CONSTRUCTION
MATERIALS
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January 8, 2009

American Step Company, Inc.
Mr. Craig Williams
830 East Broadway
P.O. Box 137
Griffin, Georgia 30223

Re: American Step Company, Inc.
Lift Device – Product Evaluation Round 5
CMS # 09-209

Dear Mr. Williams,

As authorized by you, Construction Materials Services, Inc. (CMS) has observed test prism fabrication with lift device installation, tested prism concrete, and performed the requested lifting device load testing on thirty-five separate lifting device systems for the American Step Company, Inc. (ASC). The primary purpose of this testing was to determine safe load ratings for the specified systems. This report describes the systems tested and presents the testing procedures, our observations, and the load test results.

LIFTING DEVICE SYSTEMS

As noted above, thirty-five different lifting device/systems were fabricated and tested in this evaluation; using a total of twenty-four rectangular concrete test prisms. The lifting devices fall into one of the following categories:

A. SLL Utility Anchors: ASTM A 36 Galvanized or Epoxy Coated Steel Solid Loop Lifters (SLL) of various dimensions
B. W-shaped Utility Anchors: ASTM A 36 Epoxy Coated W-shaped Lifters of various dimensions
C. Pulling Iron/ Lift Cable: A 0.375"X3.5"X16" part consisting of 270 kip, 7 – wire, PC Strands
D. ASC CA Utility Anchor: 0.470" X 3.75" X 6.2" Hot Dipped Galvanized per ASTM A 123
E. ASC Rosetta Lifter: ASTM A 36 ¾" X 9.125" X 17" Hot Dipped Galvanized per ASTM A 123

Each of the lifting devices was made/fabricated by ASC with the exception of the China Anchor on test prism 23. The tables in Appendices 1 and 2 of this report detail the various lift device types along with their corresponding test specimen numbers, test types (i.e. shear or tension), and additional load test/configuration information.

We understand that the steel in the lifting devices used in the testing has associated mill certificates. Each of these certificates can be viewed by contacting ASC.

During normal application of the subject lifting devices, the devices will typically be embedded into pre-cast Portland Cement Concrete (PCC) members while the PCC is in the plastic state, for the purpose of lifting and transporting the pre-cast member once cured. The various lifting devices and the diagrams of their dimensions, embedments, etc. are illustrated in the photographs and/or detailed schematically on drawings in Appendix 3. For pre-cast concrete items requiring steel reinforcement, the lifting device is to be integrated into the pre-cast member such that the steel reinforcement of the member shall be placed through or tied to the loop or leg during member fabrication, where possible. With regards to the subject load testing, only the concrete test prisms for test specimen numbers 5, 6, 7, 19, 21, 22 and 23 called for actual reinforcing steel. (Note 1: Only 1 of 2 of the lifting devices in test prisms 5, 7 and 21 called for reinforcing steel.) (Note 2: Only 1 of 3 lifting devices in test prism 23 has reinforcing steel.) These lifting devices were integrated into the reinforcing steel as detailed in the diagrams in Appendix 3, or as described in Appendices 1 and 2.

CONCRETE TEST PRISMS

As detailed by ASC, in order to perform the requested load testing, each of the various lifting devices was encased into cast-in-place concrete prisms (test blocks). The forms for the testing were constructed by ASC at their facility in Griffin, Georgia. Each concrete test prism was fabricated with perimeter steel reinforcement (with the exception of prisms 19 and 22 which contained reinforcement steel throughout) placed only to attempt to improve the test prisms' resistance to the four legged point loading imposed by the load testing apparatus. This prism test reinforcement is generally made up of either three or six, number four bar, grade 60, square shaped reinforcing steel frames. The individual rebar that make up each square frame is welded or bent (90 degrees) at all four corners. The three topmost horizontal rebar frames form concentric squares on about 1 ½ to 2 ½ inch spacing, beginning about one to two inches from the outside edges of the concrete test prisms. All of the test prism blocks, at least, contained a frame with this type of configuration. However, each of the test block prisms that were greater than twelve inches in depth (with the exception of test prism number 6, which only received the three, topmost horizontal rebar frames) also received three additional outer, vertical rebar frames. These three additional vertically placed rebar frames were each about identical in size and spaced approximately on 4 to 5 inch vertical spacing. These three frames were each about two inches from the outside edges of, and beginning about two inches from the top of, the concrete test prisms.

Walker Concrete produced and delivered the concrete for the load test prisms number's 1 – 13 on October 28, 2009; test prisms number's 14 - 16 on November 17, 2009 and test prisms number's 17 - 24 on December 16, 2009 all from their Griffin, Georgia plant. During prism concrete placement, concrete test cylinders were molded from samples of the plastic concrete used for prism fabrication. The compressive strength of the concrete test cylinders was used to determine when to begin load testing of the various lift devices. Our PCC test cylinder compressive strength results can be found in Appendix 4. We note that the test cylinders were cast and tested using standard ASTM protocol.

ASC specified that they wanted to load test the lifting devices at various concrete strengths as reported in pounds per square inch (psi). Lifting device load test results for each of the tests performed are located in Appendix 1.

ASC specified that all lift devices were to be tested after the concrete test specimen achieved concrete strength of 4000 psi except test specimen 1-1 and 1-2 which were tested at 1000 psi. It should also be noted that due to equipment problems; test specimen number's 14 and 16 exceeded 7000 psi at test time.

TEST CONFIGURATIONS

The load capacity for each of the lifting device systems was determined by engaging the loops formed by the lifting devices imposing a load perpendicular to the top surface of each of the concrete test prisms from which the loading devices were embedded. The load was imposed with a calibrated sixty ton, hollow core jack supported by a four legged metal frame, which reacted against the top of the concrete prism surfaces. The jack, ram and pressure gauge calibration was checked by our engineers against our CMS calibrated concrete break machine on April 3, 2009 and verified on November 13 and December 17, 2009 and found to be satisfactory. Our method of loading the systems followed no certain protocol. From a resting state with no load on the lift devices, load was steadily and systematically applied to each of the lifting device systems by manually hand pumping the jack, forcing hydraulic fluid to extend the ram assembly and engage each lift device. As the load was applied, the concrete prism surfaces nearest the load devices were observed for evidence of distress. The ultimate load capacity (in either the shear condition or the tension condition) was recorded when the lift device system experienced failure. Failure, for our test purposes, was defined as either:

1. Lift device breakage;

2. Lift device pulled out with greater than about ½ to one inch of lift device displacement (evidenced in tension by the lift device pulling out in a similar fashion to the extraction of a nail from a piece of lumber with a claw hammer) which would not allow any additional, sustained jack loading to occur; or

3. Prism PCC spalling/cracking which would not allow any additional, sustained jack loading to occur.

In each case (for each prism) the failure was rather abrupt and definable. However, we note for test prism number 24, the Rosetta Lifter experienced significant straightening prior to the noted concrete failure. The predominant type failure observed for each lift device is listed in Appendix 1 / Appendix 2. We note that when "anchor pull out" was observed as the failure type, some minor concrete spalling may have occurred, as well. Load test procedures are illustrated in some of the photographs in Appendix 3.

As part of this series of testing no dynamic loading of any devices was simulated. All tested parts were testing using static loading only. We understand in the process of loading these devices embedded into pre cast concrete items that dynamic loading conditions could occur in the field. Dynamic loading of all lift components should be kept to a minimum.

RESULTS

The load test results are summarized in the table in Appendix 1 with some added discussion in the Remarks section of the table in Appendix 2 where deemed appropriate. Measured lifting device embedment/protrusion depths prior to load testing are also provided in Appendix 1.

CMS appreciates the opportunity to perform this service for American Step Company. If you have any questions concerning this report, please contact us at (770) 914-1744.

Respectfully submitted,

Peyton Thomas Duncan
Project Engineer

Andrew Johnson, P.E.
Company President

Attachments

PTD:AJ

GEORGIA REGISTERED NO. PROFESSIONAL ENGINEER ANDREW JOHNSON

American Step Company
Load Test Results of Lifting Devices by Type
Tested by Construction Materials Services

Test Specimen Number	Prism Dimensions Length x Width x Ht. (inches)	Date Fabricated	Date Tested	Lifting Device: Pulling Iron/ Lift Cable Dimensions (inches)	Lifting Device: Utility Anchor Dia. x Length or Dia. x Length x Width (inches)	Tension, Shear, or Impact Test	Anchor Embed or Recess Depth** (inches)	Ultimate Load at Failure (lbs.)	Type Failure
1 (1)	44x44x12	10/28/09	10/28/09		ASC 0.375x5.5x8.5 SLL (Epoxy)	Tension	Not Recessed	13,000	Anch. Pull out*
1 (2)	44x44x12	10/28/09	10/28/09		ASC 0.375x5.5x8.5 SLL (Galv.)	Tension	Not Recessed	15,000	Anch. Pull out*
2 (1)	44x44x12	10/28/09	10/29/09		ASC 0.375x5.5x8.5 SLL (Epoxy)	Tension	Not Recessed	16,000	Anchor break
2 (2)	44x44x12	10/28/09	10/29/09		ASC 0.375x5.5x8.5 SLL (Galv.)	Tension	Not Recessed	17,000	Anchor break
2 (3)	44x44x12	10/28/09	10/29/09	0.375X 3.5X16		Tension	Not Recessed	7,000	Concrete
3	44x44x12	10/28/09	10/29/09		ASC 0.625x12 SLL (Epoxy)	Tension	Not Recessed	30,000	Anch. Pull out*
4	44x44x12	10/28/09	10/29/09		ASC 0.625x6.25x13.0 (Epoxy)	Tension	Recess - 0.75	37,000	Conc./ Pull out
5 (1)	44x44x24	10/28/09	10/29/09		ASC 0.625x6.25x13.0 (Epoxy)	Shear	Recess - 0.75	40,000	Anch. Pull out*
5 (2)	44x44x24	10/28/09	10/29/09		ASC 0.625x6.25x13.0 (Epoxy)	Shear	Recess - 0.75	43,000	Conc./ Pull out
6	44x44x24	10/28/09	10/29/09		ASC 0.75x6.75x10.25 (Epoxy)	Tension	Recess - 0.75	49,000	Conc./ Pull out
7 (1)	44x44x24	10/28/09	10/29/09		ASC 0.75x6.75x10.25 (Epoxy)	Shear	Recess - 0.75	52,000	Conc./ Pull out
7 (2)	44x44x24	10/28/09	10/29/09		ASC 0.75x6.75x10.25 (Epoxy)	Shear	Recess - 0.75	52,000	Conc./ Pull out
8	44x44x8	10/28/09	10/29/09		ASC 0.75x12x14 SLL (Epoxy)	Tension	Not Recessed	26,500	Concrete
9	44x44x10	10/28/09	10/29/09		ASC 0.75x12x14 SLL (Epoxy)	Tension	Not Recessed	35,000	Concrete
10	44x44x12	10/28/09	10/29/09		ASC 0.75x12x14 SLL (Epoxy)	Tension	Not Recessed	32,000	Conc./ Pull out
11	44x44x12	10/28/09	10/29/09		ASC 0.75x12x14 SLL (Epoxy)	Tension	Not Recessed	44,500	Conc./ Pull out
12	44x44x24	10/28/09	10/29/09		ASC 1x19 SLL (Epoxy)	Tension	Not Recessed	64,000	Concrete
13	44x44x24	10/28/09	10/29/09		ASC 1x19 SLL (Epoxy)	Tension	Not Recessed	71,000	Concrete

*For all loading device systems where anchor pull out was the noted failure type, some minor surface concrete spalling was observed.
Conc./ Pull out means that the failure type could not be distinguished between concrete failure and anchor pull out failure.
** See Next Page for additional discussion related to measured Lifting Device embedment/protrusion depths.

Americ[illegible]p Company
Load Test Results [illegible] Lifting Devices by Type
Tested by Construction Materials Services

Test Specimen Number	Prism Dimensions Length x Width x Ht. (inches)	Date		Lifting Device		Tension, Shear, or Impact Test	Anchor Embed or Recess Depth** (inches)	Ultimate Load at Failure (lbs.)	Type Failure
		Fabricated	Tested	Pulling Iron/ Lift Cable Dimensions (inches)	Utility Anchor Dia. x Length or Dia. x Length x Width (inches)				
GROUP #3									
14	44x44x18	11/17/09	11/19/09		ASC 0.625x4.50x11.75 UA (Epoxy)	Tension	Recessed	27,250	Anch. Pull out*
15	44x44x6	11/17/09	11-18-09		ASC 0.375x8.5 SLL (Epoxy)	Tension	Not Recessed	***6000	--
15-1	44x44x6	11-17-09	11-19-09		ASC 0.375x8.5 SLL (Epoxy)	Tension	Not Recessed	--	--
16-1	44x44x24	11/17/09	11-19-09		ASC 0.625x4.50x11.75 UA (Epoxy)	Shear	Recessed	49,630	Conc.
16-2	44x44x24	11/17/09	11-19-09		ASC 0.625x4.50x11.75 UA (Epoxy)	Shear	Recessed	51,710	Conc.
GROUP #4									
17-1	44x44x6	12/16/09	12/19/09		ASC 0.375x8.5 SLL (Epoxy)	Tension	Not Recessed	10,500	Anch. Pull out*
17-2	44x44x6	12/16/09	12/19/09		ASC 0.375x8.5 SLL (Epoxy)	Tension	Not Recessed	10,500	Anch. Pull out*
18-1	44x44x4	12/16/09	12/19/09		ASC 0.375x8.5 SLL-RR (Epoxy)	Tension	Not Recessed	11,900	Anch. Pull out*
18-2	44x44x4	12/16/09	12/19/09		ASC 0.375x8.5 SLL-RR (Epoxy)	Tension	Not Recessed	10,500	Anch. Pull out*
19	44x44x8	12/16/09	12/19/09		ASC 1.00X13.5X28 UA (Epoxy)	Tension	Not Recessed	44,445	Conc.
20	44x44x18	12/16/09	12/19/09		ASC 0.625x4.50x11.75 UA (Epoxy)	Tension	Recess - 0.75	25,790	Anch. Pull out*
21-1	44x44x24	12/16/09	12/19/09		ASC 0.625x4.50x11.75 UA (Epoxy)	Shear	Recessed	45,740	Conc.
21-2	44x44x24	12/16/09	12/19/09		ASC 0.625x4.50x11.75 UA (Epoxy)	Shear	Recessed	45,740	Conc./cage
22	NOTE 1	12/16/09	12/19/09		ASC 1.00X13.5X28 UA (Epoxy)	Tension	Recess - 0.75	81,400	Anch. Pull out*
23-1	44x44x24	12/16/09	12/19/09		ASC 0.50x3.6x11.75 UA (Epoxy)	Tension	Recess - 0.75	20,800	Anch. Pull out*
23-2	44x44x24	12/16/09	12/19/09		ASC 0.470X3.75X6.20 CA-UA (Galv.)	Tension	Recess - 0.75	28,600	Anchor break
23-3	44x44x24	12/16/09	12/19/09		ASC 1.00X19X6 SLL (Epoxy)	Tension	Not Recessed	75,000	Anch. Pull out*
24	44x44x24	12/16/09	12/19/09		ASC 0.75X9.125X17 UA-UAR (Galv.)	Tension	Not Recessed	49,630	Conc.

*For all loading device systems where anchor pull out was the noted failure type, some minor surface concrete spalling was observed.
Conc./ Pull out means that the failure type could not be distinguished between concrete failure and anchor pull out failure.
** See Next Page for additional discussion related to measured Lifting Device embedment/protrusion depths.
***Equipment problems; data not representative
NOTE 1: 12" wall x 36" Deep x 92" Long (T shaped block)
NOTE 2: Group 3 test specimen #'s 14 and 16 PCC strength exceeded 7000 psi.