TEST REPORT

REPORT NUMBER: 3083303SAT – 007 REV1
ORIGINAL ISSUE DATE: February 27, 2008
REVISION DATE: January 5, 2009

EVALUATION CENTER
Intertek Testing Services NA, Inc.
16015 Shady Falls Road
Elmendorf, TX 78112

RENDERED TO

Emmedue S.P.A.
Via Toniolo, 39/b
Z.I. Bellocchi
61032 Fano (PU), Italy

PRODUCT EVALUATED: 8’ x 8’ Single Panel PSM80 Floor/Roof Systems
EVALUATION PROPERTY: ICC – AC 15, Section 4.2.2.7, ASTM E 455 - 04,
(**Diaphragm Shear Load**)

Report of Testing 8’ x 8’ Single Polystyrene PSM80 Floor/Roof panels for compliance with the applicable requirements of the following criteria: *ICC – AC 15, Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems, under the general guidelines of ASTM E 455 - 04, Standard Test Method for Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings*

1 Table of Contents

2 Introduction

Intertek Testing Services NA, Inc. (Intertek) has conducted testing for Emmedue S.P.A on 8' x 8' Single Polystyrene PSM80 structural floor/roof panels. The test method consisted of the diaphragm shear load. Emmedue wall, floor, and roof systems are based on a series of foam polystyrene panels and electro-welded steel wire meshes, whose shapes have been specially designed to apply structural plaster during panel installation (Ref, 1, p. 3). These systems are capable of multiple applications, such as quick installation and high thermal and sound capabilities (Ref 1, p. 3). The purpose of these tests was to evaluate diaphragm shear load structural applications according to Section 4.2.2.7 of ICC – AC 15, under the general guidelines of *ASTM E 455 - 04, Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings*. The results of each test are presented in tabular and graphical form. In total, three specimens were tested under the above loading configuration to measure the deflection and failure characteristics of each of the floor/roof systems. This evaluation began January 25, 2008 and was completed January 29, 2008.

NOTE: This test report is only for the diaphragm shear tests performed. Refer to report numbers **3083303SAT - 001, - 002, - 003, - 004, - 005, - 006, and - 008** (designated **REV1, except 008**) for the rest of the testing completed for this project.

3 Test Samples

3.1. SAMPLE SELECTION

Samples were randomly selected on July 1, 2007 by Intertek representative Matt Lansdowne, EIT, at the Emmedue S.P.A manufacturing facility, located at Via Toniolo 39/b, Z.I. Bellocchi, 61032 Fano (PU), Italy. Samples were received at Intertek – San Antonio on August 28, 2007.

The subject test specimens are traceable samples selected from the manufacturer's facility. Intertek selected the specimens and has verified the composition, manufacturing techniques and quality assurance procedures.

Refer to the Pre-Test Inspection Report, dated July 1 – 2, 2007, located in the Appendix.

3.2. SAMPLE AND ASSEMBLY DESCRIPTION

The Emmedue Single Panel PSM80 consists of a foam polystyrene core reinforced with a galvanized steel wire mesh connected on both sides of the foam using corrugated steel bars. The steel bars and mesh are electro-welded together for strength. There are approximately 82 connectors per square meter of foam surface. Below is a list of specifications of the PSM80 panels (Ref 1, p. 7). The numbers below were converted from metric to inch-pounds from the Emmedue Operator's Handbook.

Galvanized Steel Wire Mesh

1) Longitudinal wires with diameter of 0.121 inches spaced every 2.56 inches
2) Transversal wires with diameter of 0.099 inches spaced every 2.56 inches

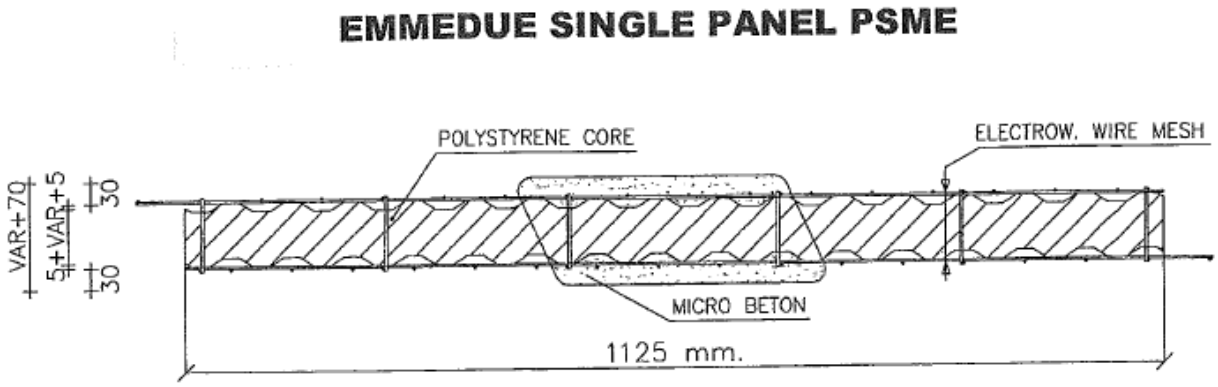


Figure 1: Emmedue Single Panel PSM80 Details (Ref. 1, p.7)

Polystyrene Slab Density: 15 Kg/m^3 (0.936 lb/ft^3)
Polystyrene Slab Thickness: 4”

The Emmedue building system comprises of different wall, floor, and roof arrangements that are finished on-site using sprayed mortar. Although different techniques exist for spray mortar, the mortar mix used for this project consisted of Portland® Cement, sand, and water. The client recommends an average quantity of plaster (or mortar) of about 1 inch sprayed per side. These panels are generally used for buildings of no more than 4 stories high, in seismic areas, for floor slabs and covering slabs whose spans are 4 m (13.12 ft) at maximum (Ref. 1, p. 7).

For these tests, a mortar mix design was provided in order to meet the required floor/roof structural plaster specifications. The mortar mixing ratio (by weight) was provided as followed:

Portland® Cement:	100 lbs
Sand:	280 lbs
Water:	5.0 gallons

The above numbers were provided by the client during sample construction. As indicated by the Emmedue Operator’s Handbook (Ref. 1, p 27), the quantity of water should vary as humidity and temperature changes are observed. Accordingly, modifications to the mixing ratio were made as indicated by the weather conditions during mortar spraying. In all cases, the minimum compressive mortar strength (f’c) was 2500 psi at 28 days curing time. These results were verified by performing mortar cylinder core tests at 7 and 28 days as per ACI 506.2, for each batch made. Additional mortar cylinder core tests were also performed within 48 hours of the completion of each set of three full-scale tests, as per AC 15, Section 4.2.2.7.

From the mortar cylinder core testing results obtained, it was found that no mortar core was lower than 2500 psi at 28 days. Refer to report number **3083303SAT – 008** for a complete listing of all mortar core tests performed.

The PSM80 floor/roof panels were constructed with a concrete top and a sprayed mortar bottom. The nominal concrete thickness was 2.0 inches. The nominal mortar thickness was

approximately 1.5 inches (finished sample thickness was 7.5 inches). The concrete specifications were as followed:

Compressive Strength (f'c):	3500 psi at 28 days
Concrete slump:	5 inches (using an Abram's slump cone)
Aggregate size:	Nominal 3/8" pea gravel

The concrete was ordered through a local supplier. The mix design was also provided by the concrete supplier. A detailed copy of the concrete mix design used is located in the Appendix.

4 Testing and Evaluation Methods

4.1. Construction of Floor/Roof Assemblies

Three diaphragm shear floor/roof samples were tested and all were constructed in the same manner. Construction of the 8' x 8' samples consisted the following:

1) Single Panel PSM80 (2 ea. Connected together to obtain 8 feet)
2) Electron wire mesh
3) 1/8" Rebar tie wire
4) #3 rebar
5) ¾" and 1" Schedule 40 PVC pipe
6) 1x10 #1 yellow pine lumber cut down to 6" wide
7) #8 x 2" wood deck screws
8) Mortar mixture (Portland® Cement, sand, and water)

All of the samples had to be constructed at the Intertek-San Antonio facility. Panel assembly first consisted of joining two PSM80 panels in order to obtain the 8 foot wide dimension. The cantilever method in ASTM E 455 (Section 6.1.3.1) calls for minimum diaphragm construction dimensions of no less than 8 feet in length and width. The two panels were attached at the joint using 1/8" rebar tie wire every 8" – 10", extending the entire panel height. This was followed by the construction of the wooden frame around the perimeter of the PSM80 panels using #8 x 2" wood deck screws and 1x10 #1 yellow pine lumber joists cut down to 7 ½" wide. The difference in thickness accounts for the two different thicknesses of mortar and concrete (2" concrete, 1.5" mortar). The perimeter frame served two purposes: 1) as a support to assure that each wall was even and plumb before mortar spraying, and 2) as a guide for applied proper mortar thickness. The 1/8" rebar tire wire was installed 32" from the top and bottom around the panel and frame in order to hold the two pieces together. Refer to Figures 2 and 3 for more details.

Figures 2 and 3: Finished framework and supports for diaphragm panels

At the lower left corner of each panel, a 1.25 inches diameter hole was cut out in order to test the "hinge" connection, as per ASTM E 455, Section 6.1.2.1 (refer to Section 4.2 in this report). The method used for testing was the Cantilever Beam Diaphragm Test with a Concentrated

Load. According to the cantilever method, a pinned frame reaction needs to be incorporated into the design in order to transfer the horizontal force to the support frame and be installed as close as possible to the diaphragm frame. These samples do not have an outer frame for support; therefore a hole was made to pass through the sample at the lower left corner. The pin hole was approximately 1.25 inches in diameter, located 8.0 inches from the left side and 6.0 inches from the bottom. The diameter of the hole was maintained by inserting a 12 inch long piece of 1.0 inch ID Schedule 40 PVC pipe (see Figure 7). Prior to testing, the PVC pipe was drilled out in order to insert the metal hinge pin. The hole was reinforced with two bars of #3 rebar (located on both concrete and mortar sides), 18 inches long, bent at 90°. These were installed by the client to reinforce the hinge support. Refer to Figures 6 through 8 for details.

Figures 6 and 7: Installation of #3 rebar at hinge location (both sides)

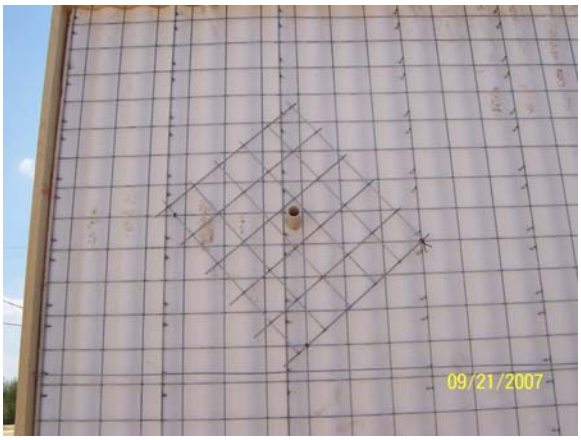
Figure 8: Rebar at hinge (concrete side)

At the request of the Test Engineer, the client made four lifting points on each diaphragm sample to facilitate transportation and setup. Each lifting point was located approximately 19 inches from the left end and 19 inches from the bottom. The hole was made with a Schedule 40 ¾" ID PVC pipe. Refer to Figures 9 and 10 for details.

Figure 9: Location of lifting point from left end

Figure 10: Location of lifting point from bottom

Once the PVC pipes were inserted, the client reinforced each lifting point using a 10 inch x 10 inch piece of extra electro-welded wire mesh on the both sides of the samples. Before testing, the PVC pipes were drilled out and lifting bolts were inserted with shackles to transport and setup each sample. Refer to Figures 11 and 12 for details.



Figures 11 and 12: Reinforcing wire mesh installation for each lifting point

The samples were then sprayed with a mortar mixture of sand, water, and Portland® Cement on one side using a plaster sprayer provided by the client. Mortar specifications included sand particles with less than 0.20" size and a slump of 2", at the appropriate ratio (refer to Section 3.2, Sample and Assembly Description, for mixing ratio). The three ingredients were mixed using a concrete mixer. A compressor capable of adjustment was used in order to assure the client recommended 90 psi application pressure. Two layers of sprayed mortar were applied to one side until the desired mortar thickness of 1" (+/- ¼") was achieved. The samples were then smoothed out as much as possible using mortar trowels or any other straight smoothing device. Refer to Figures 9 through 12 for details

Figure 9: Mortar mixing

Figure 10: Spraying application of diaphragm samples

Figures 11 and 12: Smoothing of mortar

The sprayed mortar samples were allowed to cure for approximately 7 days. Once cured, the samples were flipped over and repositioned horizontally on the floor. This was done in order to prepare the samples for concrete pouring. The concrete was poured from the truck into wheel barrels which were then carted to the appropriate samples. The concrete was gravity poured and settled using a concrete vibrator. Once poured, the tops of the samples were smoothed out using a trowel (or some other type of smoothing device), taking care not to cover up the protruding PVC pipes. The samples were then wetted down for a period of 24 hours in order to avoid accelerated curing of the concrete (which can lead to surface cracks). The samples were allowed to cure for at least 28 days prior to testing. Refer to Figures 13 and 14 for details.

Figure 13: Diaphragm shear samples before concrete pour

Figure 14: Diaphragm samples after concrete pour

4.2. ICC-AC 15 and ASTM E 455 - 04 Testing Procedures

Cantilever Beam Diaphragm Test with a Concentrated Load

All testing was performed according to ICC – AC 15, Section 4.2.2.7 and Annex B, under the general guidelines of ASTM E 455 cantilever loading procedure. In order to accommodate testing the samples in a horizontal position, a new test apparatus was constructed. The setup consisted of two rigid I-beams, steel pipe rollers, a steel pin, and a hydraulic cylinder. One horizontally positioned hydraulic cylinder (with a stroke capacity of 24") was installed with a rigid connection as described in Figure 2 of ASTM E 455. The cylinder was supported by a rigid I-beam which is bolted down to the laboratory floor. The head of the cylinder is equipped with a high strength steel nut capable of adjustment. A 7" x 7" x ½" thick steel plate was welded to the nut for proper loading of the samples. The plate was fitted with a 7" x 7" x ¼" piece of EPDM rubber (used also for compression, compression-flexural, and in-plane shear tests) in order to distribute the load evenly on the two faces of the sample. Refer to Figure 15 for details.

Figure 15: Hydraulic cylinder installation to rigid support beam

A reaction support I-beam capable of withstanding high loads was anchor bolted to the concrete floor perpendicular to the direction of the applied load. This rigid I-beam also served two purposes: 1) to construct the hinge connection and serve as the pinned frame reaction point, and 2) to accommodate a vertical reaction roller at the lower right end of each sample. The hinge was constructed of ¾" flat steel stock, cut into two pieces, or "ears". The ears were welded to the I-beam, approximately 7 ¾" apart to allow sufficient space to insert each sample between them. A 1 ¼" inch diameter pin hole was made on each ear in order to close the hinge and sample assembly. Three 4" OD steel pipes were positioned at the center of the test setup to evenly support each sample and allow in-plane movement. Refer to Figures 16 through 18 for more details.

The walls were transported to the test frame using slings and shackles. Care was taken in order to try to avoid any potential damage to the walls due to sudden movements. This was

accomplished by inserting four 15" long, ¾" diameter all-thread pieces (with nuts and washers) in each of the four lifting points. Slings were inserted at each of the far end shackles in order to lift them using a forklift with fork extenders. The samples were then positioned into the diaphragm test frame. Refer to Figures 19 and 20.

Figure 16: Reaction support with hinge (foreground) and vertical roller (background)

Figures 17 and 18: 3" In-plane steel rollers (left) and top view of hinge connection (right)

Figures 19 and 20: Expanded views of diaphragm test setup (with instruments)

Loading was applied using a hydraulic pump capable of pressures up to 3000 psi. Due to space limitations, a calibrated pressure gauge was used instead of a load cell to measure the applied force. Four low voltage linear transducers (LVDT) capable of 0.001 inch resolution were installed as illustrated in Figure 2 of ASTM E 455. Data from each transducer was monitored and recorded using data acquisition software. Refer to Figure 21 for details.

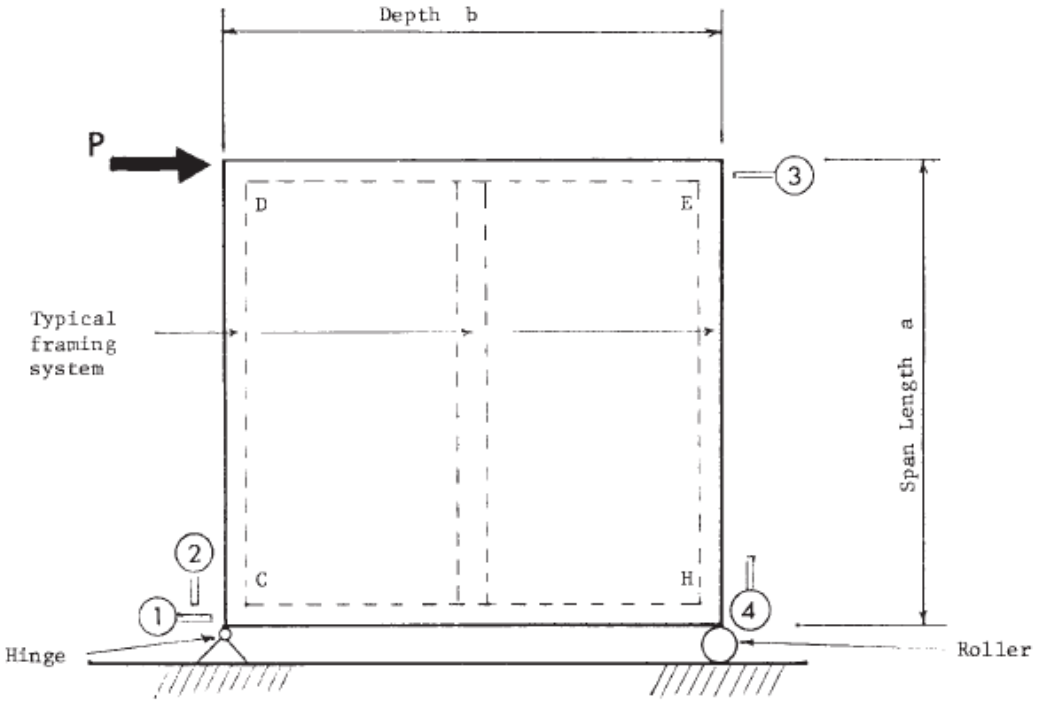


Figure 21: ASTM E 455 Cantilever beam diaphragm setup with instrumentation locations (Ref. 4, pg. 3)

A pre-load (not to exceed 10% of the ultimate load) was applied to the specimen. With the pre-load applied to the specimen, an initial reading was made. Once this measurement was made, the load was increased slightly which in turn applied an initial load to the specimen. Each specimen was loaded to a minimum of 10 predetermined target loads in order to sufficiently obtain data to effectively plot a load-deflection curve. Each load was applied for 5 minutes during which time deflection measurements were made as a function of time (as soon as it is

practical after initial loading and at the end of the 5 minute period). This method of load continued until failure occurred.

NOTE: AC 15, Section 4.2.2.7 indicates to test these types of samples under the guidelines of Annex B. This section states that "…the loading procedure described in ASTM E 455 shall apply the loads through a continuous structural member that simulates in-situ conditions including connection devices."

All diaphragm shear tests were performed without a top structural member. The client did not install such members into the walls during construction. Before testing, it was found that the walls could not be modified with such a structural load member without sustaining permanent damage. The Client agreed to go along with the testing as is.

4.2.1. ICC – AC 15 and ASTM E 455 - 04 Notes

These tests were performed in accordance to ICC- AC 15 and under the general guidelines of ASTM E 455 – 04. As per AC 15, three identical specimens were tested, which in turn consisted of equal lengths, (8 feet), equal widths (8 feet), and equal thicknesses (7.5 inches).

According to AC 15, Section 4.2.2.7, three mortar cylinder cores shall be tested within 48 hours of the completion of each set of full-scale tests. This procedure was performed for each set of constructed walls, in addition to 7 and 28 day mortar cores for each batch of mortar mixed. For example, if a set of walls required two applications of sprayed mortar on each side, then six mortar cylinder cores were made for each batch of sprayed mortar (tested at 7 and 28 days for each batch). The mortar cores were made under the general guidelines of *ACI 506.2 – 95, Specification for Shotcrete*. Under the ACI 506.2 code, Section 1.6.1.1, the preparation of the shotcrete mortar cylinder core panels was to be made according to *ASTM C 1140, Preparing and Testing Specimens from Shotcrete Test Panels*. According to ASTM C 1140, Section 5, "…the forms for making shotcrete mortar cores shall be made of wood or steel construction and sufficiently rigid to prevent dislodging of the shotcrete through vibration or deformation." The forms were constructed of 1x6 #1 yellow pine lumber, 2x4 #2 yellow pine lumber, ¾" plywood, and #8 x 1 ½" wood deck screws. The interior dimensions of the forms constructed were **24" wide x 24" long x 3 ½" deep**, as indicated in Section 5 of ASTM C 1140. One form was constructed for each time a new batch of mortar was made. From each form, a total of approximately 25 cores could be made at one time. Refer to Figure 22 for details.

Figure 22: Wooden form for mortar core sampling

Once the wooden form was made, the mortar was sprayed into the form until it covered the entire 3 ½" depth. The mortar was allowed to settle naturally with no help of any mechanical means (concrete vibrator, mixing rod, etc.). The top of the form was then smoothed out with a trowel (or any other suitable straight smoothing device) and was moved indoors and allowed to cure for a minimum of 24 hours. Each sprayed form was properly labeled and sealed using plastic sheathing and shrink wrap to maintain the proper moisture. Refer to Figures 23 through 28 for details.

Figures 23 and 24: Application of sprayed mortar into wooden forms

Figures 25 and 26: Smoothing of mortar in wooden form

Figures 27 and 28: Mortar form labeling and sealing with plastic sheathing

After a minimum curing time of 24 hours, the forms were transported to an outside core testing facility and cored for the number of samples indicated. Coring was made using a specialized coring drill with a diamond bit. Once the samples were cored, they were properly labeled, measured, weighed, sulfur capped, and stored in a 100% humidity moisture room until tested. Refer to Figures 29 through 36 for more details.

The concrete cylinders were prepared on site by a qualified field technician from an outside concrete laboratory. Slump and temperature measurements were taken from the concrete as it was delivered by the supplier. 4" x 8" cylinders were made on site for each concrete pour, tested at 7 and 28 days for quality assurance. A set of three cylinders was also tested for compliance with AC 15, Section 4.2.2.7. The standards involved in testing the concrete cylinders include (but are not limited to) *ASTM C 31, C 192, and C 617*.

Figure 29: Drilling of mortar cores

Figure 30: Mortar cores after drilling

Figures 31 and 32: Labeling, weighing, and sulfur capping of mortar cores


Figures 33 and 34: Cylinder core testing machine and placement of cores into apparatus

Figures 35 and 36: 4x8 concrete cylinder setup and failure mode

5 Testing and Evaluation Results

5.1. RESULTS AND OBSERVATIONS

Diaphragm Shear Test Results (Cantilever Beam with Concentrated Load)

In total, three diaphragm shear tests were performed. Below is a list of the test parameters:

Specimen length:	96.0 inches
Specimen width:	96.0 inches
Nominal thickness:	7.5 inches (+/- 0.25 inches)
Initial pre-load:	1130 lbs (stand-by pressure of hydraulic pump)
Load Rate:	Approximately 700 lbs every 5 minutes (140 lbs/min)

The results obtained for the diaphragm tests are tabulated as followed:

Specimen ID	Date Tested	Age of Wall (days)	Ultimate Load (lbs)	Average (lbs)	Average within 15%?	Allowable Load (lbs)
455_8X8D1	1/25/08	114	11027	10320	YES	10320
455_8X8D2	1/28/08	117	11027			
455_8X8D3	1/29/08	118	8906			

The Allowable Load for each set of three walls was calculated under the guidelines of AC 15, Section 4.3, Paragraph 2, which states the following:

"The average maximum strength from each set of tests may be the average ultimate value, provided the ultimate value for each test is within 15 percent of the average. Otherwise, the lowest ultimate value shall be used."

Refer to Appendix A for Load vs. Deflection curves for all diaphragm shear tests. Refer to Appendix B for the test data sheets.

All calculations were made in accordance to the general guidelines of ASTM E 455, Section 10.

The Ultimate Shear Strength (S_u) of each panel was calculated by:

$$S_u = (12 * R_u) / B = [12 *(Max\ Load / 2)] / B$$

Where;
R_u = maximum reaction force acting parallel to the applied load in a cantilever setup (lbs)
B = diaphragm depth (inches)

The Apparent Shear Stiffness (G') was calculated by:

$$G' = (P / \Delta s') * (A/B)$$

Where;
A = diaphragm span length (inches)
B = diaphragm depth (inches)
P = load at any point (lbs)
Delta s' = apparent shear deformation at any load point (inches)

The Maximum Deflection (Delta b) was calculated by:

$$\Delta b = (P * A^3) / (3 * E * I)$$

Where;
E = Modulus of Elasticity of the diaphragm (psi)
I = Moment of Inertia of the diaphragm (in^4)

NOTE: The Stiffness EI for the diaphragm samples was calculated using the known tested value found from testing the PSM80 Floor/Roof Flexural samples. The average result of these three floor/roof flex samples was used for calculating the maximum deflection of the diaphragms.

The Total Deflection (Delta t) at any load is calculated by the following formula;

$$\Delta t = LVDT\ 3 - [LVDT\ 1 + [(A/B) * (LVDT\ 2 + LVDT\ 4)]]$$

Where;
A = diaphragm span length (inches)
B = diaphragm depth (inches)
LVDT 1 = Lower left (measures hinge deformation)
LVDT 2 = Lower left (measures hinge rotation)
LVDT 3 = Upper right (measures in-plane panel deformation)
LVDT 4 = Lower right (measures panel rotation)

Statistical analysis calculations were computed using the linear regression analysis method included in Microsoft Excel® (command "LINEST").

A CD copy of all the assembly, setup, and test photos will be provided to the client.

6 Conclusion

Intertek Testing Services NA, Inc. (Intertek) has conducted testing for Emmedue S.P.A on 8' x 8' Single Polystyrene PSM80 structural floor/roof panels. The test method consisted of the diaphragm shear load. The purpose of these tests was to evaluate diaphragm shear load structural applications according to Section 4.2.2.7 of ICC – AC 15, under the general guidelines of *ASTM E 455 - 04, Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings*. The results of each test were presented in tabular and graphical form. In total, three specimens were tested under the above loading configuration to measure the deflection and failure characteristics of each of the floor/roof systems. This evaluation began January 25, 2008 and was completed January 29, 2008.

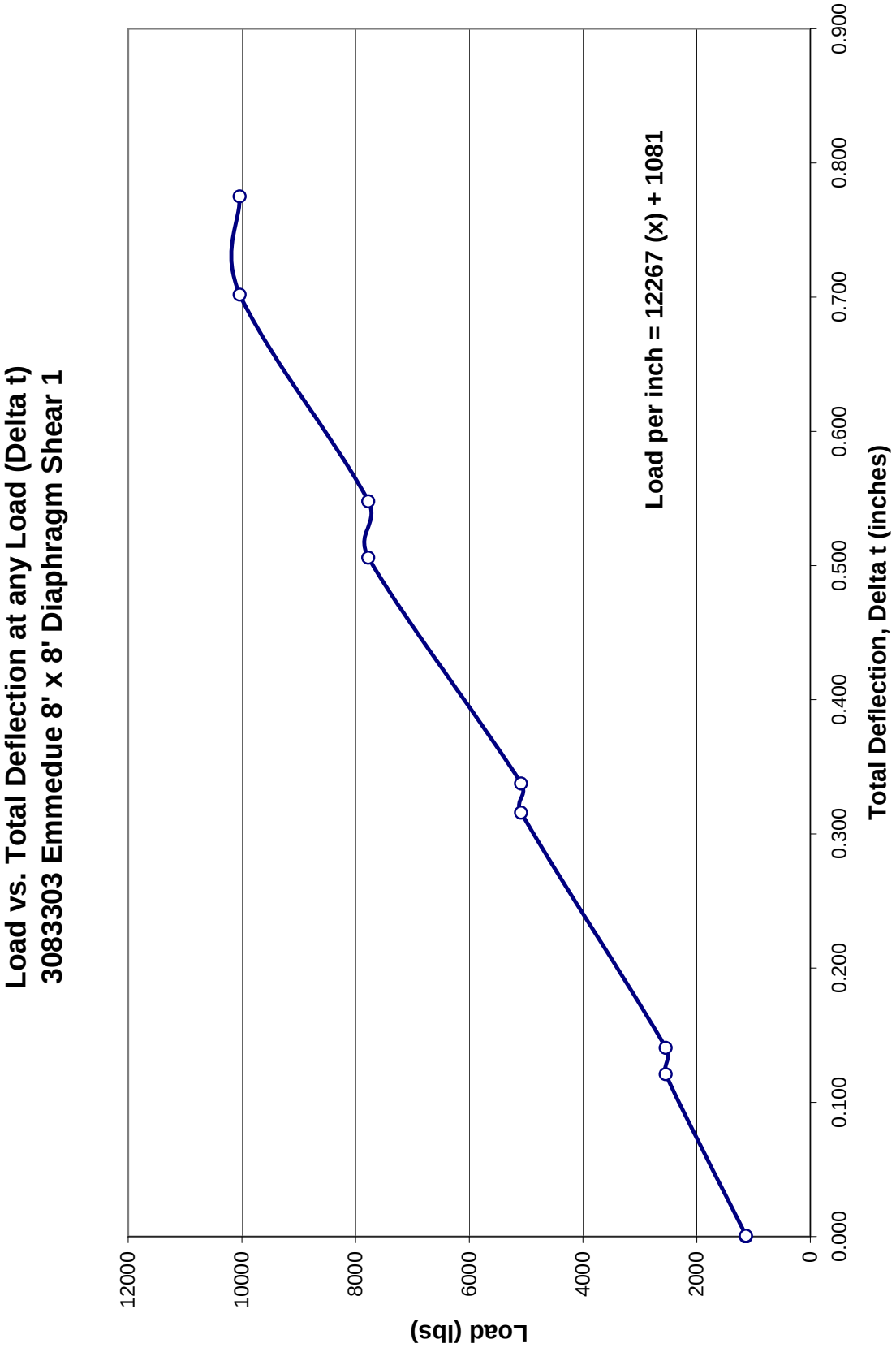
The conclusions of this test report may be used as part of the requirements for Intertek product certification. Authority to Mark must be issued for a product to become certified.

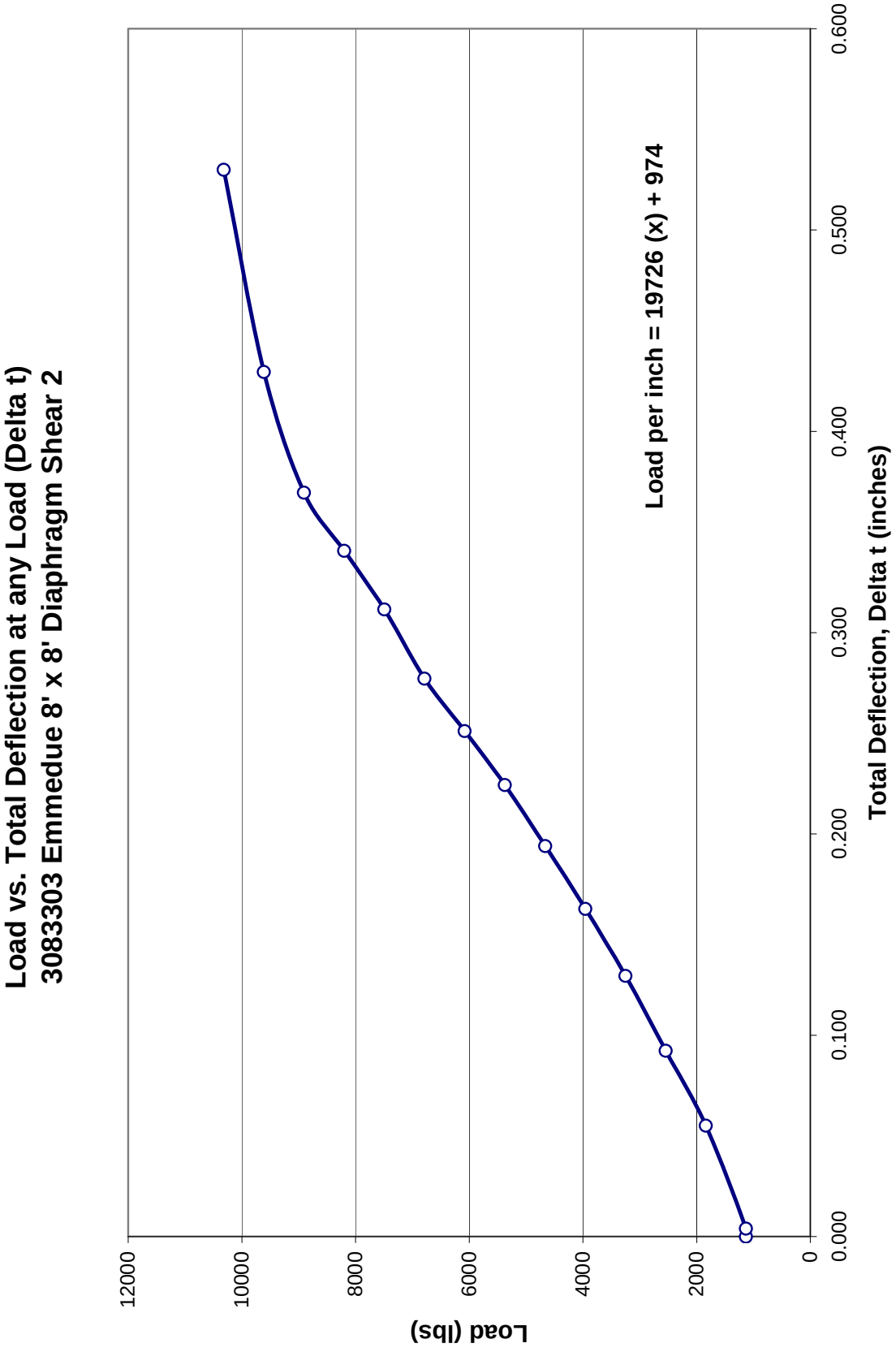
INTERTEK TESTING SERVICES NA, INC

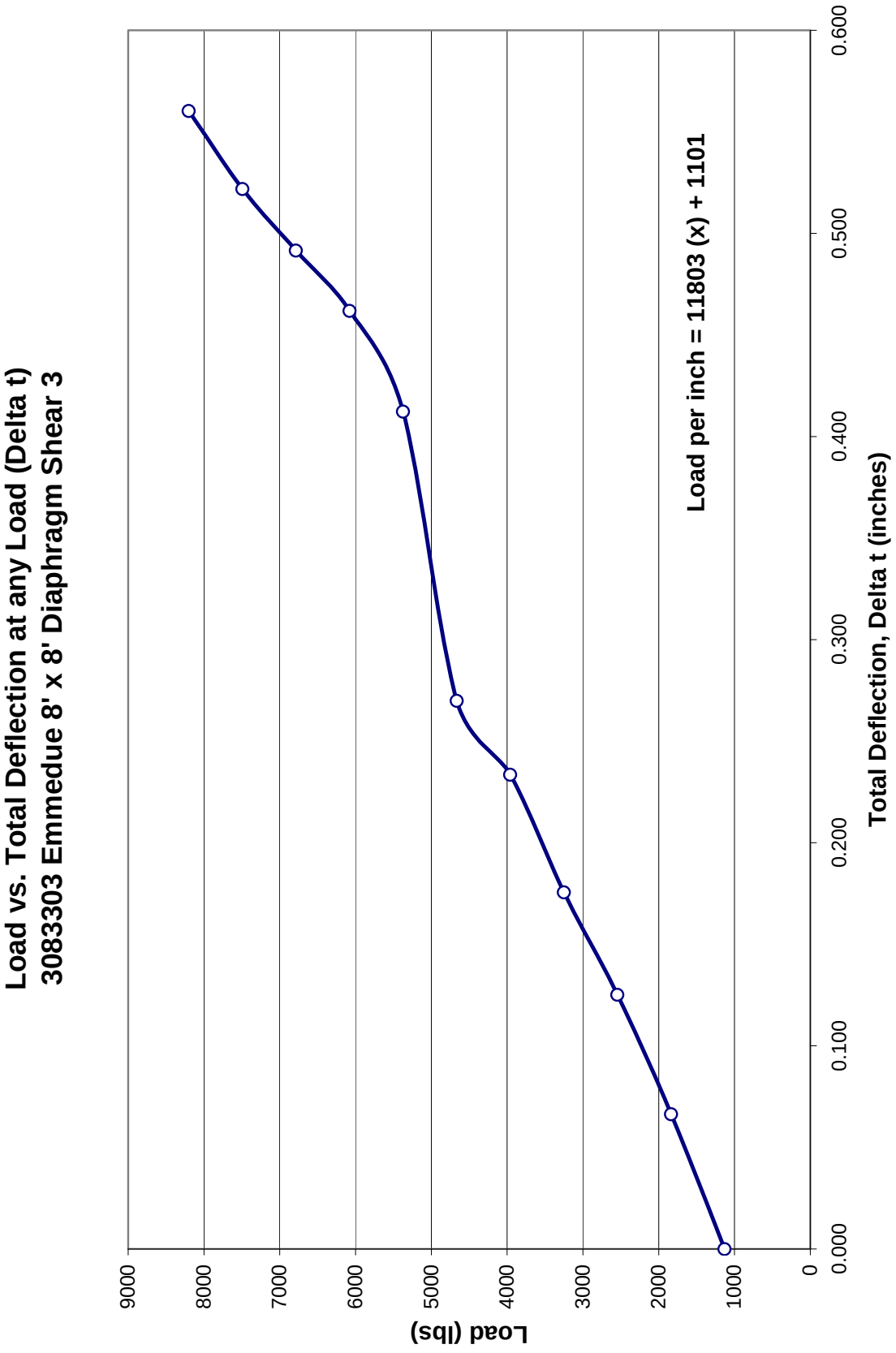
Reported by: _____
Victor M. Burgos
Test Engineer

Reviewed by: _____
Michael E. Luna, M.S.
General Manager

APPENDIX A
Graphs


Load vs. Total Deflection at any Load (Delta t)
3083303 Emmedue 8' x 8' Diaphragm Shear 1
Load per inch = 12267 (x) + 1081
Load (lbs)
Total Deflection, Delta t (inches)
0
2000
4000
6000
8000
10000
12000
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900


Load vs. Total Deflection at any Load (Delta t)
3083303 Emmedue 8' x 8' Diaphragm Shear 2
Load per inch = 19726 (x) + 974
Load (lbs)
12000
10000
8000
6000
4000
2000
0
0.000
0.100
0.200
0.300
0.400
0.500
0.600
Total Deflection, Delta t (inches)


Load vs. Total Deflection at any Load (Delta t)
3083303 Emmedue 8' x 8' Diaphragm Shear 3
Load per inch = 11803 (x) + 1101
Load (lbs)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Total Deflection, Delta t (inches)
0.000
0.100
0.200
0.300
0.400
0.500
0.600

APPENDIX B
Test Data

Intertek

Test:	**Cantilever Beam Diaphragm Test w/ Concentrated Load (Specimen Horizontal)**
Date:	1/25/2008
Client:	**Emmedue S.P.A**
Product ID:	**M2_455_8X8D1**
Product:	PSM80 8' x 8' x 7.5" Diaphragm Shear 1 Floor Panel (Nominal 2.0" concrete, 1.5" mortar)
Eng/Tech(s):	V. Burgos, Intertek - San Antonio
Test Method(s):	ICC-AC 15 - Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems Section 4.2.2.7: Floor or Roof Panel Diaphragm Shear Tests in accordance with the general guidelines of ASTM E 455 - 04
Load Rate:	**Approximately 2500 lbs every 5 minutes (500 lbs/min)**
Preload (lbs):	1130
Hydraulic Bore Area (in^2):	28.274
Age of Wall:	114 days (at test date)
Total Time under Load (min):	27.75

Project #: **3083303**
Engineer Initials:

Panel		
Span Length, A (ft)	Depth, B (ft)	Thickness (in)
8.0	8.00	7.500

Load (lbs)	Load (plf)	Measurement Time	Hinge Deformation Trans 1 (in)	Hinge Rotation Trans 2 (in)	Panel Deformation Trans 3 (in)	Panel Rotation Trans 4 (in)	Total Deflection at any load (Delta T, in)	Real Shear Deformation (Delta S, in)	Apparent Shear Deformation (Delta S Prime, in)	Apparent Shear Stiffness of Diaphragm (lbs/in)
1131	**141**	**immediate**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.0**
1131	141	after 5 minutes	0.000	0.000	0.000	0.000	0.001	25.452	25.451	**433.3**
2545	318	immediate	0.041	-0.066	-0.177	-0.031	0.121	25.306	25.331	**435.3**
2545	318	after 5 minutes	0.047	-0.076	-0.204	-0.034	0.141	25.282	25.311	**435.6**
5089	636	immediate	0.111	-0.160	-0.446	-0.080	0.316	25.087	25.136	**438.7**
5089	636	after 5 minutes	0.116	-0.171	-0.475	-0.082	0.338	25.059	25.115	**439.1**
7775	972	immediate	0.176	-0.259	-0.722	-0.133	0.506	24.863	24.946	**442.0**
7775	972	after 5 minutes	0.200	-0.277	-0.764	-0.138	0.548	24.827	24.904	**442.8**
10037	1255	immediate	0.244	-0.357	-0.989	-0.174	0.702	24.637	24.750	**445.5**
10037	1255	after 5 minutes	0.269	-0.391	-1.076	-0.180	0.775	24.555	24.677	**446.8**
11027	**1378**	**Ultimate**	**Panel Failure** Failure occurred approx 15 seconds into target load Complete shear failure occurred at the hinge location. The shear break extended 10" in depth and 16" in span length. Shear failure is categorized as concrete, mortar, wire mesh, and foam failure No additional visible damage present							

Ultimate Shear Strength (Su):	**8270**	**lbs/ft**
****Average EI (stiffness):**	**887272**	**lbs-ft^2**
Maximum Deflection (Delta b):	**25.45**	**inches**

ADDITIONAL NOTES:

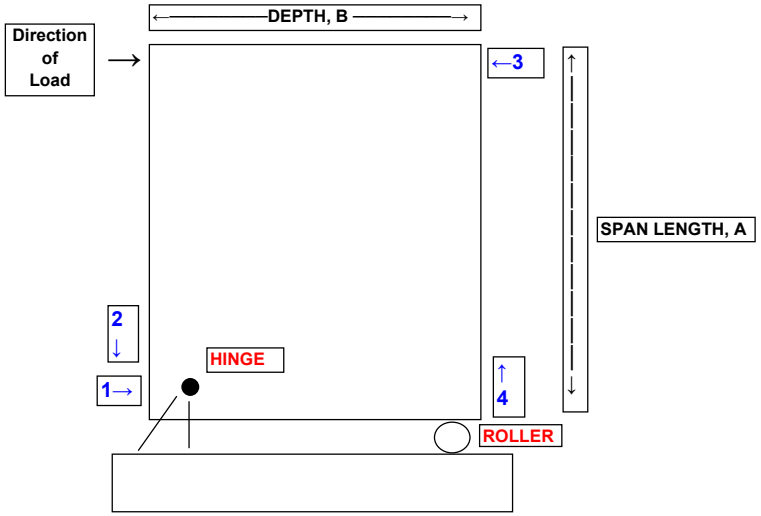
**The Average Stiffness EI value was calculated from a known tested value. The calculation was made by taking the known EI values from the three tested 80_4X8 Floor/Roof Flexural Tests and determining the average EI values from the three specimens. Refer to Floor/Roof Flexural Test results for more details
*The Ultimate Shear Strength (Su) of the specimen was calculated according to Formula (1) on Section 10.1.1 of ASTM E 455, where Ru = Ultimate Load / 2
*All other formulas calculated according to Section 10.1.2 of ASTM E 455
*The hinge pin for all diaphragm tests had a 1 inch diameter, located at a depth (B) of 8 inches and a span length (A) of 6 inches
*All diaphragm shear tests were performed without a top horizontal member for uniform load distribution along the specimen depth. The client did not install such members into the specimens during sample construction. The constructed walls could not be modified with a horizontal load member without sustaining permanent damage.
*At Load = 7775 lbs, crack beginning to form at the hinge, 10" depth, 15 - 30 seconds into target load
*At Load = 10037 lbs, secondary crack formation at the hinge, 16" span length, 30 seconds into target load
*Positive numbers indicate transducers extending **outward**; Negative numbers indicate transducers extending **inward**
*Statistical calculations below computed using Linear Regression Analysis

Load vs. Total Deflection at any Load (Delta t) Linear Regression Analysis

12267.2087	1081.303477
436.2604933	200.3646879
0.991224531	331.6047204
790.6781464	7
86944305.67	769731.8339

Equation of Best Fit Line (based on Linear Regression Analysis results)

Load (lbs-in) = Defl. (in) x 12267.21 + 1081.30



Transducer Locations and Designations
Transducer 1: Measures Hinge Deformation
Transducer 2: Measures Hinge Rotation
Transducer 3: Measures Panel Deformation
Transducer 4: Measures Panel Rotation

Diaphragm Specifications	
Thickness (in):	**7.5**
Depth, B (in):	**96.0**
Span Length, A (in):	**96.0**

Hinge Specifications	
Diameter (in):	**1.0**
Depth, B (in):	**8.0**
Span Length, A (in):	**6.0**

Intertek

Test:	**Cantilever Beam Diaphragm Test w/ Concentrated Load (Specimen Horizontal)**
Date:	1/28/2008
Client:	**Emmedue S.P.A**
Product ID:	**M2_455_8X8D2**
Product:	PSM80 8' x 8' x 7.5" Diaphragm Shear 2 Floor Panel (Nominal 2.0" concrete, 1.5" mortar)
Eng/Tech(s):	V. Burgos, Intertek - San Antonio
Test Method(s):	ICC-AC 15 - Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems Section 4.2.2.7: Floor or Roof Panel Diaphragm Shear Tests in accordance with the general guidelines of ASTM E 455 - 04
Load Rate:	**Approximately 700 lbs every 5 minutes (140 lbs/min)**
Preload (lbs):	1130
Hydraulic Bore Area (in^2):	28.274
Age of Wall:	117 days (at test date)
Total Time under Load (min):	67.75

Project #: **3083303**
Engineer Initials:

Panel		
Span Length, A (ft)	Depth, B (ft)	Thickness (in)
8.0	8.00	7.500

Load (lbs)	Load (plf)	Measurement Time	Hinge Deformation Trans 1 (in)	Hinge Rotation Trans 2 (in)	Panel Deformation Trans 3 (in)	Panel Rotation Trans 4 (in)	Total Deflection at any load (Delta T, in)	Real Shear Deformation (Delta S, in)	Apparent Shear Deformation (Delta S Prime, in)	Apparent Shear Stiffness of Diaphragm (lbs/in)
1131	**141**	**immediate**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.0**
1131	141	after 5 minutes	0.001	-0.002	-0.005	0.000	0.004	25.448	25.448	**433.3**
1838	230	after 5 minutes	0.021	-0.040	-0.089	-0.014	0.055	25.378	25.397	**434.2**
2545	318	after 5 minutes	0.035	-0.066	-0.148	-0.025	0.092	25.329	25.360	**434.8**
3252	406	after 5 minutes	0.049	-0.087	-0.203	-0.035	0.130	25.284	25.323	**435.5**
3958	495	after 5 minutes	0.061	-0.106	-0.255	-0.047	0.163	25.244	25.289	**436.0**
4665	583	after 5 minutes	0.073	-0.125	-0.304	-0.058	0.194	25.206	25.258	**436.6**
5372	672	after 5 minutes	0.084	-0.154	-0.424	-0.129	0.224	25.157	25.228	**437.1**
6079	760	after 5 minutes	0.093	-0.168	-0.461	-0.135	0.251	25.126	25.201	**437.6**
6786	848	after 5 minutes	0.102	-0.183	-0.503	-0.145	0.277	25.094	25.175	**438.0**
7493	937	after 5 minutes	0.113	-0.203	-0.557	-0.156	0.312	25.051	25.141	**438.6**
8199	1025	after 5 minutes	0.124	-0.218	-0.600	-0.165	0.341	25.018	25.111	**439.1**
8906	1113	after 5 minutes	0.134	-0.241	-0.684	-0.208	0.370	24.976	25.083	**439.6**
9613	1202	after 5 minutes	0.153	-0.266	-0.776	-0.233	0.430	24.909	25.023	**440.7**
10320	1290	after 5 minutes	0.184	-0.333	-0.961	-0.282	0.530	24.773	24.922	**442.5**
11027	**1378**	**Ultimate**	**Panel Failure** Failure occurred approx 10 seconds into target load Complete shear failure occurred at the hinge location. The shear break extended 13" in depth and 15" in span length. Shear failure is categorized as concrete, mortar, wire mesh, and foam failure No additional visible damage present							

Ultimate Shear Strength (Su):	**8270**	**lbs/ft**
****Average EI (stiffness):**	**887272**	**lbs-ft^2**
Maximum Deflection (Delta b):	**25.45**	**inches**

ADDITIONAL NOTES:

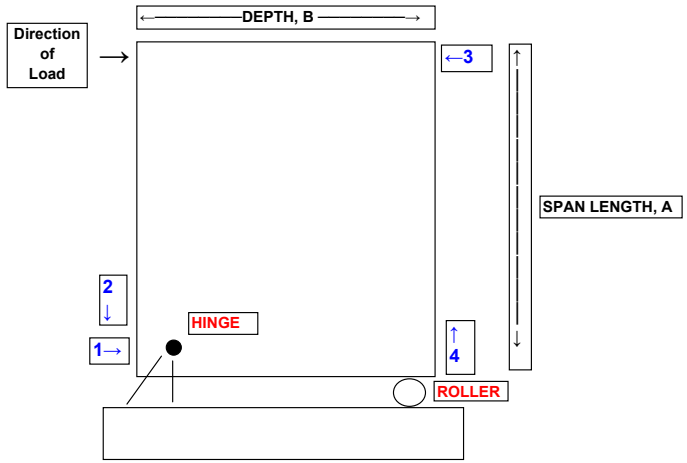
**The Average Stiffness EI value was calculated from a known tested value. The calculation was made by taking the known EI values from the three tested 80_4X8 Floor/Roof Flexural Tests and determining the average EI values from the three specimens. Refer to Floor/Roof Flexural Test results for more details
*The Ultimate Shear Strength (Su) of the specimen was calculated according to Formula (1) on Section 10.1.1 of ASTM E 455, where Ru = Ultimate Load / 2
*All other formulas calculated according to Section 10.1.2 of ASTM E 455
*The hinge pin for all diaphragm tests had a 1 inch diameter, located at a depth (B) of 8 inches and a span length (A) of 6 inches
*All diaphragm shear tests were performed without a top horizontal member for uniform load distribution along the specimen depth. The client did not install such members into the specimens during sample construction. The constructed walls could not be modified with a horizontal load member without sustaining permanent damage.
*At Load = 10320 lbs, crack beginning to form at the hinge, 13" depth x 14" span length, 15 - 20 seconds into target load
*Positive numbers indicate transducers extending **outward**; Negative numbers indicate transducers extending **inward**
*Statistical calculations below computed using Linear Regression Analysis

Load vs. Total Deflection at any Load (Delta t) Linear Regression Analysis

19726.10561	973.7479595
848.4852112	237.6335318
0.978280467	453.5786219
540.4980777	12
111198597.1	2468802.795

Equation of Best Fit Line (based on Linear Regression Analysis results)

Load (lbs-in) = Defl. (in) x 19726.11 + 973.75



Transducer Locations and Designations
Transducer 1: Measures Hinge Deformation
Transducer 2: Measures Hinge Rotation
Transducer 3: Measures Panel Deformation
Transducer 4: Measures Panel Rotation

Diaphragm Specifications	
Thickness (in):	**7.5**
Depth, B (in):	**96.0**
Span Length, A (in):	**96.0**

Hinge Specifications	
Diameter (in):	**1.0**
Depth, B (in):	**8.0**
Span Length, A (in):	**6.0**

Intertek

Test:	**Cantilever Beam Diaphragm Test w/ Concentrated Load (Specimen Horizontal)**
Date:	1/29/2008
Client:	**Emmedue S.P.A**
Product ID:	**M2_455_8X8D3**
Product:	PSM80 8' x 8' x 7.5" Diaphragm Shear 3 Floor Panel (Nominal 2.0" concrete, 1.5" mortar)
Eng/Tech(s):	V. Burgos, Intertek - San Antonio
Test Method(s):	ICC-AC 15 - Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems Section 4.2.2.7: Floor or Roof Panel Diaphragm Shear Tests in accordance with the general guidelines of ASTM E 455 - 04
Load Rate:	**Approximately 700 lbs every 5 minutes (140 lbs/min)**
Preload (lbs):	1130
Hydraulic Bore Area (in^2):	28.274
Age of Wall:	118 days (at test date)
Total Time under Load (min):	63.35

Project #: **3083303**
Engineer Initials:

Panel		
Span Length, A (ft)	Depth, B (ft)	Thickness (in)
8.0	8.00	7.500

Load (lbs)	Load (plf)	Measurement Time	Hinge Deformation Trans 1 (in)	Hinge Rotation Trans 2 (in)	Panel Deformation Trans 3 (in)	Panel Rotation Trans 4 (in)	Total Deflection at any load (Delta T, in)	Real Shear Deformation (Delta S, in)	Apparent Shear Deformation (Delta S Prime, in)	Apparent Shear Stiffness of Diaphragm (lbs/in)
1131	**141**	**immediate**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.0**
1838	230	after 5 minutes	0.022	-0.032	-0.089	-0.013	0.066	20.481	20.491	**434.6**
2545	318	after 5 minutes	0.045	-0.048	-0.151	-0.023	0.125	20.430	20.432	**435.9**
3252	406	after 5 minutes	0.065	-0.067	-0.211	-0.033	0.176	20.380	20.382	**437.0**
3958	495	after 5 minutes	0.087	-0.094	-0.285	-0.045	0.234	20.317	20.324	**438.2**
4665	583	after 5 minutes	0.098	-0.113	-0.339	-0.054	0.270	20.273	20.288	**439.0**
5372	672	after 5 minutes	0.152	-0.179	-0.513	-0.074	0.412	20.118	20.145	**442.1**
6079	760	after 5 minutes	0.163	-0.190	-0.570	-0.080	0.462	20.068	20.096	**443.2**
6786	848	after 5 minutes	0.170	-0.202	-0.610	-0.086	0.492	20.034	20.066	**443.9**
7493	937	after 5 minutes	0.178	-0.223	-0.662	-0.094	0.522	19.990	20.036	**444.5**
8199	1025	after 5 minutes	0.189	-0.255	-0.730	-0.104	0.560	19.931	19.997	**445.4**
8906	**1113**	**Ultimate**	**Panel Failure** Failure occurred approx 1:10 seconds into target load Complete shear failure occurred at the hinge location. The shear break extended 14.5" in depth and 15" in span length. Shear failure is categorized as concrete, mortar, wire mesh, and foam failure No additional visible damage present							

Ultimate Shear Strength (Su):	**6680**	**lbs/ft**
****Average EI (stiffness):**	**887272**	**lbs-ft^2**
Maximum Deflection (Delta b):	**20.56**	**inches**

ADDITIONAL NOTES:

**The Average Stiffness EI value was calculated from a known tested value. The calculation was made by taking the known EI values from the three tested 80_4X8 Floor/Roof Flexural Tests and determining the average EI values from the three specimens. Refer to Floor/Roof Flexural Test results for more details
*The Ultimate Shear Strength (Su) of the specimen was calculated according to Formula (1) on Section 10.1.1 of ASTM E 455, where Ru = Ultimate Load / 2
*All other formulas calculated according to Section 10.1.2 of ASTM E 455
*The hinge pin for all diaphragm tests had a 1 inch diameter, located at a depth (B) of 8 inches and a span length (A) of 6 inches
*All diaphragm shear tests were performed without a top horizontal member for uniform load distribution along the specimen depth. The client did not install such members into the specimens during sample construction. The constructed walls could not be modified with a horizontal load member without sustaining permanent damage.
*Positive numbers indicate transducers extending **outward**; Negative numbers indicate transducers extending **inward**

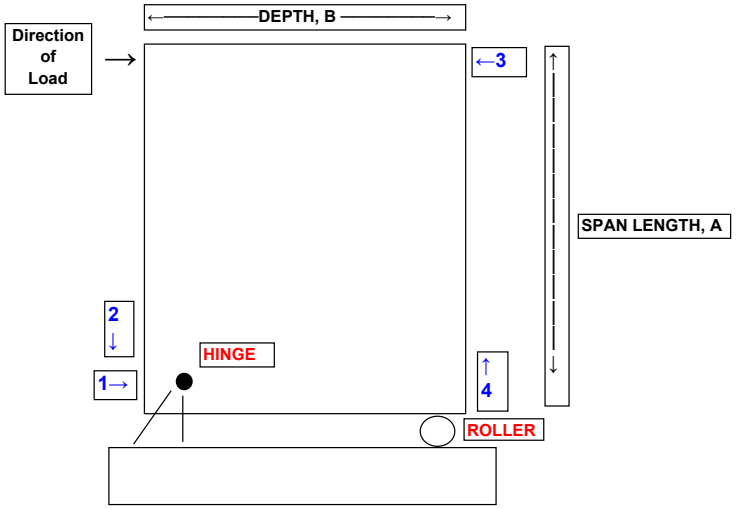
*Statistical calculations below computed using Linear Regression Analysis
*Ruben Caputo, representing Emmedue S.P.A, present during test

Load vs. Total Deflection at any Load (Delta t) Linear Regression Analysis

11802.73098	1101.072532
672.8877994	250.880583
0.974656769	361.3601299
307.6661445	8
40175396.96	1044649.148

Equation of Best Fit Line (based on Linear Regression Analysis results)

Load (lbs-in) = Defl. (in) x 11802.73 + 1101.07



Transducer Locations and Designations
Transducer 1: Measures Hinge Deformation
Transducer 2: Measures Hinge Rotation
Transducer 3: Measures Panel Deformation
Transducer 4: Measures Panel Rotation

Diaphragm Specifications	
Thickness (in):	**7.5**
Depth, B (in):	**96.0**
Span Length, A (in):	**96.0**

Hinge Specifications	
Diameter (in):	**1.0**
Depth, B (in):	**8.0**
Span Length, A (in):	**6.0**

APPENDIX C

Test Photographs

Note: Only a small number of photos were selected for this report. A CD copy of all the project photos will be provided to the client

455_8X8D2 (Setup and Failure Mode)

Figure 1A: Front view with lifting all-threads (four total)

Figure 2A: LVDT #1 (parallel) and #2 (perpendicular) to reaction I-beam

Figure 3A: LVDT #3 location (in-plane with load)

Figure 4A:LVDT #4 location (perpendicular with load)

Figure 5A: Failure mode at hinge

Figure 6A: Failure mode (close-up)

Intertek ETL SEMKO

PRE-TEST INSPECTION REPORT

Inspection Date: July 1-2, 2007 Intertek Inspector: Matt Lansdowne, EIT

Inspector's Tel: (604) 520 - 3321 Inspector's Email: matt.lansdowne@intertek.com

Product Name: Emmedue Structurally Insulated Panels

Project #: 3083303 Production Lot #: 07/01-02/07 # of Samples: See back page

General Instruction(s): Please complete ALL sections of this report. When information is not applicable, indicate "NA" and provide an explanation. Installation Instructions and MSDS sheets are required. Attach to this form, other product information, which is critical for follow-up inspections and ongoing certification. Please use the enclosed page for manufacturer's shipment.

	Owner/Distributor	Manufacturer (If Different From Owner/Distributor)
Company Name:	**Emmedue S.P.A.**	**SAME AS OWNER**
Address:	Via Toniolo 39/b Z.I. Bellocchi 61032 Fano (PU) Italy	
Tel:	(0039) 0721 855650 / 1	Fax:
Email:	(0039) 0721 854030	
Contact Person:	Omero Bassotti	

FORMULATION (attach material specification sheet(s) or "Certificate of Analysis")

Material	Approved Supplier(s)	Specification	% Content
EPS	ISOPAK Adratica Spa	15AE (It. Gov. Standard)	No Grind
EPS	Sulpol		
Steel Coil	MEttallurgica Ledrense	2.4mm diam., 3.00mm diam., 2.50mm diam.	3.0mm Yield 793 N/mm2 2.5mm Yield 712N/mm2
Adhesive	DA.FO.TEC	ABATECK D40/R	Use to join under length EPS panels

MANUFACTURING PROCESS (attach flowchart and/or details)

EPS and Steel Coil received, COA inspected to ensure quality, moved into inventory. Hotwires are set to Dimension using automated system, operator checks manually to ensure. EPS cut to size. Metal wire is Checked COA and diam. (calibrated caliper), monthly yield, ultimate, and elongation checked with calibrated tensile equipment. Steel wire loaded in to automated system. Unrolled and straightened, passed through welder that joins vertical and horizontal steel columns in preset grid pattern. Steel grid and EPS block taken To automated joiner. The EPS has steel grid laid on bottom surface and top surface. Joiner welds two grid Surfaces together. Inspector verifies welds are present . If > 3% welds missing, manual welding done.

PRODUCT DESCRIPTION: See Next Page

OTHER COMMENTS

Emmedue buys completed component parts. Uses proprietary automated equipment to cut and weld

Components together forming completed EPS Steel Grid System. This system is taken onsite, where Customers follow Emmedue installation instructions to apply shot crete exterior facings.

Intertek Testing Services NA Ltd.
Inspector: Matt Lansdowne, EIT
Email: matt.lansdowne@intertek.com

Phone: (604) 520-3321 ext. 112

EMMEDUE TEST SAMPLE SIZES
July 1-2, 2007

Type of test	Normative	Type of panel	Lengths	Height	Final thickness	Quantity of tests
Load Bearing Wall	ASMT E 119	PSM 80	10'	10'	6"	2
Floor/Roof Fire Test	ASMT E 119	PSM 80	10'	10'	6"	2
Wall Compression	AC15 4.2.2.2	PSM 80	4'	8'	6"	5
	ASTM E 72	PSM 80	4'	14'	6"	5
Wall Flexural	AC15 4.2.2.3	PSM 80	4'	8'	6"	5
	ASTM E 72	PSM 80	4'	14'	6"	4
Wall Flexural-Compression	AC15 4.2.2.4	PSM 80	4'	8'	6"	5
	ASTM E 72	PSM 80	4'	14'	6"	5
Wall Shear	AC15 4.2.2.5	PSM 80	8'	8'	6"	5
	ASTM E 72	PSM 80	8'	14'	6"	4
Floor/Roof Flexural	AC15 4.2.2.6 ASTM E 455	PSM 80	4'	8'	7"	5
		PSM 80	4'	12'	7"	6
		PSM 150	4'	8'	9.5"	6
		PSM 150	4'	12'	9.5"	6
Floor/Roof Diaphragm	AC15 4.2.2.7	PSM 80	4'	8'	6"	5
	ASTM E 455	PSM 80	4'	12'	6"	5
					Total panel	75

2/07/07.

ALAMO CONCRETE PRODUCTS, Ltd

Mix design report

CERTIFICATE NO :

Mix design No. :	**3135371**	**Client :**	
Plant :	**Alamo Concrete Products, Ltd.**	**Project :**	
Compressive Strength :	3 500 psi at 28 Day	w/c Ratio :	0.55
Nominal size :	# 8 (3/8")	Slump :	4.00 ± 1.00 in
Usage :		Slump with SuperP :	
Placement :		Air :	0.0 to 0.0 %

Constituents

Material - Type - Supplier - City	F.M.	Sp. Gr.	Abs.	Qty SSD	Volume
Stone & Sand					
3/8" Limestone - # 8 (3/8") - Alamo Concrete Products, Ltd.		2.580		1780 lb	11.05 ft³
Mfg Sand ACP - 0.39 in - Alamo Concrete Products , San Antonio		2.610	2.50	1079 lb	6.62 ft³
Silica Sand - 0.39 in - Alamo Concrete Products, Ltd.		2.630		466 lb	2.84 ft³
Cement & Additive					
Portland - Type I/II LA - Alamo Cement , San Antonio		3.150		376 lb	1.91 ft³
510 - Fly Ash Class C - - Boral , Decly		2.720		94 lb	0.55 ft³
Water					
Standard water - Standard water - Not defined		1.000		258 lb	4.13 ft³
Air					0.00 ft³
Admixture & Others constituants					
961A - WRDA 35 - ASTM C 494 Type A (Winter) - W.R. Grace , Houston		1.000		11.28 oz	0.01 ft³
960A - Daratard 17 - ASTM C 494 Type D (Summer) - W.R. Grace , Houston		1.000		9.40 oz	0.01 ft³
		Total		4053 lb	27.10 ft³

Unit Weight : 149.6 lb/ft³ Total mix cost :

Remarks :

Prepared by : Chris G. Slate, Technical Services Director	Approved by :
Date : 06/06/2007	Date : 06/06/2007

List of Calibrated Instrumentation Used for Testing

Description	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
LVDT (#1)	JEC-AG	L9301000	3/1/07	3/1/08
LVDT (#2)	JEC-AG	L9233000	3/1/07	3/1/08
LVDT (#3)	JEC-AG	L9300600	3/1/07	3/1/08
LVDT (#4)	JEC-AG	L9301100	3/1/07	3/1/08
DAQ Cart	N/A	99LE004	11/27/07	5/27/08
Stopwatch	14-649-9	61809410	8/15/07	8/15/08
1000 psi pressure gauge	316-SS	98LE005	10/12/07	10/12/08
3000 psi pressure gauge	N/A	298967	5/18/07	5/18/08

REFERENCES

1) Emmedue Advanced Building Systems Operator's Manual, Rev. 02 or 3/19/2004, pp. 2-7, 15-16.
2) Acceptance Criteria for Sandwich Panels, ICC – AC 04, Effective July 1, 2007, Section 4.4.1, p. 5.
3) Acceptance Criteria for Concrete Floor, Roof and Wall Systems and Concrete Masonry Wall Systems, ICC – AC 15, Effective July 1, 2007.
4) Standard Test Method for Static Load Testing of Framed Floor or Roof Diaphragm Constructions for Buildings, ASTM E 455 – 04 (last revised).

REVISION SUMMARY

DATE	SUMMARY
January 5, 2009	Section 3.2 (Sample and Assembly Description); galvanized steel wire mesh diameters changed to 0.099 inches (transverse) and 0.121 inches (longitudinal)
February 20, 2008	Original Report Issue Date