	422	426				
7		500	3	44	399	393	1	
8	2	0	21	5				
9		500	3	27	395	397	0	
10	3	0	21	5				
11	4	0	28	11	394	394	0	
12		0	22	5				
13		0	27	10	392	392	1	
14	5	0	22	6				
15		500	3	10	393	397	1	
16	6	0	22	5				
17		500	4	21	401	391	1	
18	7	0	21	5				
19		500	3	21	394	394	0	
20	8	0	21	5				
21		500	3	10	395	395	0	
22	9	0	21	5				
23		500	3	10	395	395	0	
24	10	0	21	6				
25		0	21	7	395	394	0	

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of

Experimental Tests IP471 Floor and roof
Construction Laboratory

Observers

W. J. ...

Date 5-12, 1932

No.

1	1	0	19	44	1
2		450	20	429	20 441 435 0
3	2	0	20		9
4		450	26	434	72 437 435
5	3	0	20		1
6		450	24	436	71 432 437 0
7	4	450	17		1
8		450	24	435	71 432 436 0
9	5	450	11		0
10		450	25	434	72 436 435 1
11	6	0	17		7
12		450	24	435	72 435 435 0
13	7	0	20		7
14		450	25	435	70 437 436 0
15	8	0	17		0
16		450	23	436	71 441 438 0
17	9	0	17		7
18		450	25	434	74 432 433 0
19	10	0	17		8
20		450	24	435	710 438 436 0
21		0	20		0
22	1	0	20		8
23		600	22	478	30 478 418 0
24	2	0	20		5
25		600	22	478	30 475 418 0

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of

Experimental Test of 174.1 Tons and
Root Construction in Traction

Observers {

Date 9-12, 1932

No.

1	0	0							
2		000	4	41	472	4	477	477	1
3	4	0		21					
4		000	4	46	475	4	472	473	0
5	5	0		21					
6		000	4	41	480	4	474	477	2
7	6	0		21					
8		000	4	41	480	4	477	478	0
9	7	0		21					
10		000	4	41	480	4	476	478	0
11	8	0		21					
12		000	4	42	479	4	476	475	0
13	9	0		17					
14		000	4	41	472	4	473	475	0
15	10	0		17					
16		000	4	41	472	4	472	476	0
17	11	0		17					
18	1	0		17					
19		000	5	1	514	5	507	510	0
20	2	0		17					
21		000	4	44	523	5	511	516	2
22	3	0		17					
23		000	5	15	520	5	508	514	0
24	4	0		17					
25		000	4	44	511	5	510	515	0

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of

Experimental Test of 11.11.12. 1/2 in. 1010
 Rec. - 1010.12.12. 1/2 in. 1010

Observers {

Date 5-12, 1932

No.	Trial No	Load (lb)	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
1	5	0	17																								
2		100	5	0	517	5	57	517	517	1																	
3	6	0	16																								
4		500	5	0	516	5	516	516	516	1																	
5	7	0	5																								
6		100	5	0	515	5	515	515	515	0																	
7	8	0	5																								
8		500	5	0	514	5	514	514	514	0																	
9	9	0	5																								
10		500	5	0	513	5	513	513	513	0																	
11	10	0	5																								
12		500	5	0	512	5	512	512	512	0																	
13		0	5																								
14	1	500	5	0	511	5	511	511	511	0																	
15		700	5	0	510	5	510	510	510	0																	
16	2	0	5																								
17		700	5	0	509	5	509	509	509	0																	
18	3	0	5																								
19		700	5	0	508	5	508	508	508	0																	
20	4	0	5																								
21		700	5	0	507	5	507	507	507	1																	
22	5	0	5																								
23		700	5	0	506	5	506	506	506	0																	
24	6	0	5																								
25		700	5	0	505	5	505	505	505	0																	

Remarks:

**MECHANICAL ENGINEERING LABORATORY
MICHIGAN STATE COLLEGE**

Running Log of

Experiments 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
Root Construction in Flatiron
Wg/Hz

Observers

Date *7-13*, 193*2*

No.

Thel No

1000 Hz
(1000)

Base Point 1000 Hz
< Gap 1000 Hz >

1	7	0								
2		700	5	43	550	5	52	546	548	0
3	8	0		92			4			
4		700	5	42	530	5	56	548	549	0
5	9	0		92			4			
6		700	5	45	547	5	54	550	548	1
7	10	0		91			2			
8		700	5	44	547	5	53	550	548	0
9		0		71			4			
10	1	0		15			5			
11		700	5	7	532	5	5	546	547	0
12	2	0		11			2			
13		700	5	5	536	5	17	542	541	0
14	3	0		15			2			
15		700	5	95	540	5	5	544	547	2
16	4	0		23			0			
17		700	5	29	537	5	16	546	545	0
18	5	0		25			3			
19		700	5	12	547	5	4	546	542	1
20	6	0		21			5			
21		700	5	11	549	5	7	547	545	0
22	7	0		21			0			
23		700	5	1	542	5	5	545		1
24	8	0		21			0			
25		700	5	1	540	5	5	545	541	1

Remarks

MECHANICAL ENGINEERING LABORATORY
MICHIGAN STATE COLLEGE

Running Log of

Observers

Date 5-15, 1932

No.	Trip No	Load - M								
1	9	0								
2		7-0	5	73	627	5	7	648	645	1
3	10	0		23			21			
4		7-0	5	75	627	5	2	647	645	1
5		0		27			20			
6	1	0		0			21			
7		200	6	71	627	6	25	646	647	11
8	2	0		1			20			
9		100	6	71	642	6	22	647	640	3
10	3	0		71			17			
11		100	6	74	627	6	72	640	647	2
12	4	0		13			14			
13		200	6	40	627	6	72	644	625	3
14	5	0		13			15			
15		100	6	40	633	6	66	647	647	10
16	6	0		15			14			
17		200	6	78	627	6	65	644	640	7
18	7	0		25			15			
19		300	6	52	627	6	65	645	640	3
20	8	0		15			15			
21		200	6	60	627	6	65	645	645	5
22	9	0		11			12			
23		100	6	53	627	6	11			✓
24	10	0		17			15			
25		200	6	52	642	6	61	650	645	1

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of Experimental Test of IPAN Floor and Roof Construction in Flex-21C

Observers { Waltz } Date 5-13, 1934

Supplemental Notes: 527-4 x 527-5

No.	Test No.	Load (lb.)	Rev	Deflection (in.)	Deflection (in.)	Deflection (in.)	Deflection (in.)
1	1	0		61	62		
2		850	6	45	62	613	1
3	2	0		63	63		
4		850	6	64	65	690	2
5	3	0		64	65		
6		850	6	64	70	690	2
7	4	0		65	65		
8		850	6	69	62	673	2
9	5	0		63	64		
10		850	6	65	67	692	2
11	6	0		64	69		
12		850	6	66	67	702	2
13	7	0		62	68		
14		850	6	77	71	681	0
15	8	0		65	68		
16		850	6	75	70	678	0
17	9	0		65	68		
18		850	6	75	75	686	0
19	10	0		65	68		
20		850	6	75	75	681	0
21		0		65	68		
22	11	0		65	60		
23		900	7	28	727	735	6
24	2	0		49	54		
25		900	7	21	728	735	2

Remarks:

MECHANICAL ENGINEERING LABORATORY

MICHIGAN STATE COLLEGE

Running Log of Experimental Club

Observers { Hiltz } Date 5-13, 1932

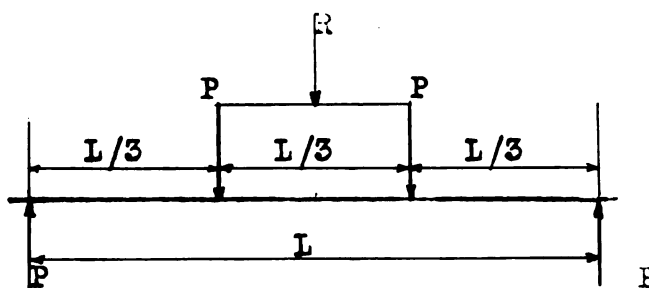
No.

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24	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0

Remarks:

DISCUSSION:

In order that the two-point loading may be changed into an equivalent distributed loading, the following formula was derived:



For two-point loading, where, $M_{\max}$ = Maximum live moment

$$M_{\max} = \frac{PL}{3}$$

P = 1/2 Total load applied on 18" strip

For distributed loading,

L = Length of span

$$M_{\max} = \frac{WL}{8}$$

W = Weight of distributed load over 18" strip

$$\frac{LP}{3} = \frac{WL}{8}$$

w = unit loading in lbs. per sq. ft.

$$P = 3/8W$$

Q = 6P or load applied to slab 54" wide by lever

$$W = 3/2 WL$$

or,

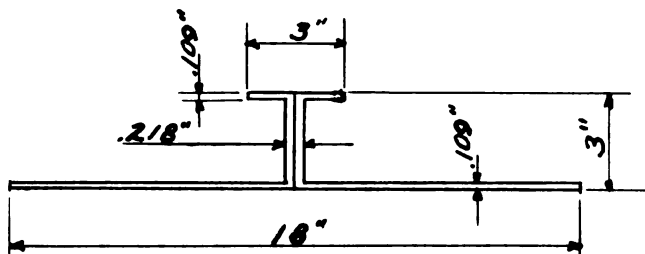
$$P = 9/16 WL$$

For 54' strip, and $L = 9 \frac{3}{4}'$

$$Q = 6 \times 9/16 WL = 27/8 \times 9 \frac{3}{4} w = 32.9w$$

The total live load applied is equal to Q plus 250 lbs., which is the weight of the structure resting directly on the floor slab.

It should be noted that the slab was designed for a total load of 98.62 lbs. per sq. ft., assuming s (for steel) equal 18,000 lbs. per sq. in. and that the lower flange of the "I" is of the same width as the upper flange,



Moment of inertia:

$$1/12 \times .218 \times \frac{2.782^3}{3} = .3911529$$

$$2 \times 3 \times .109 \times \frac{1.4455^2}{2} = 1.3665135$$

$$2 \times 1/12 \times 3 \times \frac{.109^3}{3} = .0006475$$

$$I = 1.758$$

$$S = I/c = 1.758 / 1.5 = 1.17$$

$$M_{\max} = Ss = 18,000 \times 1.17 = 21,096 \text{ in., lbs.}$$

$$M_{\max} = WL/8 = 117/8 W$$

$$117/8 W = 21096$$

$$W = 1,442.46 \text{ lbs.}$$

$$\text{Area of each section} = 9 \frac{3}{4}' \times 1 \frac{1}{2}' = 14.625 \text{ sq. ft.}$$

$$w = \frac{1,442.46}{14.625} = 98.62 \text{ lbs. per sq. ft.}$$

The deflection expected was computed from the formula taken from a steel handbook for a beam supported at ends with two symmetrical concentrated loads.

$$D_{\max} = \frac{Wa(3/4L^2 - a^2)}{12EI} \quad \text{where, } D_{\max} = \text{Maximum deflection}$$

$$W = (Q + 250)/3$$

$$a = L/3$$

$$D_{\max} = \frac{39 \left(.75 \times \frac{117^2}{12 \times 30,000,000 \times 1.758} - \frac{39^2}{12 \times 30,000,000 \times 1.758} \right) W}{12 \times 30,000,000 \times 1.758}$$

$$= .000539 W$$

For loading near the designed loading,

$$Q + 250 = 2700 \text{ lbs.}$$

$$W = 900 \text{ lbs.}$$

$$D_{\max} = 900 \times .000539 = .4851"$$

The average deflection for this loading was .2277", or less than 1/2 the computed deflection.

The Aerocrete filler appeared very little injured by the test. One transverse crack appeared in a section. In the other sections the Aerocrete appeared to be elastic enough to resist cracking due to compression. Longitudinal or diagonal cracking at the ends was caused by the warping of the slab in movement on the test apparatus.

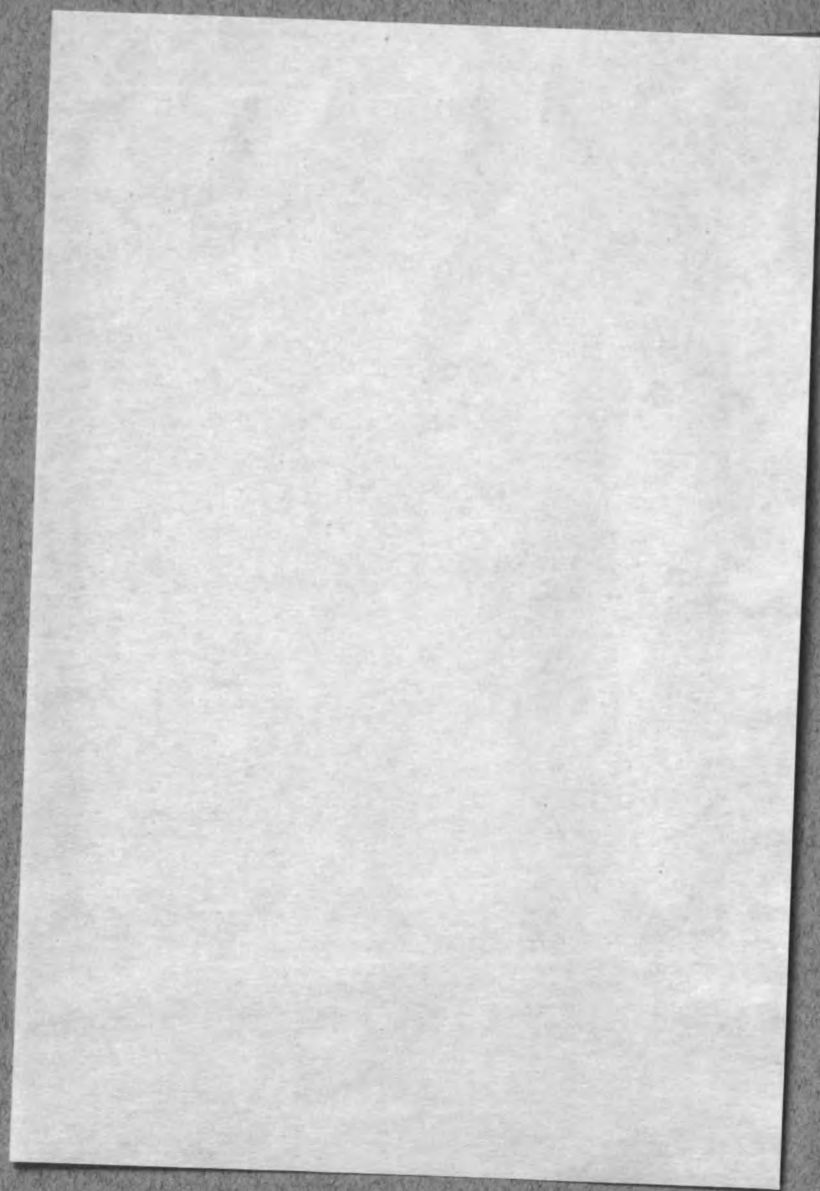
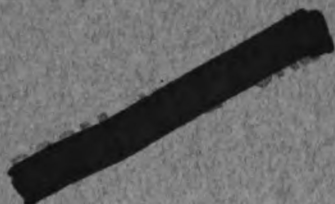
CONCLUSION:

The deflection obtained from the various loads was too high. The variation of the deflection between the computed and the actual can partially be attributed to the fact that the Aerocrete filler provided arch action or longitudinal stiffness. Even if lower than computed, it was higher than is expected of a floor in a building. It is true that this deflection will be decreased if the floor is securely fastened to the supporting beams by either bolting or electric welding, which is the common practice of the fabricators of this type of floor.

By observation of the data it is observed that the permanent set is negligible for all loads of reasonable value. Where high values of the set are observed the steel is stressed beyond the proportional limit.

Under the most severe loading there was no warping of any web or flange, verifying the statement by Mr. Schick that the filler "provides arch action for the area between the ribs as well as lateral stiffness to the ribs."

In general, this type of floor construction is very adaptable where a light weight floor is desired. Other favorable considerations are its minimum thickness, incombustibility and economy.



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