WJE ENGINEERS ARCHITECTS MATERIALS SCIENTISTS

Wiss, Janney, Elstner Associates, Inc.
330 Pfingsten Road
Northbrook, Illinois 60062
847.272.7400 tel | 847.291.5189 fax
www.wje.com

20 March 2007

Engineered Plastics Inc.
300 International Drive, Suite 100
Williamsville, NY 14221

Re: Armor Deck Transit Platform
Load Test at Stony Island Metra Station
WJE No. 2007.0971

Gentlemen:

At the request of Engineered Plastics Inc. (EPI), the firm of Wiss, Janney, Elstner Associates, Inc. (WJE) performed a load test to verify compliance with the Chicago Building Code (CBC) on a representative Metra Rail station Armor Deck Transit Platform manufactured by EPI. The station that Metra chose for this test was the Stony Island station located on the Metra Electric Line in Chicago, Illinois. The load test was performed in accordance with CBC Section 17(13-120-120) for a design live load of 100-psf.

PRODUCT INFORMATION

The product under evaluation in the load test is identified as Armor Deck Transit Platform (ADTP). The ADTP is a 14-ft by 4-ft by 8-1/4 in. thick composite material, intended to replace concrete panels currently used at transit platforms. The ADTP is supported by W21x68 steel beams located approximately 32 in. from each end. Concrete piers support the steel beams and are typically spaced at 24-ft. between the beam supports.

TEST DESCRIPTION

The load test was performed on 6 March and 7 March 2007 in accordance with CBC Section 17(13-120-120) with a design live load of 100-psf. Present during the load test were Messrs. Andrew Roth of Metra, Bruce Woolner of EPI, and Dirk Heidbrink and David Boddy of WJE. The CBC specifies that for testing purposes the superimposed load during testing be equal to two and one-half times the design live load, for a total test load of 250-psf. This is equivalent to 14,000 lbs over the 14-ft by 4-ft area.

A typical ADTP platform section was selected by Metra near the far end of the Stony Island station (Figure 1). This platform is supported by typical steel sections with a pier spacing of 20-ft. Deflections were monitored using Cable Extension Transducers (CET) placed at both ends of the platforms, adjacent to each of the steel beam supports, and at the center of the platform (Figure 2).

Load was applied in approximately four equal increments using lead ingots with an average weight of 58 lbs each (Figure 3). Deflections were recorded at each load increment. After the final load was applied, four hourly deflection measurements were recorded and the full load remained in place for 24 hours. At the conclusion of the 24-hour load duration, deflections were recorded and load was removed in four equal stages with deflections recorded at each load stage. After the load was fully removed, residual

deflections were recorded for two hours, at which point the test was concluded and the instrumentation removed.

TEST DATA

The net deflections of the ADTP are listed in Table 1. The deflections of the steel beam supports have been subtracted from the center deflection to display the actual deflections of the ADTP. Figure 4 displays the net deformed shape of the ADTP at selected load stages. The maximum net deflection at the center of the span was calculated to be 0.056-in.

During the load test, the steel beams supporting the ADTP were observed to have a maximum deflection of approximately 0.09-in. Note that this value is greater than the observed net deflection of 0.056-in. at the center of the span (Figure 5).

After the load was removed, residual deflection measurements were recorded every hour for two hours. The residual deflection readings were halted after two hours due to unavailability of track safety and security personnel, and the ADTP product having minimal change in residual deflection. At the conclusion of deflection monitoring, the structure had a net residual deflection at the center of 0.02-in., which is a recovery of 64 percent of the net maximum deflection.

DISCUSSION

Under CBC Section 17(13-120-120), there are several conditions of acceptance in evaluating the physical properties of structural assemblies. The first condition is that the test assembly shall sustain without failure, superimposed loads equal to two and one-half times the design load. Load testing of the ADTP met this condition of acceptance.

The second condition is that the maximum observed deflection for unplastered construction be less than one two-hundred fortieth of the span. This corresponds to an allowable maximum deflection of 0.43-in. for the 8-ft 8-in. span. The maximum deflection measured during testing was 0.056-in., which is 87 percent less than the CBC allowable (Figure 6). In terms of a fraction, the total deflection of the plank was less than 1/16 of an inch.

The third condition states that the residual deflections shall recover not less than three-quarters (75 percent) of the total test load deflection. The residual deflection was computed as 64 percent of the net maximum deflection. In order to meet the 75 percent criteria, the plank would need to have recovered an additional 0.006-in., which is less than 1/128 of an inch.

Some codes, such as the American Concrete Institute (ACI) load test criteria, have provisions to ensure that the recovery of deflection of a very stiff structure is not penalized (ACI 318R-05 *Building Code Requirements for Structural Concrete* Chapter R20.5.2). The commentary in that chapter states the following*: In the case of a very stiff structure, however, the errors in measurements under field conditions may be of the same order as the actual deflections and recovery. To avoid penalizing a satisfactory structure in such a case, recovery measurements are waived if the maximum deflection is less than* $l_t^2/(20{,}000h)$. For the ADTP product, the ACI criteria equates to a deflection of 0.071-in. Since the

net measured deflection of 0.056-in. is less than the ACI criteria, this platform would be considered a stiff structure and the recovery measurements would be waived (Figure 6).

CONCLUSION

On 6 March and 7 March 2007, WJE conducted a load test on a representative Engineered Plastics Inc. Armor Deck Transit Platform according to the Chicago Building Code Section 17(13-120-120) for a design live load of 100-psf. Deflections were monitored during both loading and unloading of the platform.

During testing, the Armor Deck Transit Platform did not display any signs of structural distress or failure. The maximum net deflection of 0.056-in. is less than the CBC allowable maximum deflection of 0.43-in. The ADTP had a net residual deflection of 0.02-in., which corresponds to a net recovery of 64 percent, less than the CBC requirement of 75 percent. In order to meet the 75 percent criteria, the plank would need to have recovered an additional 0.006-in., which is less than 1/128 of an inch. Since the Chicago Building Code is silent for very stiff structures, waiving of the recovery requirement as stated in Chapter R20.5.2 of ACI 318-R05 should be considered.

It has been a pleasure working with Engineered Plastics Inc. and Metra representatives during the load test of Armor Deck Transit Platforms. If you have any questions, please feel free to contact either of the undersigned.

Very truly yours,

WISS, JANNEY, ELSTNER ASSOCIATES, INC.

David M. Boddy
Project Associate

F. Dirk Heidbrink, PE
Project Manager

p:\2007\0901-1000\2007.0971\report\final report.doc

Table 1. Net ADTP Load Test Data

Description	Elapsed Time (hours)	Load (lbs)	Net Deflections (in.)		
			North	Center	South
Zero	0.00	0	0.000	0.000	0.000
LS 1	0.17	3,363	0.001	0.003	0.002
LS 2	0.33	6,667	0.006	-0.007	0.003
LS 3	0.50	10,030	0.016	-0.021	0.011
LS 4	0.75	14,160	0.027	-0.033	0.023
Hold	1.75	14,160	0.034	-0.040	0.027
Hold	2.75	14,160	0.043	-0.044	0.041
Hold	3.75	14,160	0.050	-0.048	0.049
Hold	4.75	14,160	0.058	-0.051	0.051
LS - 4	24.75	14,160	0.058	-0.056	0.052
LS - 3	25.08	10,620	0.055	-0.048	0.041
LS - 2	25.50	7,080	0.049	-0.037	0.035
LS - 1	25.72	3,540	0.042	-0.029	0.026
Zero	26.08	0	0.044	-0.020	0.028
Residual	27.08	0	0.050	-0.020	0.036
Residual	28.08	0	0.057	-0.020	0.041

Figure 1. Typical Armor-Deck Transit Platform.

Figure 2. Cable Extension Transducers used to monitor deflections.

Figure 3. Full testing load of 14,160 lbs applied to the ADTP.

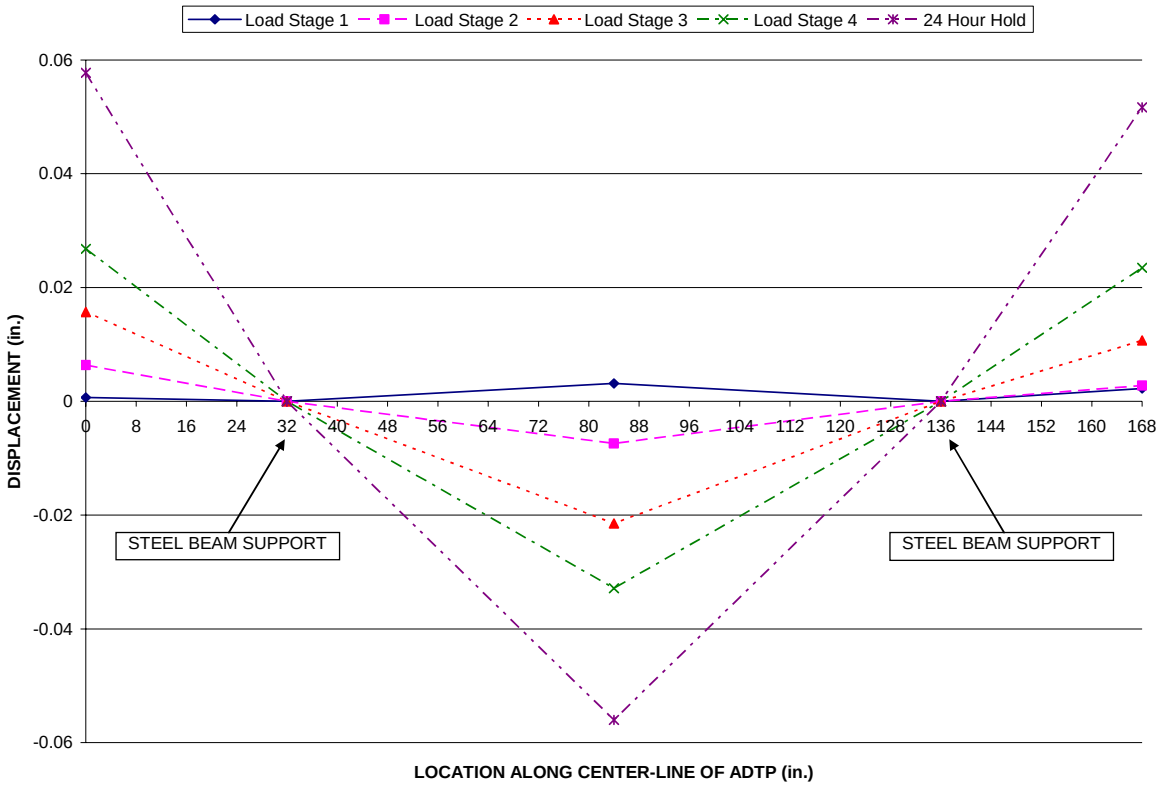

Figure 4. Net displaced shape of ADTP at selected load stages.

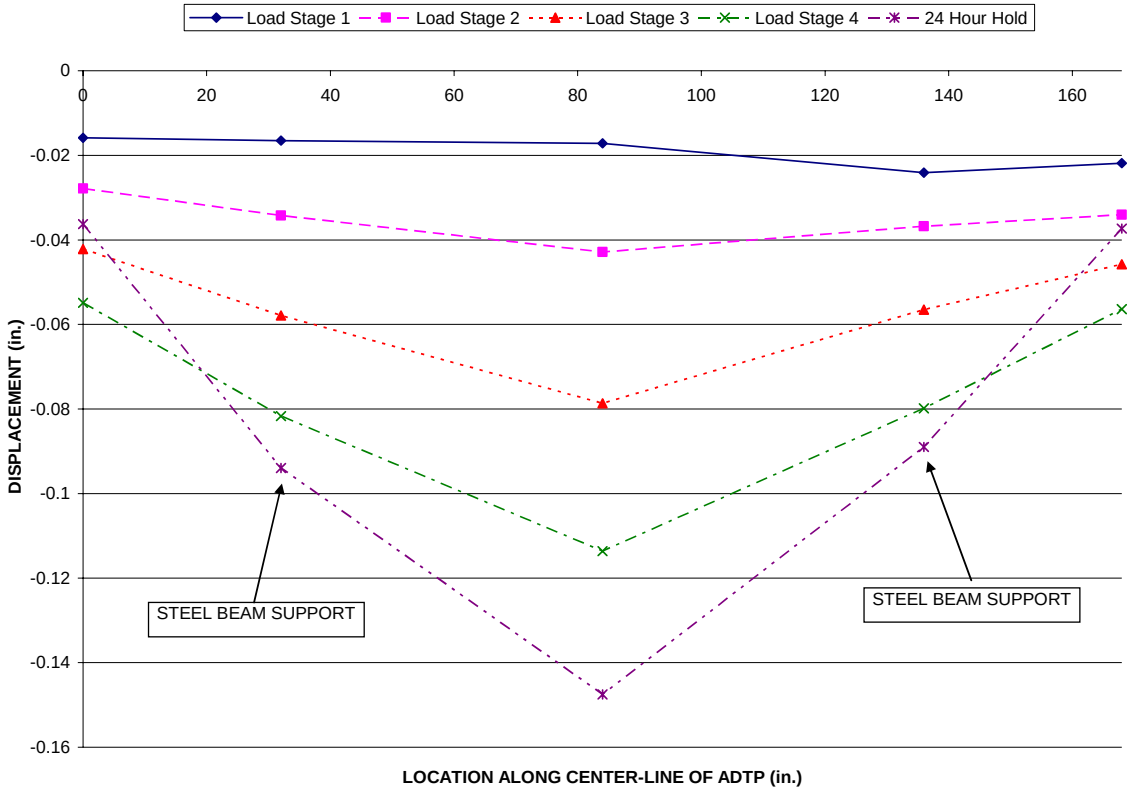

Figure 5. Displaced shape of ADTP including steel beam supports at selected load stages.

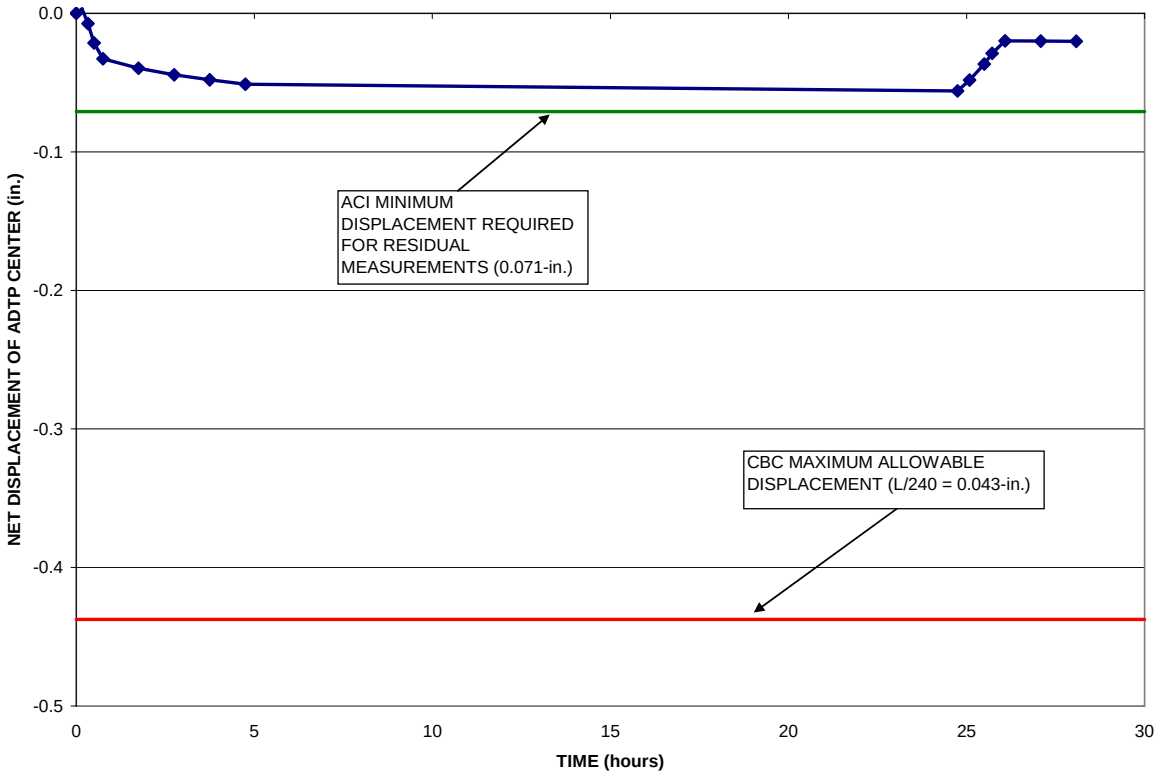

Figure 6. Net deflection of ADTP center of span versus time.