

CORPS OF ENGINEERS STATIC AIR PRESSURE TEST REPORT

Prepared by: M. Croucher P.E.

Present at test: M. Huizinga
M. Croucher

Witnessed by: Tim Royer P.E.

Test date: July 30, 1993 10:00 am
Location: Fabral Research and Development Lab

Specimen tested: Stand'N Seam panels
Specimen properties: 24 ga., grade C galvanized steel
Type of test: wind uplift

SUMMARY

A 10' by 25' air pressure test chamber was constructed with purlins 2'-6" o.c.. Fabral Stand'N Seam panels were tested for wind uplift capacity using constant air pressure loading. After achieving 110 psf load the plastic at the free end (ridge end) of the panels tore bad enough that higher pressures were not obtainable. The ridge end of the sheets were then screwed down to reseal the plastic and the load was again applied to failure. The ultimate failure was recorded at 158 psf.

The failure mechanism was the clip disengaging from the panel clip hem.

TEST PROCEDURES

A. Specimen:

- 10' x 25' chamber
- purlins 2'-6" o.c. 10 span condition
- panel clips were located at each purlin and panel side joint with 2 #12 SDST fasteners per clip
- one end had a standard cleated eave detail
- the opposite end was left completely free
- one edge had a standard gable detail
- the opposite edge was left completely free
- a 6 mil pleated plastic barrier was placed under the panels and held down by a batten to maintain the air pressure. This plastic was approximately 20' wide and 35' long so it could be pleated and would fully load the panels
- test loads were adjusted using a manometer on one end of the test specimen and checked by a manometer on the other side of the chamber that reads directly in psf.

B. Loading pattern:

1. take deflection readings at 0 psf
2. load to 10 psf (reference 0), hold for 1 minute then measure deflections
3. relax load for 1 minute
4. load to 20 psf, hold for 1 minute and measure deflections
5. relax load for 1 minute
6. load to 10 psf, hold for 1 minute and measure deflections
7. load to 30 psf, hold for 1 minute and measure deflections
8. repeat 5,6 and 7 adding 10 psf load each cycle to 110 psf
9. reseal the plastic by screwing down the free end
10. load directly to failure and record ultimate load and failure method without stopping so plastic does not tear

C. Deflection readings:

Deflection readings were taken at the following locations:

1. panel rib 15'-4" from eave over a purlin
2. center of panel pan 15'-4" from eave over a purlin
3. panel rib 16'7" from eave at midspan between purlins
4. center of panel pan 16'7" from eave at midspan between purlins

The deflections are shown in the data sheet and are shown in two attached graphs. The graphs show that the pan deflection was almost identical at the support and at midspan.

TEST OBSERVATIONS

- 90 psf noticeable pan deflection that was consistent from about 7' from the eave all the way to the unrestrained ridge end of the panels
- 100 psf the eave cleat began to bend upward at the unrestrained edge of the cleat
- the first rib in from the gable side was noticed to have unfolded at a point where the seaming machine had improperly folded the seam, for a length of 3'-6"
- 120 psf on the way to the 120 psf load, the plastic had ripped so badly at the free end (opposite the eave end) that adequate pressure could not be maintained. In an effort to reseal the plastic, three screws per panel pan were installed in the free end to reseal the tears. Also, one screw was installed in the free end of the eave cleat, since this condition does not occur on a building and because the plastic was tearing.
- 158 psf ultimate failure occurred. Failure was a combination of the clip bending up and the panel clip hem bending down

with disengagement occurring

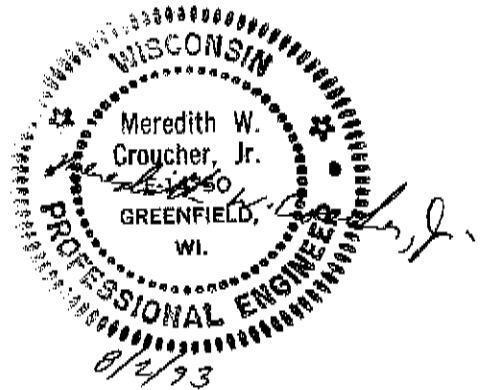
TEST RESULTS

Failure of this test occurred at an uplift force of 158 psf with purlins on a 2'-6" span. The 158 psf load was recorded on both manometers.

The failure observed near the center of the 25' X 10' specimen with the panel clip hem releasing from the clips.

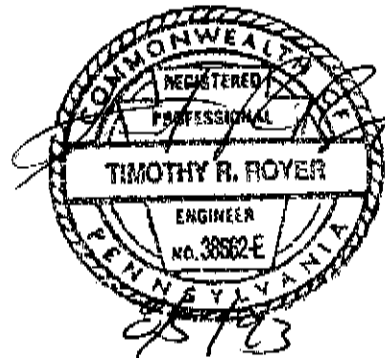
Photographs are attached and a video of the entire test is available upon request.

Meredith W. Croucher, Jr.
M. W. Croucher, Jr. P.E.
FABRAL - Alcan Building Products



I witnessed the test described above and to the best of my knowledge, this report is accurate.

T. Royer, 8/5/93
Tim Royer P.E.
Timber Tech



DEFLECTIONS 7-30-93

LOAD	15'-4" ON (FROM EDGE) RIB @ SUPPORT	15'-4" MID PAN @ SUPPORT	16'-7" @ MID SEAM OF PANEL ON RIB.	16'-7" MID PAN @ MID SP OF PAN.
ABSOLUTE 0	1.56	2.00	1.47	2.10
(REFERENCE) 10	1.65	3.05	1.55	3.15
20	1.73	3.90	1.72	4.02
10	1.67	3.33	1.61	3.40
30	1.95	4.60	1.92	4.71
10	1.69	3.33	1.61	3.40
40	2.09	5.05	2.07	5.16
10	1.69	3.39	1.63	3.44
50	2.22	5.35	2.18	5.47
10	1.70	3.37	1.63	3.43
60	2.32	5.70	2.31	5.81
10	1.69	3.44	1.63	3.50
70	2.45	6.03	2.42	6.15
10	1.67	3.33	1.59	3.43
80	2.57	6.30	2.55	6.42
10	1.68	3.35	1.59	3.41 3.41
90 NO NOTICABLE PROBLEMS OUTER RIB PANEL	2.70	6.56	2.67	6.70
10	1.75	3.73	1.68	3.85
100 FIRST RIB FROM EDGE CLEFT BEHIND PANELS 7'-10" FROM AT DISCONTINUOUS END RIBS UNDERLAY LEE UNFOLDED AT LOCATION OF QUESTIONABLE SEAM FOLD FOR 3'-0"	2.85	6.85	2.82	7.00
10	1.84	4.06	1.80	4.25
110 DOD SEAM STILL HOLDING WITH NO CHANGE	3.02	7.16	3.00	7.32
10	1.93	4.31	1.84	4.75
120 TOO MANY PLASTIC RIPS AT FREE END OPPOSITE SEAM TO MAINTAIN PRESSURE				

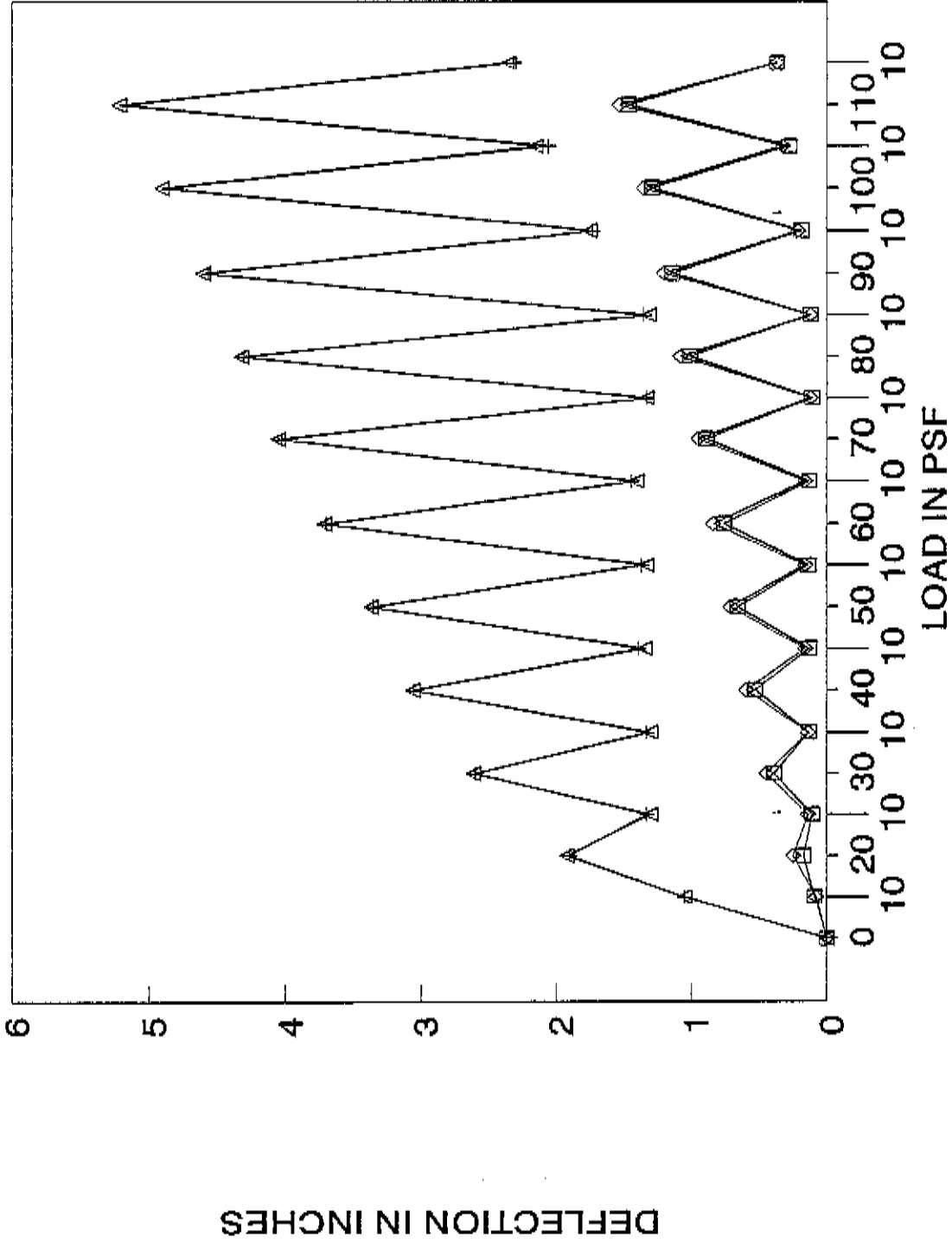
FREE END SCREWED DOWN WITH 3 SCREWS PER PANEL TO SEAL. ALSO 1 SCREW WAS ADDED AT END OF CLEFT ON FREE END.
Failure at 158 psf

Liquid manometer : 19.27 #/inch
Failure @ 8.2" = 158 psf

TESTED BY: Meredith W. Conroy, Jr., P.E.
Michael A. Fryer

Stand'N Seam Corner Test

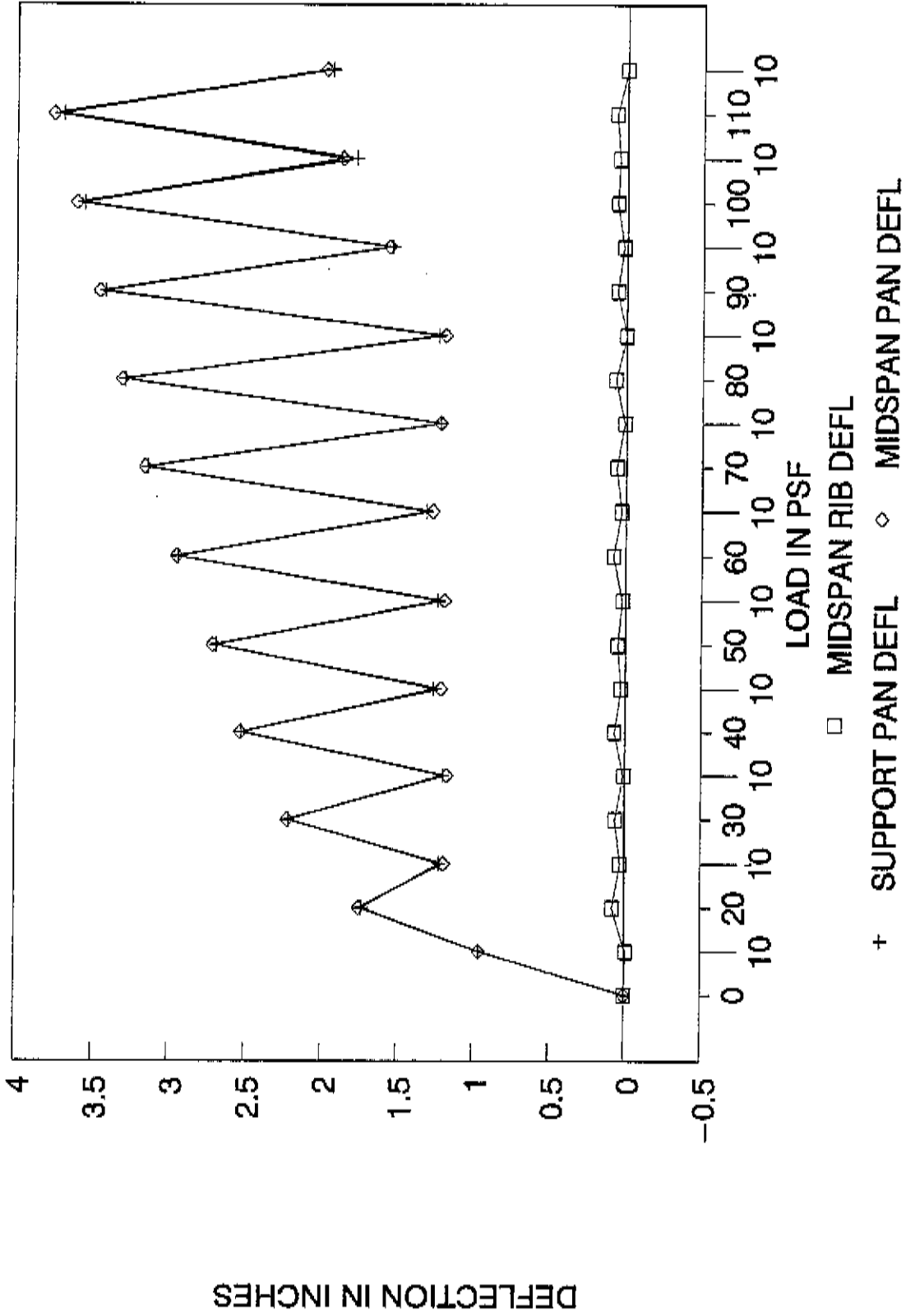
Corps of Engineers Test 7/30/93



□ RIB @ SUPPORT + PAN @ SUPPORT ◊ RIB @ MIDSPAN △ PAN @ MIDSPAN

Stand'N Seam Corner Test

Reduced deflections

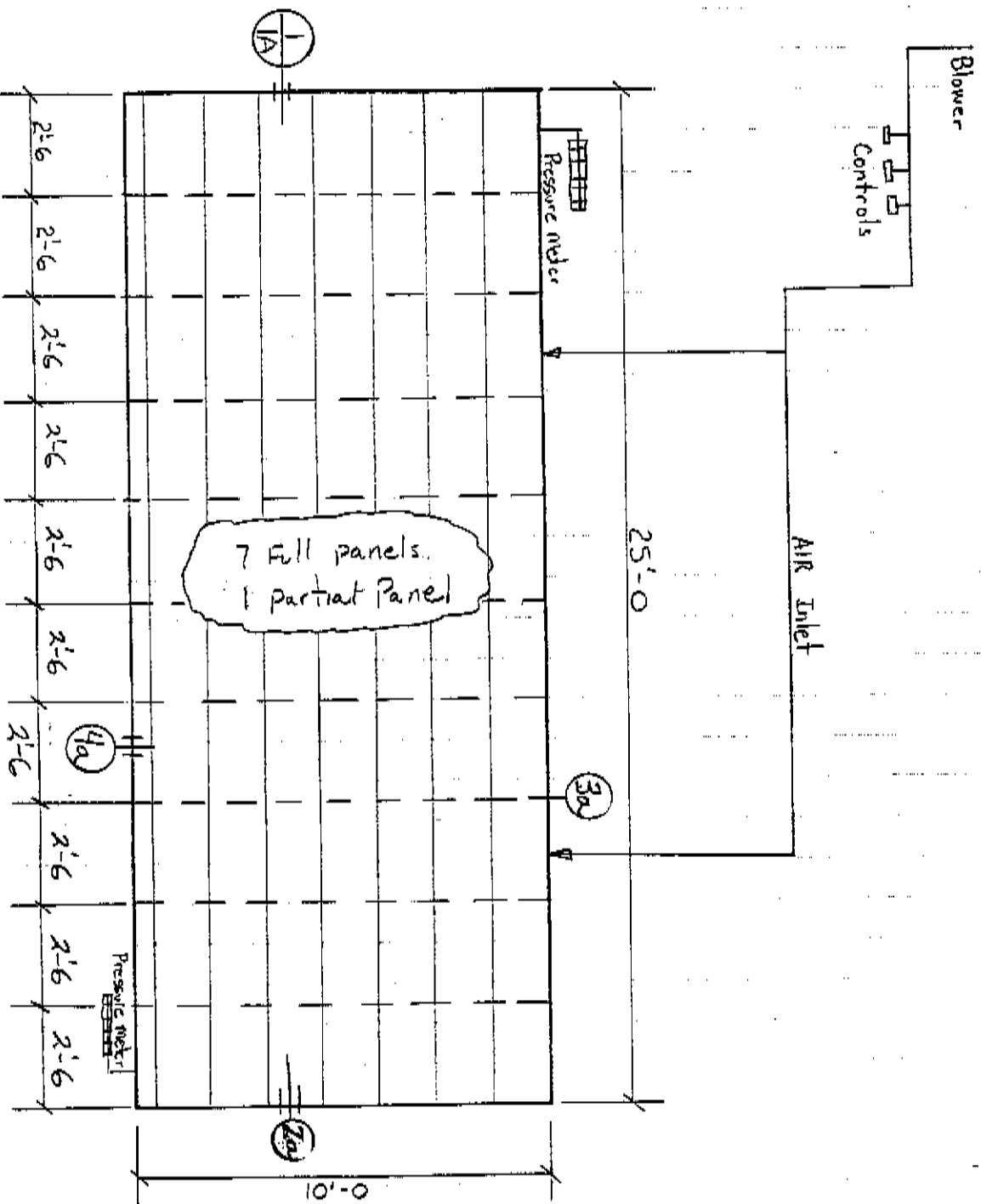


FABRAL	NAME: CHAMBER ASSEMBLY	DATE: 7-9-93
	PROJECT:	PAGE 1 OF 5

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Edge Test

Support Spacing



FABRAL

NAME: Detail 1 - Eave

DATE: 7-9-93

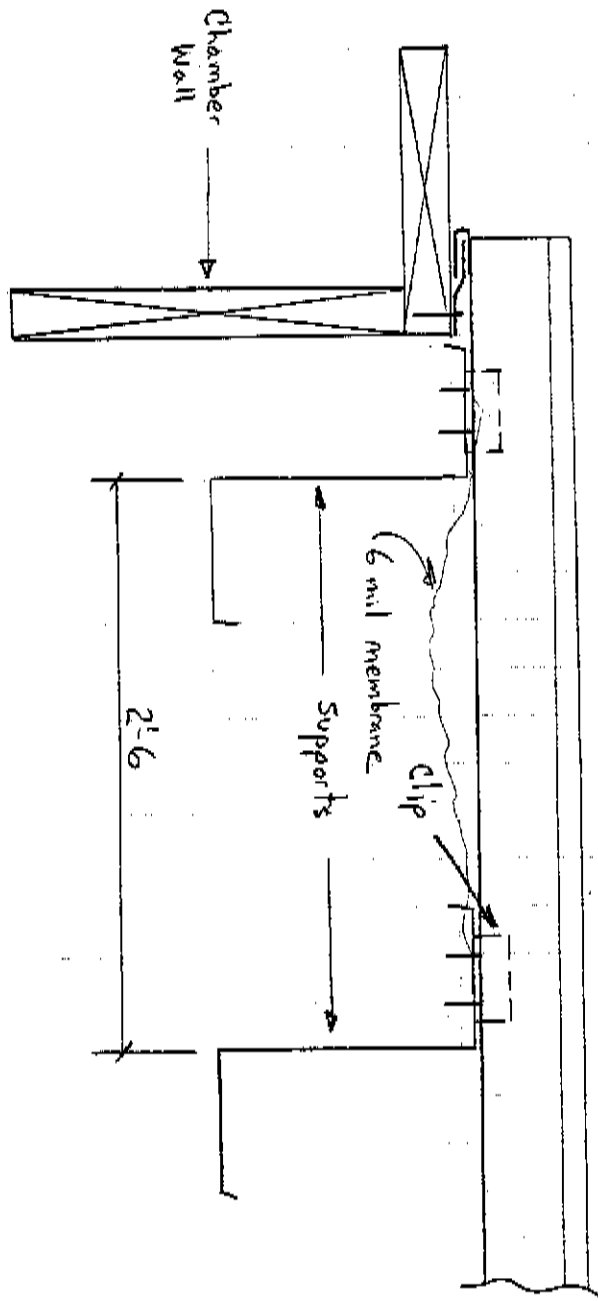
PROJECT:

PAGE 2 OF 5

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(Edge Test)

DETAIL 1a - EAVE



1 1/2" SSR		V-BEAM		SUP-R-BATTEN	POSI-LOCK SOFFIT
		4" RIB			
GRANDRIB 3		3" RIB		DECOR-RIB	
		CFP-6			
STRONG RIB		CFP-12			
FABRIB	2 1/2" SSR				
5 V CRIMP	3" SNAP RIB SSR				

FABRAL

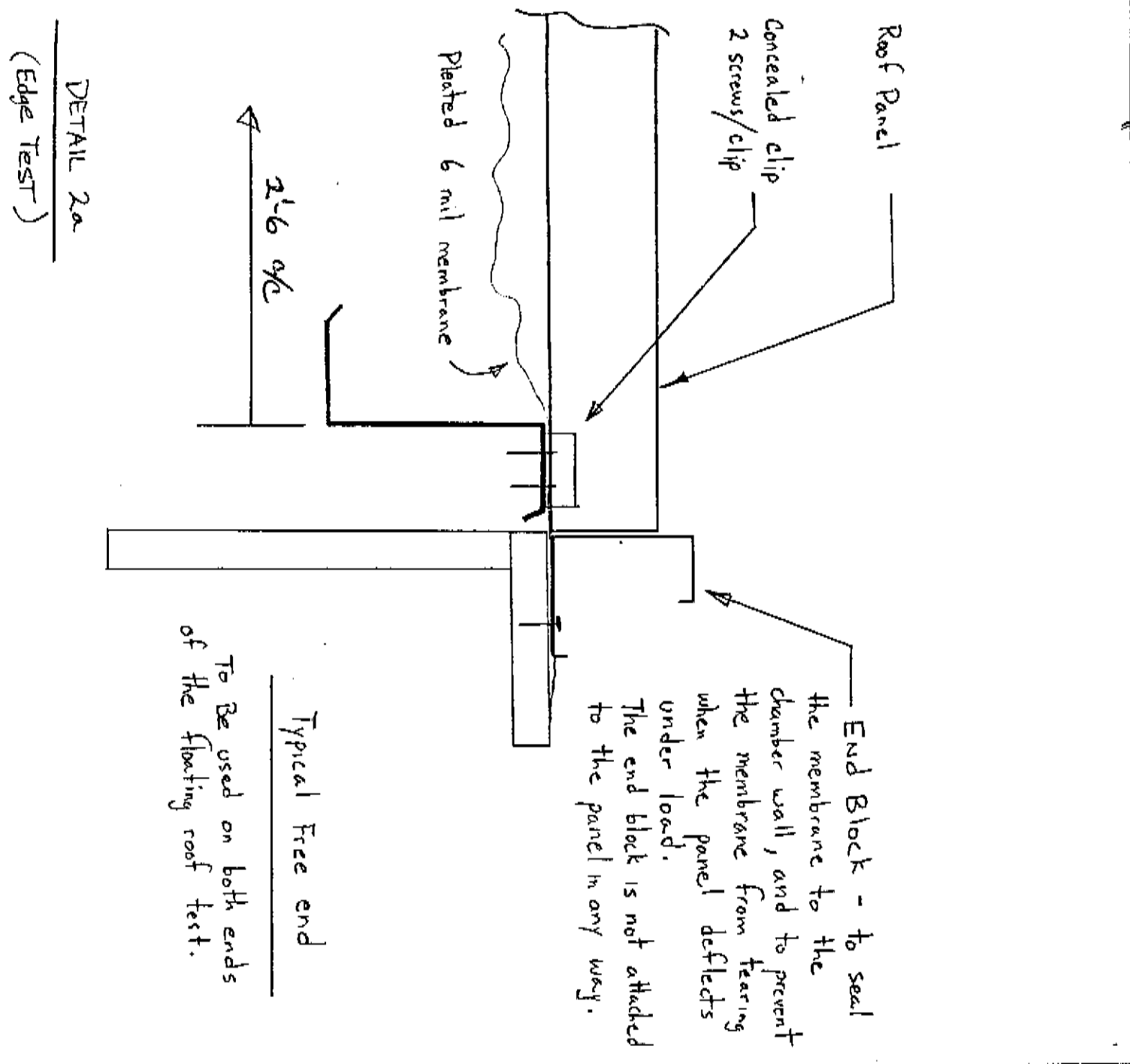
NAME: **FREE END DETAIL**

DATE: **7-9-93**

PROJECT: **Corps of Engr. Uplift Testing**

PAGE **3** OF **5**

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FABRAL

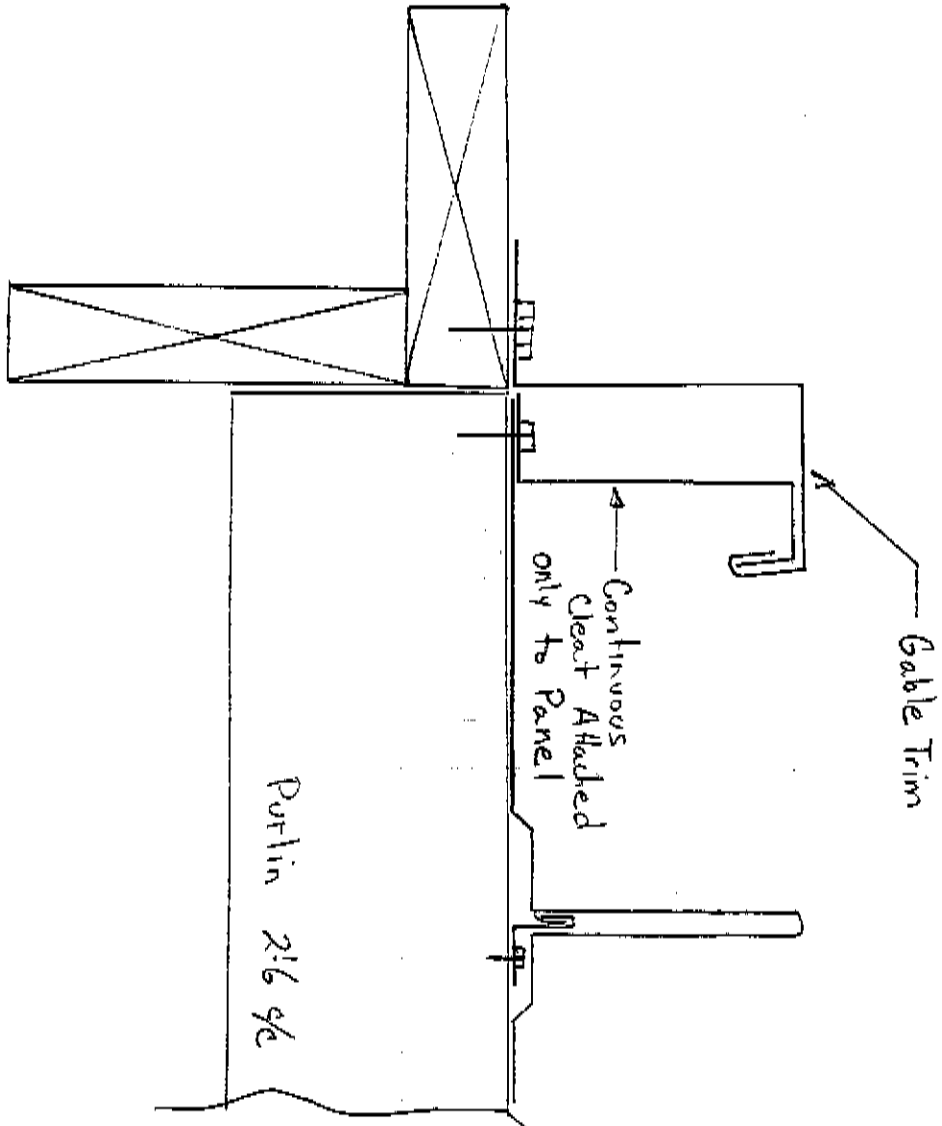
NAME: *C Chamber Assembly*
PROJECT:

DATE: 7-9-93

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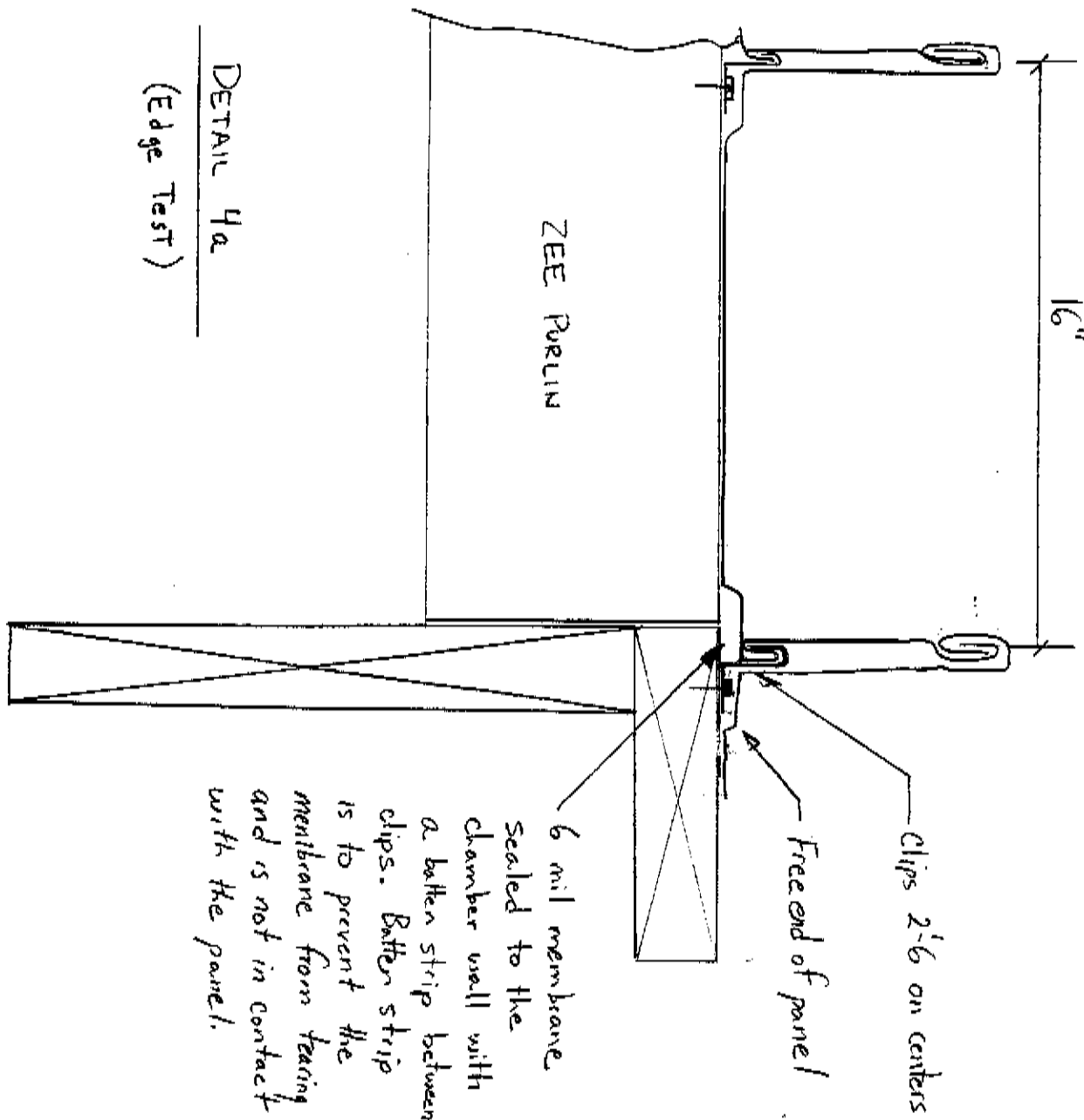
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DETAIL 3a
(Edge Test)



FABRAL	NAME: <i>Chamber Assembly</i>	DATE: <i>7-9-93</i>
	PROJECT:	PAGE <i>5</i> OF <i>5</i>

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Alcan Building Products
Division of Alcan Aluminum Corporation

CORPS OF ENGINEERS STATIC AIR PRESSURE TEST REPORT

Prepared by: M. Huizinga
Present at test: M. Huizinga
M. Croucher, P.E.
Witnessed by: Tim Royer, P.E.
Timber Tech Engineering, Inc.

Test date: October 19, 1993 10:00 am
Location: Fabral Research and Development Lab

Specimen tested: Stand'N Seam panels
Specimen properties: 24 ga., grade C galvanized steel
Type of test: wind uplift

SUMMARY

A 10' by 25' air pressure test chamber was constructed with purlins 5'-0" o.c.. Fabral Stand'N Seam panels were tested for wind uplift capacity using constant air pressure loading. Failure occurred at 115 psf after being held for 1 minute, 10 seconds.

The failure mechanism was the clip disengaging from the panel clip hem. This was a result of both clip failure and panel failure at the point of clip engagement.

TEST PROCEDURES

A. Specimen:

- 10' x 25' chamber
- purlins 5'-0" o.c. 5 span condition
- panel clips were located at each purlin and panel side joint with 2, #12 SDST fasteners per clip
- all specimen edges were installed free from restraint
- a 6 mil pleated plastic barrier was placed under the panels and held down by a batten to maintain the air pressure. This plastic was approximately 20' wide and 35' long so it could be pleated and would fully load the panels
- test loads were adjusted using a manometer on one end of the test specimen and checked by a manometer on the other side of the chamber that reads directly in psf.

B. Loading pattern:

1. take deflection readings at 0 psf
2. load to 10 psf (reference 0), hold for 1 minute then measure deflections
3. relax load for 1 minute
4. load to 20 psf, hold for 1 minute and measure deflections

Page Two

5. relax load for 1 minute
6. load to 10 psf, hold for 1 minute and measure deflections
7. load to 30 psf, hold for 1 minute and measure deflections
8. repeat 5,6 and 7 adding 10 psf load each cycle to 80 psf
9. relax load for 1 minute
10. load to 10 psf, hold 1 minute and measure deflections
11. load to 86 psf, hold 1 minute, measure deflections
12. load to 90 psf, hold 1 minute, measure deflections
13. relax load for 1 minute
14. load to 10 psf, hold 1 minute and measure deflections
15. load to 95 psf, hold 1 minute, measure deflections
16. load to 100 psf, hold 1 minute, measure deflections
17. relax load for 1 minute
18. load to 10 psf, hold 1 minute and measure deflections
19. load to 105 psf, hold 1 minute, measure deflections
20. load to 110 psf, hold 1 minute, measure deflections
21. relax load for 1 minute
22. load to 10 psf, hold 1 minute and measure deflections
23. load to 115 psf, hold 1 minute 10 seconds, failure occurred while inspecting specimen just prior to measuring deflections

C. Deflection readings:

Deflection readings were taken at the following locations and were taken on the fourth panel in the specimen:

1. center of panel pan, 7'-6" from end support, at mid-span
2. center of panel pan 12'-6" from end support, at mid-span
3. panel rib 12'-6" from end support, at mid-span
4. center of panel pan 15'-0" from end support, over support
5. panel rib 15'-0" from end support, over support
6. center of panel pan 12'-6" from end support, at mid-span

Three readings were taken over the panel pan at mid-span (1, 2 and 6) to be used as a check for consistent panel deflection along the panel length.

The deflections are shown in the data sheet and are shown in two attached graphs. The graphs show that the pan deflection was almost identical at the support and at midspan. It should be noted that deflection reading #6 at the 80 psf load appears out of place. It is assumed that the deflection gage was misread.

TEST OBSERVATIONS

OVERALL Visual observations of the specimen during loading indicated that the plastic barrier was well pleated and did not have any noticeable leaks during the testing cycle.

Page Three

80 psf The incremental loading was reduced to 5 psf once the 80 psf cycle was completed. This was in anticipation of panel failure anytime beyond this load, and to obtain as much data as possible.

115 psf Failure occurred as a result of clip disengagement at several locations along two panels (see photos)

TEST RESULTS

Failure of this test occurred at an uplift force of 115 psf with purlins on a 5'-0" span. The 115 psf load was recorded on both manometers.

The failure observed near one end of the 25' X 10' specimen, along two panel ribs. Failure mode was clip disengagement due to simultaneous yielding of the clip and the panel.

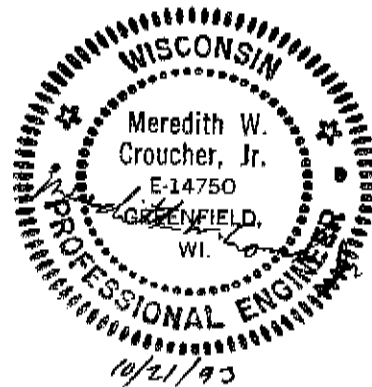
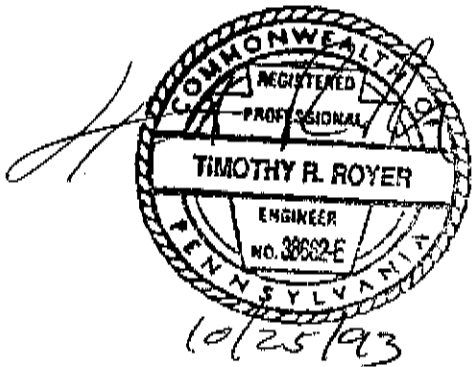
Photographs are attached and a video of the entire test is available upon request.

Michael A. Huizinga
Michael A. Huizinga
FABRAL - Alcan Building Products

I witnessed the test described above and to the best of my knowledge, this report is accurate.

Timothy Royer
Timothy Royer, P.E.
Timber Tech Engineering, Inc.

Meredith W. Croucher, Jr.
M. W. Croucher, Jr., P.E.
FABRAL - Alcan Building Products



Field TEST

Deflection Readings (in)

10-19-93

4TH PANEL 7'-6"
FROM WEST SUPPORT
Mid-span

4TH RIB 12'-6"
FROM WEST SUPPORT
Mid-span

4TH RIB 12'-6"
FROM WEST SUPPORT
Mid-span

4TH PANEL 15'-0"
FROM WEST SUPPORT
over support

4TH RIB 15'-0"
FROM WEST SUPPORT
over support

4TH PANEL 17'-6"
FROM WEST SUPPORT
mid-span

Load (psf)	1	2	3	4	5	6
Absolute 0	2.05	1.73	1.52	2.58	1.53	1.75
ref. 0 / 10 psf	3.38	2.82	1.85	3.68	1.85	3.15
20 psf	4.32	3.80	2.05	4.66	2.01	4.11
10 psf	3.10	2.67	1.81	3.36	1.81	2.32
30 psf	4.77	4.35	2.20	5.20	2.16	4.61
10 psf	3.08	2.60	1.78	3.25	1.79	2.26
40 psf	5.30	4.90	2.40	5.75	2.40	5.15
10 psf	3.25	2.72	1.81	3.58	1.82	3.06
50 psf	5.60	5.27	2.54	6.15	2.55	5.55
10 psf	3.25	2.75	1.82	3.63	1.83	3.11
60 psf	5.91	5.61	2.67	6.51	2.73	5.90
10 psf	3.36	2.84	1.88	3.72	1.90	3.20
70 psf	6.22	5.95	2.80	6.86	2.91	6.26
10 psf	3.59	3.16	1.94	4.10	1.98	3.47
80 psf	6.50	6.25	2.92	7.15	3.05	5.56
10 psf	3.71	3.22	1.96	4.08	2.02	3.55
86 psf	6.66	6.42	3.00	7.32	3.15	6.73
90 psf	6.79	6.57	3.07	7.46	3.25	6.90
10 psf	4.00	3.41	2.06	4.36	2.15	3.92
95 psf	6.89	6.71	3.13	7.62	3.34	7.05
100 psf	7.07	6.87	3.22	7.77	3.41	7.20
EVERY OTHER 100 PSF 100 PSF	4.29	3.84	2.15	4.70	2.23	4.18
105 psf	7.19	7.00	3.26	7.89	3.48	7.32
110 psf	7.32	7.14	3.34	8.02	3.56	7.48
10 psf	4.50	4.09	2.21	5.00	2.31	4.49

EVERY OTHER
100 PSF
100 PSF

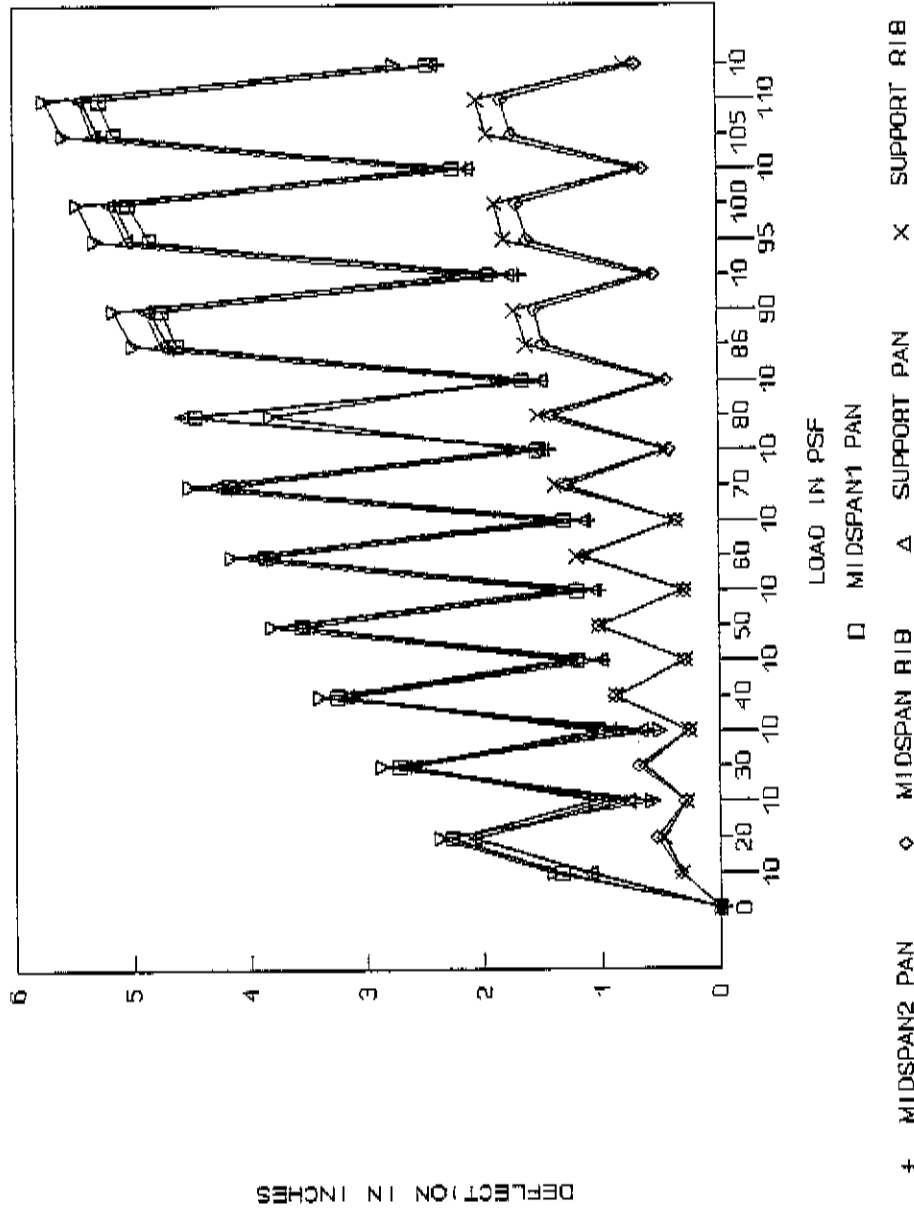
115 psf HELD LOAD FOR 1 MINUTE AND 10 SECONDS, BUT NO DEFLECTIONS WERE RECORDED

CLIPS DEFORMED AND PANEL CLIP CHANNEL YIELDED AND DISENGAGED FROM CLIP.

TESTED BY: *Michael W. Conley, PE*
JAR, PE
M.H.T.

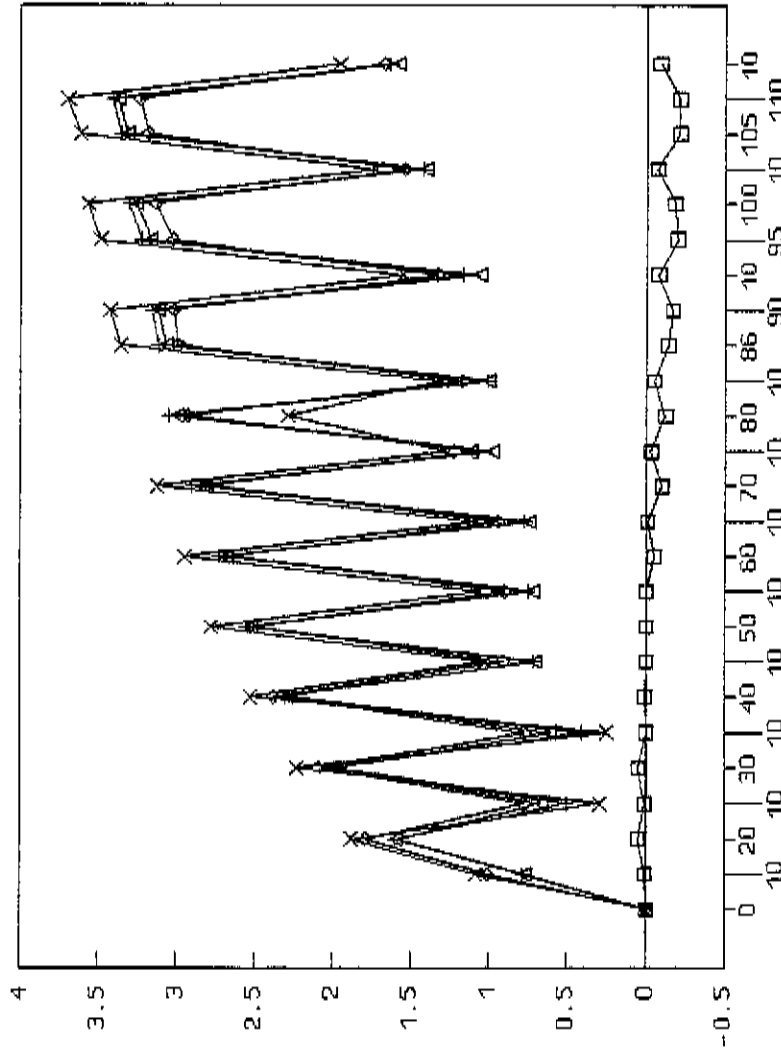
Stand 'N Seam 5' Center Test

Actual deflection readings



Stand 'N Seam 5' Center Test

Reduced deflections

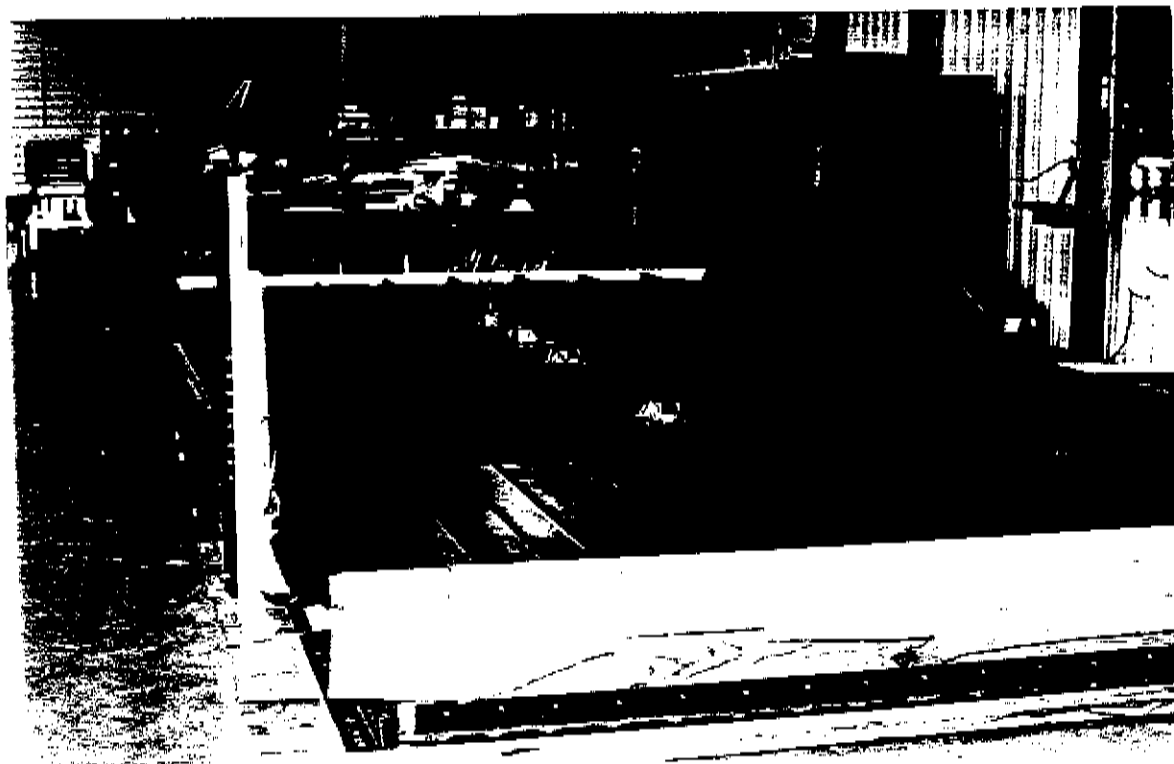


LOAD IN PSF

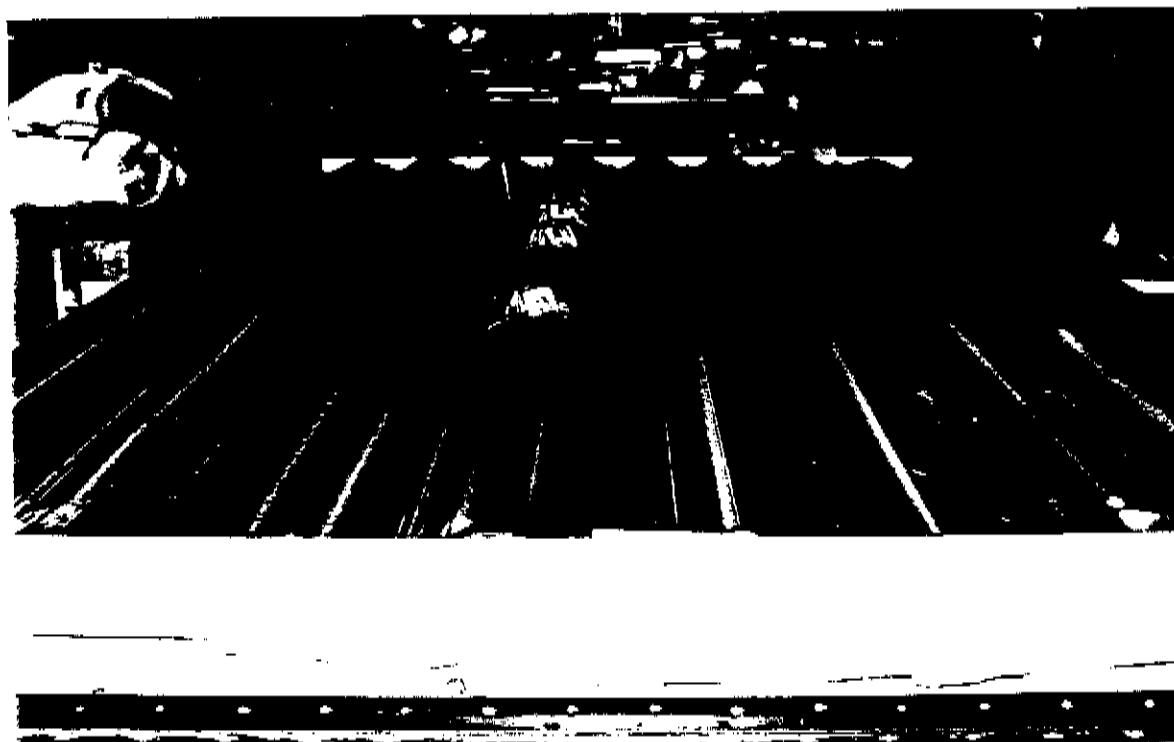
□ MIDSPAN R18

+ SUPPORT PAN ◊ MIDSPAN1 PAN △ MIDSPAN2 PAN X MIDSPAN PAN

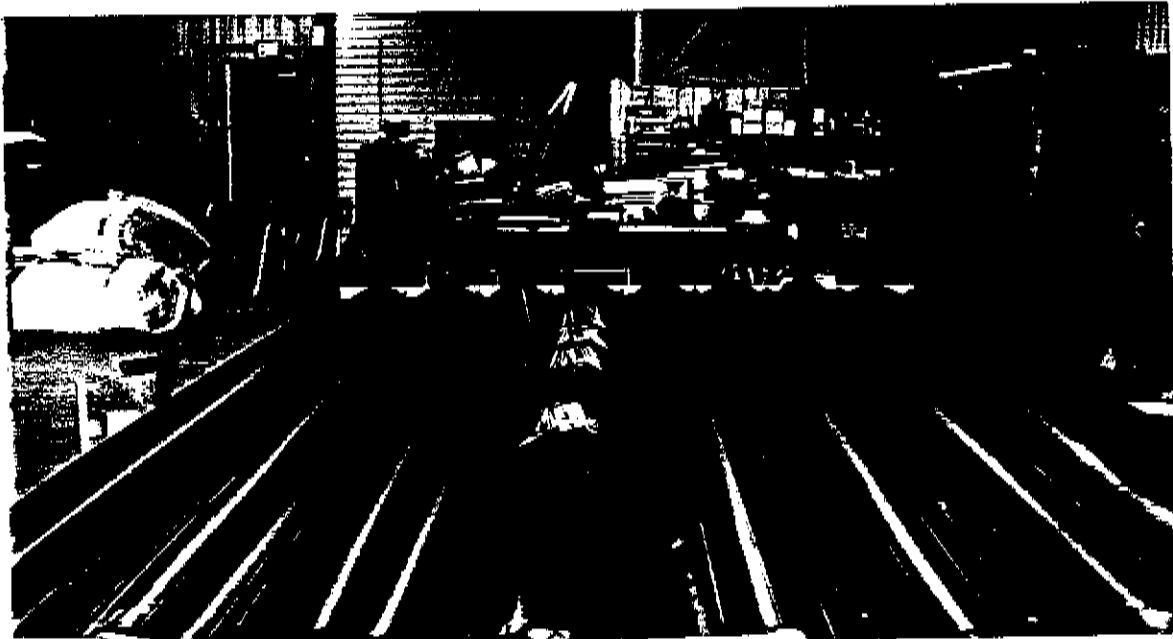
DEFLECTION IN INCHES



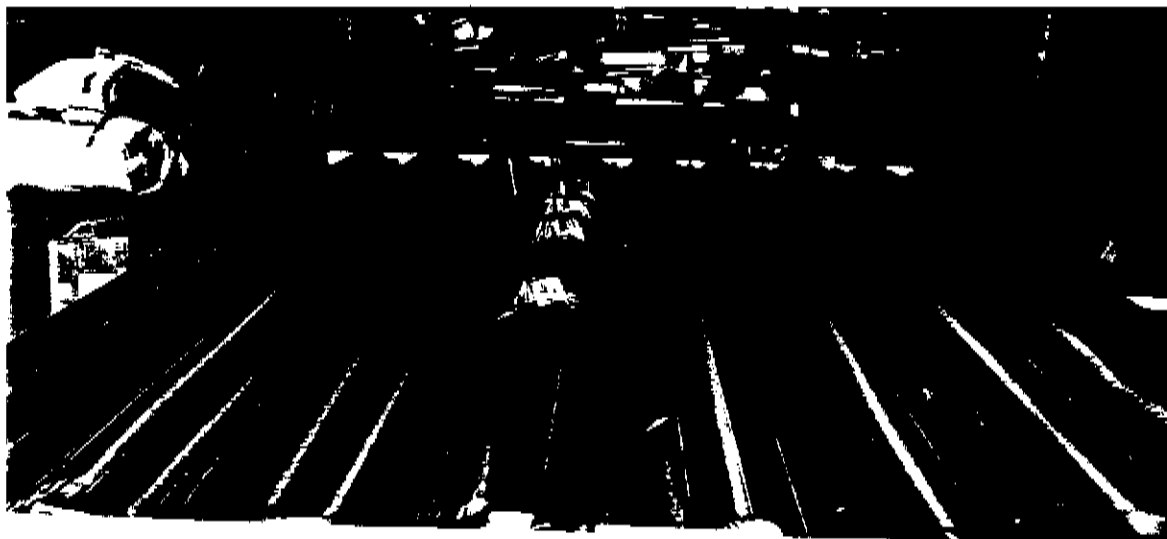
(1) Test Specimen Unloaded



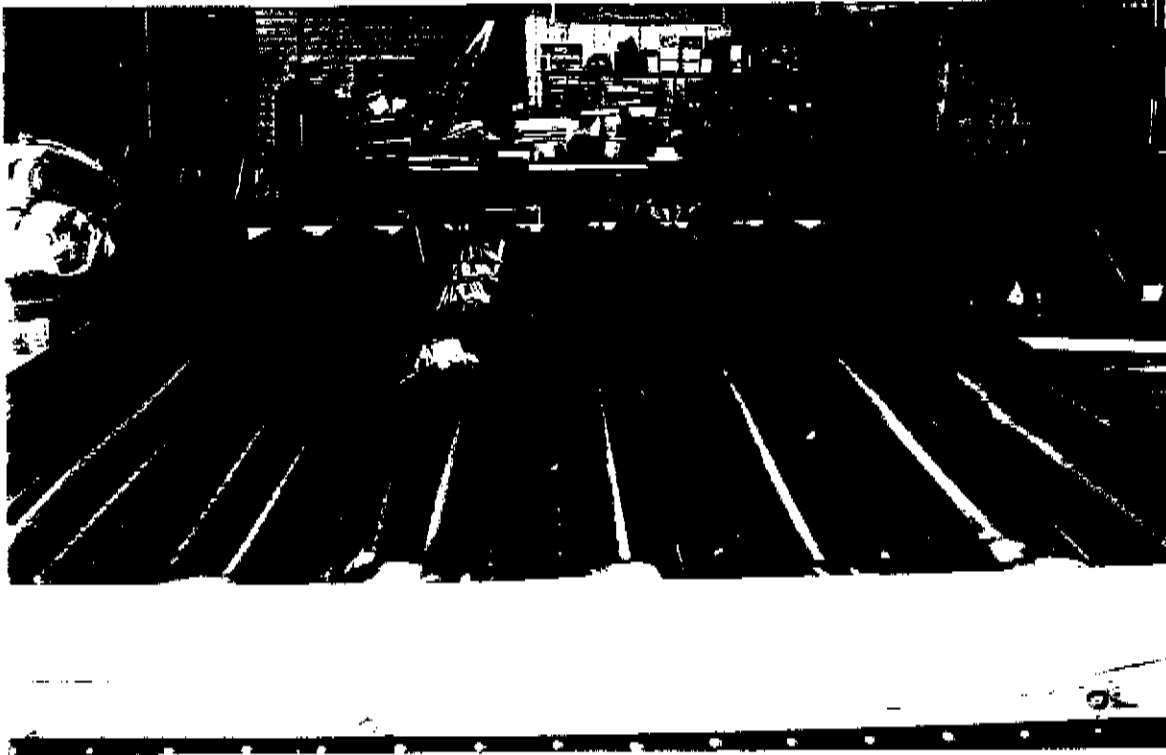
(2) Specimen Loaded to 60 psf



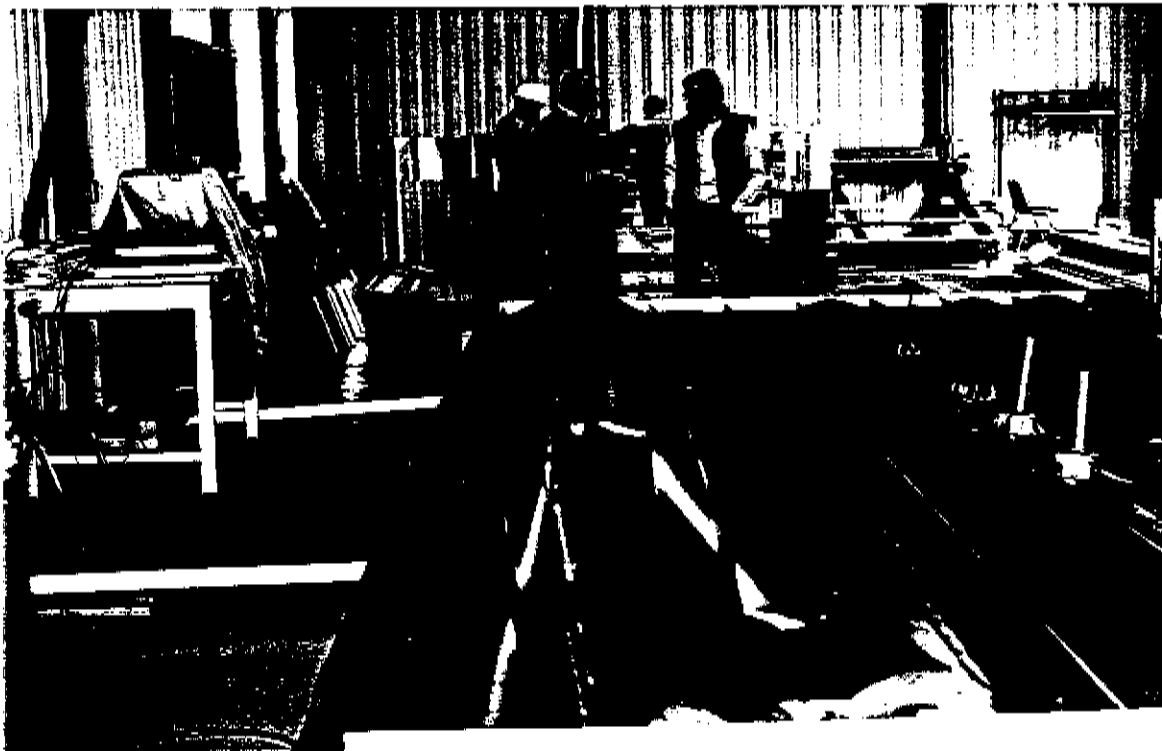
(3) Specimen Loaded to 80 psf



(4) Specimen Loaded to 90 psf



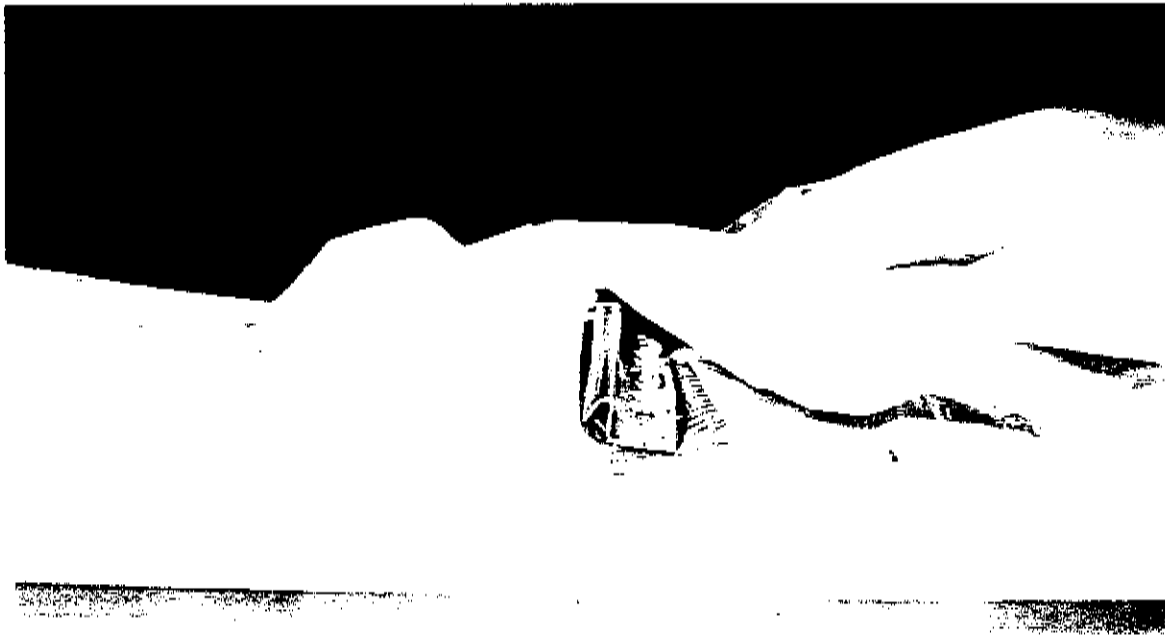
(5) Specimen Loaded to 100 psf



(6) Specimen at Failure



(7) Specimen at Failure, Close-up



(8) Clip at Failure