Trow

Since 1957

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November 18, 2009

Reference: BRBS00390681B

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Load Testing of Fiberglass Columns in Axial Vertical Compression

Trow Associates Inc. (Trow) was retained by HB & G Building Products (HB&G) to conduct testing of fiberglass columns under axial compression loading.

The testing was carried out on October 8th, 9th , 22nd and 26th, 2009 at Trow's laboratory in Brampton by Andrew Poirier and Harsh Trivedi MBA, B.Eng. of Trow. The testing on October 8th, 2009 was witnessed by Mr. Paul Deal, Chief Operating Officer of HB&G Building Products.

A total of twelve columns were supplied by HB&G Building Products for axial vertical compression load testing. All columns are round in cross section. Close to the top of each column is a short narrower ornament ("neck ring") section. Type of columns, number of samples and their dimensions, Average achieved load/ average ultimate load are summarized in Table 1 of this report

Table 1: Summary of the Tested Samples

Type of Column	No. of Samples	Height (m)	Outside bottom Diameter (mm)	Average Achieved/Ultimate Load kN(lbs)
A	3	2.44 (8')	194 (8")	198.63 (44,691)
B	3	2.44 (8')	245 (10")	200.00 (45,000))
D	3	3.04 (10')	194 (8")	200.00 (45,000))
E	3	3.04 (10')	245 (10")	200.34 (45,077)

Details of the tests are outlined in Trow's report with project number BRBS00390681B, dated November 18, 2009 with title "Load Testing of Fiberglass Columns in Axial Vertical Compression".

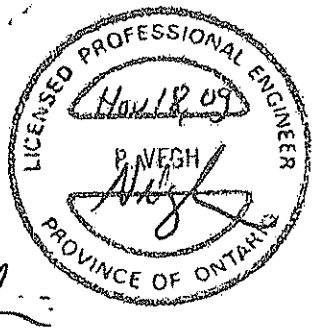
Summary and Comments:

Based on Trow's past experience the concentric compression service load for the tested columns can be derived from the ultimate test load (in case of the carried out tests, the average of the achieved loads) for each tested column type by dividing it by an appropriate safety factor. The value of this factor typically ranges from 2.5 to 3.5.

We trust the above is satisfactory. If you have any questions or comments, please do not hesitate to contact the undersigned.

Yours truly,

Trow Associates Inc.



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Prepared for:

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Table of Contents

1. Introduction

Trow Associates Inc. (Trow) was retained by HB&G Building Products to conduct testing of fiberglass columns under axial compression loading.

The testing was carried out on October 8th, 9th , 22nd and 26th, 2009 at Trow's laboratory in Brampton by Andrew Poirier and Harsh Trivedi MBA, B.Eng. of Trow. The testing on October 8th, 2009 was witnessed by Mr. Paul Deal, Chief Operating Officer of HB&G Building Products.

1.1 Description of the Tested Sections

A total of twelve columns were supplied by HB&G Building Products for axial vertical compression load testing. All columns are round in cross section. Close to the top of each column is a short narrower ornament ("neck ring") section. Type of columns, number of samples and their dimensions are summarized in Table 1 of this report, and photos which better illustrate the cross section of the columns, can be found in Appendix A.

Table 1: Summary of the Tested Samples

Type of Column	No. of Samples	Height (m)	Outside Bottom Diameter (mm)
A	3	2.44	194
B	3	2.44	245
C	3	3.04	194
D	3	3.04	245

2. Test Program

2.1 Test Apparatus and Test Set up

In order to conduct the static load tests a structural steel reaction frame consisting of four columns and two adjustable cross-beams was employed. The loads were applied using a Power Team (model RD256) double acting hydraulic cylinder, manufactured by Owatonna

Tool Company (OTC). The load was transferred to the steel plate panels through a 50,000 lbs (50K) Intertechnology load cell with a digital process indicator, which was used in the testing program to monitor the applied loads.

To provide a suitable surface for the columns during testing, the following set-up was used under the structural steel reaction frame:

- A large, circular 25mm thick steel plate was laid on the concrete floor, followed by
- The column specimen to be tested, followed by
- Two plywood pieces 19mm thick fastened together with screws, followed by
- A steel plate 20mm thick, followed by
- The load cell and the hydraulic cylinder.

2.2 Test Procedure

The tested columns were centered under the loading cylinder and loaded gradually either up to the failure or up to a load between 195.91 kN (44080 lbs) to 200.62 kN (46400 lbs) the safe limit of the test set up.

Each load stage was gradually reached and held until load stabilization was achieved. This was repeated until the failure load or the limit load of the test set up was reached.

After the tests were completed, the tested samples were examined for deformations, cracking, and signs of structural distress.

Observations made during and after the test were recorded.

Failure and/or maximum applied loads were recorded, and are summarized in Tables 2 and 3 of this report. Also given in the Tables are average loads for each set of columns with the same length and outside diameter.

Digital photographs were taken to illustrate typical test set ups during the tests. The representative ones are attached in Appendix A of this report.

3. Summary of the Test Results

The column test results for all columns, with rounded off column sizes, are summarized in Table 2 and 3. Detailed column dimensions with drawings are attached in Appendix B:

Table 2: Summary of the Results for 2.44m (8') long columns

Column number*	Outside Bottom Diameter (mm)	Load (kN)	Load (LBS)	Observations
A-1-8-8"	194	195.91	44,080	No visual sign of distress or failure
A-2-8-8"	194	200.00	45,000	Sudden compression failure near bottom of the column.
A-3-8-8"	194	200.00	45,000	Sudden compression failure near top the column.
	AVG	198.63	44,691	
B-1-8-10"	245	200.00	45,000	No visual sign of distress or failure
B-2-8-10"	245	200.00	45,000	No visual sign of distress or failure
B-3-8-10"	245	200.00	45,000	No visual sign of distress or failure
	AVG	200.00	45,000	

Table 3: Summary of the Results for 3.04m (10') long columns

Column number*	Outside Bottom Diameter (mm)	Load (kN)	Load (LBS)	Observations
C-1-10-8"	194	200.00	45,000	No visual sign of distress or failure
C-2-10-8"	194	200.00	45,000	No visual sign of distress or failure
C-3-10-8"	194	200.00	45,000	No visual sign of distress or failure
	AVG	200.00	45,000	
D-1-10-10"	245	200.40	45,090	No visual sign of distress or failure
D-2-10-10"	245	200.62	45,140	No visual sign of distress or failure
D-3-10-10"	245	200.00	45,000	No visual sign of distress or failure
	AVG	200.34	45,077	

* The column number denotes the following:

- The letter denotes the type of the column and is followed by the test number within the group of three columns of the same size.
- Second number is the height (length) of the column in feet.
- Third number is the outside diameter of the column measured at its bottom end rounded off to the nearest inch.

4 Summary and Comments

- All columns were tested under short term loading only.
- No failure was observed in all tested columns with the exception of two column samples – A-2-8-8" and A-3-8-8" (second and third tests of the 8 foot (2.44m) long columns with an 8" (194 mm) outside bottom diameter).
- The bottom end section of the column A-2-8-8" close to the bottom support split up suddenly into several pieces as a result of the tension created by the axial compression load Column A-3-8-8" failed in a sudden compression failure at 200.0 kN (45,000 lbs).
- The top section of the column A-3-8-8" failed in a sudden compression failure – the top end of the column crushed under the applied load - at 200.00 kN (45000lbs).
- The average achieved loads for each type of column are summarized in Table 4.

Table 4:

Type of Column	Column Height (length) In (ft)	Column outside bottom Diameter mm(inch)	Average achieved Load kN (lbs)
A	2.44m (8.0)	194 (8")	198.63 (44,691)
B	2.44m (8.0)	245 (10")	200.00 (45,000)
C	3.04 (10.0)	194 (8")	200.00 (45,000))
D	3.04 (10.0)	245 (10")	200.34 (45,077)

4.1 Service load for the tested columns

Based on Trow's past experience the concentric compression service load for the tested columns can be derived from the ultimate test load (in case of the carried out tests, the average of the achieved loads) for each tested column type by dividing it by an appropriate safety factor. The value of this factor typically ranges from 2.5 to 3.5.

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