

December 23, 2015

Mr. Steve Stiles
Reliable Void Forms
13801 Avenue K
Austin, Texas 78728

Re: Void Form Testing
WJE No. 2011.4633

Dear Mr. Stiles:

At your request, the firm of Wiss, Janney, Elstner Associates, Inc. (WJE) performed static load tests on cardboard and molded pulp void forms provided by you. The forms were tested to determine the load carrying capacity effect of moisture at varying exposure times. All testing was performed at the WJE Structural Laboratory in Northbrook, Illinois. This report describes the test procedure and results.

BACKGROUND

Void forms are typically used for construction of concrete slabs in severe expansive soil conditions. An expansive soil swells when it becomes saturated with moisture (e.g., rain, snow). The void forms create space between concrete structures and expansive soils, thereby isolating the concrete from the swelling ground. The forms provide a temporary support platform for concrete placement until the structural member (i.e., a grade beam or structural concrete slab) cure adequately and can support itself across drilled piers, intermittent footings, or other concrete foundation members. The form material, lying under cast structural concrete, is designed to gradually absorb ground moisture and lose its strength. After the concrete has cured, a space which soil can expand without causing damage to the hardened concrete is created as the form gradually deteriorates.

Testing was performed on several styles of void forms to determine load capacity loss after exposure to 100 percent relative humidity for a specified time period.

TEST SAMPLES

Testing was performed on two different void forms. One type was manufactured from cardboard with a wax coating. This type of form was referred to as a cardboard void form (CV). The other type was manufactured from paper pulp. This form was referred to as a molded pulp void form (MPV).

Cardboard Void Form - The CV forms had three configurations: trench, trap and slab. The trench form was rectangular in shape measuring 12-in. wide by 6-in. tall by 60-in. long (Figure 1). The trap form was trapezoidal in shape measuring 12-in. at the base and 7-in. at the top, 6-in. tall and 60-in. long (Figure 2). During testing of the trap CV, two forms were placed together, alternating forms with the 12-in. base on the floor and forms with the 7-in. dimension on the floor. The slab form was rectangular in shape measuring 30-in. wide by 6-in. tall by 60-in. long (Figure 3).

Molded Pulp Void Form - The MPV forms were square in shape measuring 24-in. wide by 24-in. long by 6-in. high (Figure 4). The MPV slab forms have an average weight of 3 lbs and the MPV trench forms have an average weight of 5 lbs. Only the MPV slab forms were tested.

TEST PROCEDURE

Sample Conditioning - Each form sample type was tested dry and after being exposed to 100 percent relative humidity for a specified period of time. The moist exposure period ranged from 24 hours to 28 days. Each form was weighed before testing to determine the amount of moisture absorbed during the exposure period.

Test Setup - Testing consisted of uniformly loading a form to failure. The test setup consisted of a load frame, hydraulic ram, and load cell (Figure 5). The load was applied through a stiffened wood box to uniformly distribute the applied load from the hydraulic ram (Figures 6 and 7).

Performance of Test - Each tested form was placed on the laboratory structural floor; the wood box was positioned on the form; and a steel tube or aluminum beam was placed on the wood box as a spacer between the hydraulic ram. The form was loaded monotonically until failure occurred. Failure occurred within 1 to 2 minutes of the initial loading. The applied load was recorded with a digital load indicator.

Testing was stopped when failure occurred. Failure was defined as the forms inability to resist an increase in applied load. The form typically crushed at failure. Figures 8 and 9 show a typical failure of a CV and MPV form, respectively.

TEST RESULTS

The test results are tabulated below. The table lists the sample identification, duration of moisture exposure, dry weight, tested weight (weight after 100 percent humidity exposure), failure load and failure pressure based on the form area.

Table 1. Cardboard Void - Trench¹

Exposure Period (days)	Dry Weight (lbs)	Tested Weight (lbs)	Ultimate Load (lbf)	Ultimate Stress (psf)
Dry	4.25	4.25	6861	1372
1	4.25	5.15	3878	776
3	4.25	5.90	1876	375
7	4.25	5.90	466	94

Note 1: Data based on a single test for each exposure period

Table 2. Cardboard Void - Trap¹

Exposure Period (days)	Dry Weight (lbs)	Tested Weight (lbs)	Ultimate Load (lbf)	Ultimate Stress (psf)
0	7.90	7.90	9294	1174
1	7.90	10.0	5830	736
3	7.90	12.0	3265	412
7 ²	7.90	---	---	---

Note 1: Data based on a single test for each exposure period

Note 2: Trap form at 7 days was deteriorated to the point that it could not be tested

Table 3. Cardboard Void - Slab¹

Exposure Period (days)	Dry Weight (lbs)	Tested Weight (lbs)	Ultimate Load (lbf)	Ultimate Stress (psf)
0	8.10	8.10	10,280	822
1	8.10	9.40	6322	505
3	8.05	11.6	2248	180
7	8.05	---	466	37

Note 1: Data based on a single test for each exposure period

Table 4. Molded Pulp Void - Slab³

Exposure Period (days)	Dry Weight (lbs)	Tested Weight (lbs)	Ultimate Load (lbf)	Ultimate Stress (psf)
0	3.05	3.05	5693	1423
1	3.05	9.10	533	134
3	3.05	9.50	551	138
7	3.05	11.0	391	98
28	3.05	10.5	482	121

Note 3: Data based on the average of three tests for each exposure period

Table 4 shows a slight increase in the ultimate stress comparing samples with exposure times of 1 day and 3 days, and 7 days and 28 days. This is a result of one sample of the three for 3 days and one sample of the three for the 28 days not absorbing as much water as the other two of the group.

SUMMARY

WJE has performed compression load testing of cardboard and molded pulp void forms. These forms are typically used for form casting concrete in areas with expansive soils. Testing was performed to determine the load capacity loss after exposure to 100 percent humidity over varying periods of time.

Sincerely,

WISS, JANNEY, ELSTNER ASSOCIATES, INC.



John Pearson
Associate Principal

FIGURES



Figure 1. Cardboard void trench form



Figure 2. Cardboard void trap form



Figure 3. Cardboard void slab form



Figure 4. Molded pulp void form



Figure 5. Typical test setup

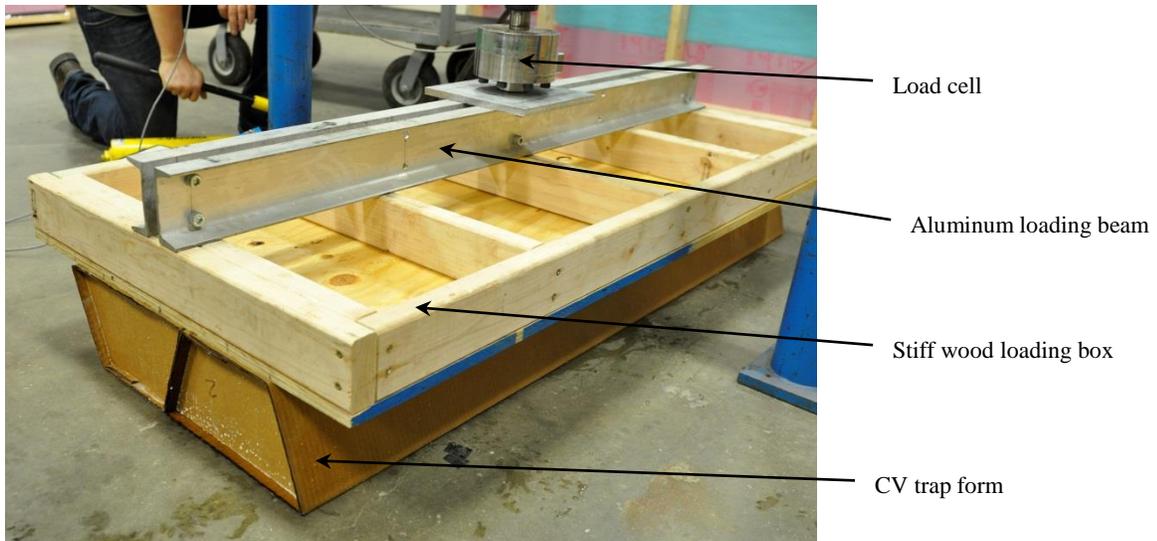


Figure 6. Typical test setup for cardboard void form



Figure 7. Typical MPV form



Figure 8. Failure of a slab cardboard void form



Figure 9. Failure of a molded pulp void form