

Appendix B :
Data Analyses and Data Correlations

DATA ANALYSES

1. CHAMBER CORRECTION FACTOR

The chamber correction factor is used to relate the loading width of the test condition to that of the real structure. The source of the difference comes from the following two facts. First, the test panel width is larger than the coverwidth due to the off-set side joint design. Second, the chamber width is larger than the test panel width to allow unobstructed deflection under load. Therefore, the actual load on the test panel is higher than that registered on the load indicator by a factor calculated by the following equation.

$$CCF = (B + C)/(2 Cw) \text{ ----- (B1)}$$

where CCF = chamber correction factor.

B = out-to-out width of test panel (")

C = inside width of vacuum chamber (")

Cw = coverwidth of test panel (")

The above factors are applied to the bending and shear tests.

For the connection strength tests, it is considered that the edge effect on the engaged side joint is minimal. Therefore, a chamber correction factor of 1.0 is conservatively used for the connection strength tests.

2. ULTIMATE LOAD

The loads were registered by the load indicator in inches of water head. Therefore, the ultimate load is calculated by the following equation.

$$Wu = CCF \times Hu \times 5.2 + Wd \text{ ----- (B2)}$$

where Wu = ultimate load (psf)

Hu = load indicator at failure (" of water)

Wd = dead weight of test panel (psf)

3. LOAD VS. DEFLECTION

Several deflection readings were recorded at load stages with fixed load increment. Once linear load-deflection behavior is verified, the load-deflection point near $L/180$ deflection is selected for stiffness data analyses. The applied load is calculated by the following equation.

$$W = CCF \times H \times 5.2 \quad \text{-----} \quad (B3)$$

where W = load at the selected data point (psf)

CCF = chamber correction factor.

H = reading of load indicator (" of water)

4. PROCEDURES OF DATA ANALYSES

Step No. 1 : Calculate the theoretical composite section properties. (Tables B-1)

Step No. 2 : Analyze the shear modulus of the panel core using the measured load-deflection data and the theoretical composite section properties. (Table B-2A)

Step No. 3 : Analyze the stresses at failure loads for bending and shear tests using the properties developed above. (Table B-3A)

Step No. 4 : Obtain the average shear strength of the shear tests and develop the empirical equation.

Step No. 5 : Correlate the skin buckling stresses using the theoretical parameters to develop the empirical skin buckling stress equation and verify the empirical equation by correlation analyses. (Tables B-5)

Step No. 6 : Calculate the panel reaction and fastener forces for the connection strength tests using the developed panel properties and the tested ultimate loads. (Tables B-4A)

Step No. 7 : Correlate the ultimate panel reaction to the proper panel parameters to develop the empirical equation and verify the empirical equation by correlation analyses. (Tables B-6)

TABLE B-1 COMPOSITE PANEL PROPERTIES

<u>Panel Notation</u>	<u>D (")</u>	<u>I (in⁴/ft)</u>	<u>S (in³/ft)</u>	<u>Ac (in²/ft)</u>
EPS02.0-26/26	2.0	0.430	0.430	24.0
EPS03.0-26/26	3.0	0.967	0.644	36.0
EPS04.0-26/26	4.0	1.718	0.859	48.0
EPS05.0-26/26	5.0	2.685	1.074	60.0
EPS06.0-26/26	6.0	3.866	1.289	72.0
EPS08.0-26/26	8.0	6.874	1.718	96.0
EPS10.0-26/26	10.0	10.740	2.148	120.0
EPS12.0-26/26	12.0	15.466	2.578	144.0

TABLE B-2A : FOAM CORE SHEAR MODULUS

ONE D.O.F. STIFFNESS DATA ANALYSIS FOR PRECISION FOAM FABRICATORS

ELASTIC MODULUS OF SKIN = 29000.

COMPOSITE COEFF. = 1.00

REGRESSED SHEAR MODULUS OF CORE = 280.10

TEST NO.	NO. OF SPANS	SPAN	LOAD	MIDSPAN TESTED	DEFLECTION CORRELATED	CORR./TESTED
S1PA	1	6.00	72.80	.382	.347	.909
S1NA	1	6.00	72.80	.397	.347	.874
S2PA	1	10.00	41.60	.245	.223	.912
S2PB	1	10.00	41.60	.239	.223	.935
S2NA	1	10.00	41.60	.236	.223	.947

S2NB	1	10.00	41.60	.223	.223	1.002
P3A	1	10.00	15.60	.729	.652	.895
P3B	1	10.00	15.60	.780	.652	.836
N3A	1	10.00	15.60	.764	.652	.854
N3B	1	10.00	15.60	.753	.652	.866

P4A	1	10.00	41.60	.697	.675	.969
P4B	1	10.00	41.60	.691	.675	.977
N4A	1	10.00	41.60	.681	.675	.992
N4B	1	10.00	41.60	.680	.675	.993
P5A	1	10.00	41.60	.370	.407	1.100

P5B	1	10.00	41.60	.382	.407	1.066
N5A	1	10.00	41.60	.394	.407	1.033
N5B	1	10.00	41.60	.382	.407	1.066
P6A	1	14.00	41.60	.361	.397	1.100
P6B	1	14.00	41.60	.356	.397	1.116

N6A	1	14.00	41.60	.349	.397	1.138
N6B	1	14.00	41.60	.356	.397	1.116

TABLE B-3A: BENDING/SHEAR STRENGTH TEST SUMMARY

FAILURE LOAD ANALYSIS OF PRECISION FOAM FABRICATORS

TEST NO.	STRESSES AT FAILURE LOAD							VE	VI
	FT	FB	FTS	FBS	FN	FNS			
S1PA	-10.121	10.121	.000	.000	.000	.000	10.063	.000	
S1NA	10.014	-10.014	.000	.000	.000	.000	9.956	.000	
S2PA	-7.242	7.242	.000	.000	.000	.000	4.321	.000	
S2PB	-7.095	7.095	.000	.000	.000	.000	4.233	.000	
S2NA	6.453	-6.453	.000	.000	.000	.000	3.850	.000	
S2NB	6.718	-6.718	.000	.000	.000	.000	4.008	.000	
P3A	-13.814	13.814	.000	.000	.000	.000	8.250	.000	
P3B	-13.814	13.814	.000	.000	.000	.000	8.250	.000	
N3A	15.872	-15.872	.000	.000	.000	.000	9.479	.000	
N3B	16.256	-16.256	.000	.000	.000	.000	9.708	.000	
P4A	-14.930	14.930	.000	.000	.000	.000	8.906	.000	
P4B	-14.371	14.371	.000	.000	.000	.000	8.573	.000	
N4A	17.462	-17.462	.000	.000	.000	.000	10.417	.000	
N4B	16.240	-16.240	.000	.000	.000	.000	9.688	.000	
P5A	-16.676	16.676	.000	.000	.000	.000	9.951	.000	
P5B	-14.488	14.488	.000	.000	.000	.000	8.646	.000	
N5A	15.547	-15.547	.000	.000	.000	.000	9.278	.000	
N5B	18.433	-18.433	.000	.000	.000	.000	11.000	.000	
P6A	-15.658	15.658	.000	.000	.000	.000	6.674	.000	
P6B	-15.042	15.042	.000	.000	.000	.000	6.412	.000	
N6A	16.764	-16.764	.000	.000	.000	.000	7.146	.000	
N6B	18.235	-18.235	.000	.000	.000	.000	7.773	.000	

FT = MIDSPAN FACIA STRESS (KSI)
 FB = MIDSPAN LINER STRESS (KSI)
 FTS = SUPPORT FACIA STRESS (KSI)
 FBS = SUPPORT LINER STRESS (KSI)
 FN = MIDSPAN NON-COMPOSITE STRESS (KSI)
 FNS = SUPPORT NON-COMPOSITE STRESS (KSI)
 VE = CORE SHEAR STRESS AT END SUPPORT (PSI)
 VI = CORE SHEAR STRESS AT INTERMEDIATE SUPPORT (PSI)

TABLE B-4A : RESULTS OF ANALYSES
 CONNECTION STRENGTH TEST SUMMARY

PANEL NOTATION	TEST	NS	L(FT)	WU(PSF)	RE(PLF)	RI(PLF)	PE(#)	PI(#)
EPS-04.0-26/26	C11B	9	6.00	44.15	132.5	264.9	504.	1007.
EPS-04.0-26/26	C11C	2	6.00	42.58	117.6	275.8	447.	1049.
EPS-04.0-26/26	C11D	9	6.00	48.82	146.5	292.9	557.	1114.
EPS06.0-26/26	C15B	2	6.00	39.64	111.9	251.9	425.	958.
EPS06.0-26/26	C15C	9	6.00	44.84	134.5	269.0	511.	1023.
EPS06.0-26/26	C15D	9	6.00	50.56	151.7	303.4	577.	1153.
EPS10.0-26/26	C19A	9	6.00	56.08	168.2	336.5	640.	1279.
EPS10.0-26/26	C19B	2	6.00	74.80	215.6	466.4	820.	1773.
EPS10.0-26/26	C19C	9	6.00	48.80	146.4	292.8	557.	1113.
EPS10.0-26/26	C19D	2	6.00	58.16	167.6	362.7	637.	1379.
EPS02.0-26/26	C9A	1	6.00	65.83	197.5	.0	751.	0.
EPS02.0-26/26	C9B	1	6.00	69.99	210.0	.0	798.	0.
EPS02.0-26/26	C10A	1	6.00	100.67	302.0	.0	1148.	0.
EPS02.0-26/26	C10B	1	6.00	100.67	302.0	.0	1148.	0.
EPS04.0-26/26	C13A	1	6.00	96.68	290.0	.0	1103.	0.
EPS04.0-26/26	C13B	1	6.00	97.20	291.6	.0	1109.	0.
EPS04.0-26/26	C14A	1	6.00	134.64	403.9	.0	1536.	0.
EPS04.0-26/26	C14B	1	6.00	132.04	396.1	.0	1506.	0.
EPS06.0-26/26	C17A	1	6.00	99.94	299.8	.0	1140.	0.
EPS06.0-26/26	C17B	1	6.00	104.62	313.9	.0	1193.	0.
EPS06.0-26/26	C18A	1	6.00	137.38	412.1	.0	1567.	0.
EPS06.0-26/26	C18B	1	6.00	147.78	443.3	.0	1686.	0.
EPS10.0-26/26	C21A	1	6.00	97.15	291.5	.0	1108.	0.
EPS10.0-26/26	C22A	1	6.00	136.15	408.4	.0	1553.	0.
EPS10.0-26/26	C22B	1	6.00	136.67	410.0	.0	1559.	0.

NS = SPAN CONDITION (1,2,3); 9 FOR CENTER BUTT JOINT CONDITION.

L = TESTED SPAN.

WU = ULTIMATE LOAD.

RE = END SUPPORT REACTION AT FAILURE.

RI = INTERMEDIATE SUPPORT REACTION AT FAILURE.

PE = SIDE JOINT CONNECTION FORCE AT END SUPPORT.

PI = SIDE JOINT CONNECTION FORCE AT INTERMEDIATE SUPPORT.

TABLE B-5 : BENDING/SHEAR STRENGTH TEST CORRELATION

FAILURE LOAD CORRELATION OF PFF PANELS

TEST	NS	L(FT)	LD	SC(IN3/FT)	WU(PSF)	WP(PSF)	WP/WU	MODE
S1PA	1	6.000	+	.8590	161.00	162.00	1.006	SH
S1NA	1	6.000	-	.8590	159.30	162.00	1.017	SH
S2PA	1	10.000	+	2.1480	103.70	97.20	.937	SH
S2PB	1	10.000	+	2.1480	101.60	97.20	.957	SH
S2NA	1	10.000	-	2.1480	92.40	97.20	1.052	SH
S2NB	1	10.000	-	2.1480	96.20	97.20	1.010	SH
P3A	1	10.000	+	.4300	39.60	45.44	1.147	BM
P3B	1	10.000	+	.4300	39.60	45.44	1.147	BM
N3A	1	10.000	-	.4300	45.50	45.44	.999	BM
N3B	1	10.000	-	.4300	46.60	45.44	.975	BM
P4A	1	10.000	+	.8590	85.50	90.77	1.062	BM
P4B	1	10.000	+	.8590	82.30	90.77	1.103	BM
N4A	1	10.000	-	.8590	100.00	90.77	.908	BM
N4B	1	10.000	-	.8590	93.00	90.77	.976	BM
P5A	1	10.000	+	1.2890	143.30	136.20	.950	BM
P5B	1	10.000	+	1.2890	124.50	136.20	1.094	BM
N5A	1	10.000	-	1.2890	133.60	136.20	1.019	BM
N5B	1	10.000	-	1.2890	158.40	136.20	.860	BM
P6A	1	14.000	+	2.5780	137.30	138.98	1.012	BM
P6B	1	14.000	+	2.5780	131.90	138.98	1.054	BM
N6A	1	14.000	-	2.5780	147.00	138.98	.945	BM
N6B	1	14.000	-	2.5780	159.90	138.98	.869	BM

NS = SPAN CONDITION.

L = SPAN.

LD = APPLIED LOAD DIRECTION.

SC = SECTION MODULUS OF THE COMPRESSIVE SKIN.

WU = TESTED ULTIMATE LOAD.

WP = PREDICTED ULTIMATE LOAD.

SH = SHEAR FAILURE MODE.

YD = SKIN YIELDING MODE.

BM = SKIN BUCKLING AT MIDSPAN.

BS = SKIN BUCKLING OVER INTERMEDIATE SUPPORT.

TABLE B-6 : PPF PANEL TESTS
 CONNECTION STRENGTH TEST CORRELATION

PANEL NOTATION	TEST	NS	L(FT)	WU(PSF)	WP(PSF)	WP/WU	MODE
EPS-04.0-26/26	C11B	9	6.00	44.15	44.80	1.0148	SJ
EPS-04.0-26/26	C11C	2	6.00	42.58	42.07	.9880	PO
EPS-04.0-26/26	C11D	9	6.00	48.82	44.80	.9177	SJ
EPS06.0-26/26	C15B	2	6.00	39.64	42.87	1.0816	PO
EPS06.0-26/26	C15C	9	6.00	44.84	45.41	1.0128	PO
EPS06.0-26/26	C15D	9	6.00	50.56	49.58	.9807	SJ
EPS10.0-26/26	C19A	9	6.00	56.08	56.34	1.0046	SJ
EPS10.0-26/26	C19B	2	6.00	74.80	75.16	1.0048	SJ
EPS10.0-26/26	C19C	9	6.00	48.80	45.41	.9306	PO
EPS10.0-26/26	C19D	2	6.00	58.16	43.70	.7513	PO
EPS04.0-26/26	C13A	1	6.00	96.68	95.04	.9830	TB
EPS04.0-26/26	C13B	1	6.00	97.20	95.04	.9777	TB
EPS04.0-26/26	C14A	1	6.00	134.64	142.55	1.0588	TB
EPS04.0-26/26	C14B	1	6.00	132.04	142.55	1.0796	TB
EPS06.0-26/26	C17A	1	6.00	99.94	95.04	.9509	TB
EPS06.0-26/26	C17B	1	6.00	104.62	95.04	.9084	TB
EPS06.0-26/26	C18A	1	6.00	137.38	142.55	1.0377	TB
EPS06.0-26/26	C18B	1	6.00	147.78	142.55	.9646	TB
EPS10.0-26/26	C21A	1	6.00	97.15	95.04	.9782	TB
EPS10.0-26/26	C22A	1	6.00	136.15	142.55	1.0470	TB
EPS10.0-26/26	C22B	1	6.00	136.67	142.55	1.0430	TB

NS = SPAN CONDITION (1, 2, OR 3).

L = TESTED SPAN.

WU = TESTED ULTIMATE LOAD.

WP = PREDICTED ULTIMATE LOAD.

SJ = PREDICTED SIDE JOINT FAILURE.

TB = PREDICTED LINER SKIN TEARING AROUND BOLT FAILURE.

PO = PREDICTED SCREW PULL-OUT FAILURE.