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ENGINEERING REPORT 23397-1

Eccentric Column Compression Testing
Square and Round Composite Columns
Reference P.O. Number 891706

CERNY & IVEY ENGINEERS, INC.

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December 3, 2003

Mr. Pat Davin
CW Ohio, Inc.
1209 Maple Avenue
Conneaut, OH 44030

SUBJECT: Engineering Report 23397-1
Eccentric Column Compression Testing
Square and Round Composite Columns
Reference P.O. Number 891706

Dear Mr. Davin:

INTRODUCTION

On November 25, 2003, testing was completed on twenty synthetic columns manufactured by CW Ohio, Inc. The columns were of various round or square cross section and various lengths. The columns had either a round exterior with a round interior, or a square exterior with a square interior. The round columns had either smooth or fluted exterior surfaces. The square columns were prismatic (non-tapered). The round columns were either prismatic or had a taper from the bottom to the top. The tapered, round columns included a decorative ridge around the circumference of the top end.

The columns were evaluated to determine their ultimate compressive strength under eccentric loads at ambient temperature conditions. The eccentric load simulated a nominal 4-inch wide wood beam (3 ½-inch actual width) bearing at the top end. The base end was installed against a flat steel surface to create concentric loading. After installation, a gradually increasing compressive load was applied until failure occurred. Photographs taken during the tests are included in this report.

SPECIMENS

The samples provided were columns of various cross-section, sizes and lengths manufactured by CW Ohio, Inc. The composite columns tested were all hollow, one-piece castings. The square columns included non-load bearing plastic corner forms that remained in the cast column. The plastic corner forms on square columns were supported by non-load bearing, spaced circular rings fabricated from cardboard. The details for each column tested are included in the table below.

Column	Description (Nominal)*	Length (ft)	Base Outside (in)	Top Oustide (in)	Base Avg. Thickness (in.)	Top Avg. Thickness (in.)
1	6x8P	8-foot, 1-inch	5 3/4	5	0.371	0.304
2	8x10P	10-foot, 1-inch	7 3/4	6 3/4	0.415	0.331
3	8x10F	10-foot, 2-inch	7 3/4	6 1/2	0.433	0.441
4	8x10NT	10-foot, 1-inch	7 3/4	7 3/4	0.369	0.496
5	6x6x10S	10-foot, 0-inch	6x6	6x6	0.374	0.453
6	8x8x10S	10-foot, 0-inch	8x8	8x8	0.465	0.484
7	10x10x10S	10-foot, 0-inch	10x10	10x10	0.512	0.426
8	10x10NT	10-foot, 1-inch	9 1/2	9 1/2	0.352	0.407
9	10x12P	12-foot, 1-inch	9 3/4	8 3/4	0.401	0.414
10	10x12F	12-foot, 2-inch	9 1/2	8 1/2	0.557	0.602
11	12x12NT	12-foot, 1-inch	11 3/4	11 3/4	0.450	0.349
12	14x14NT	14-foot, 0-inch	13 1/2	13 1/2	0.599	0.604
13	12x16P	16-foot, 1-inch	11 3/4	10 1/4	0.565	0.601
14	12x16F	16-foot, 1-inch	11 1/2	9 3/4	0.497	0.664
15	12x12x16S	16-foot, 0-inch	12x12	12x12	0.680	0.567
16	14x16P	16-foot, 3-inch	13 1/2	11 1/2	0.596	0.574
17	16x20P	20-foot, 3-inch	15	13	0.593	0.630
18	20x20P	20-foot, 3-inch	19 1/2	16 1/2	0.624	0.730
19	24x20P	20-foot, 3.5-inch	23 3/4	19 3/4	0.883	0.731
20	18x24P	24-foot, 4-inch	17 1/2	14	0.767	0.629

*P=Plain, F=Fluted, S=Square, NT=Non-Tapered

PROCEDURE

Each column was placed in a load frame. A steel plate was positioned at the top of the column to produce a 3 ½-inch wide bearing surface. For columns up to 14-inch diameter, the edge of which was flush with the outside surface of the column. For columns greater than 14-inch diameter, the 3 ½-inch wide bearing plate was positioned to produce a 4 ¼-inch eccentricity from the center of the column to the center of the bearing plate. Compressive static loads were then applied to the column in approximately 1000-pound increments. Each load was sustained for one minute before proceeding to the next higher load increment. Loads were increased until failure occurred and the maximum sustained load was recorded.

RESULTS

Failure modes are documented in the following table and attached photographs.

Specimen	Description (Nominal)	Ultimate Load (lbf)	Mode of Failure	Photograph	Eccentricity (in.)
1	6x8P	16,500	Crushed at top	1-5	0.75
2	8x10P	16,500	Crushed at top	6-10	1.625
3	8x10F	28,800	Crushed at top	11-14	1.5
4	8x10NT	20,600	Crushed at top	15-18	2.125
5	6x6x10S	24,700	Exploded at top	19-22	1.25
6	8x8x10S	26,800	Exploded at top	23-27	2.25
7	10x10x10S	33,000	Exploded at top	28-31	3.25
8	10x10NT	28,800	Crushed at top	32-35	3
9	10x12P	26,800	Crushed at top	36-39	2.625
10	10x12F	26,800	Crushed at top	40-43	2.5
11	12x12NT	28,800	Crushed at top	44-47	4.125
12	14x14NT	45,300	Exploded at top	48-51	5
13	12x16P	33,000	Exploded at top	52-55	3.375
14	12x16F	30,900	Exploded at top	56-59	3.125
15	12x12x16S	43,300	Exploded at top	60-63	4.25
16	14x16P	28,800	Crushed at top	64-67	4
17	16x20P	33,000	Exploded at top	68-71	4.25
18	20x20P	47,400	Exploded at top	72-75	4.25
19	24x20P	33,000	Exploded at top	76-79	4.25
20	18x24P	22,600	Exploded at top	80-83	4.25

If you have any questions or need additional information, please contact us.

Respectfully submitted,

Mark L. Jansen, E.I.T.
Staff Engineer

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