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Legacy report on the BOCA® National Building Code/1999

DIVISION: 05— METALS

SECTION: 05100—Structural Metal Framing

REPORT HOLDER:

DEAN COLUMN CO., INC.
POST OFFICE BOX 529
BOHEMIA, NEW YORK 11716

EVALUATION SUBJECT:

3¹/₂-INCH AND 4-INCH DEAN LIGHTWEIGHT COLUMNS

EVALUATION SCOPE:

Compliance with the following code:

BOCA® National Building Code/1999

- Section 1604.1 Safe support required
- Section 2203.1 General

1.0 DESCRIPTION OF EVALUATION

This report evaluates prefabricated concrete-filled steel columns as structural columns supporting vertical concentric compression loads. This evaluation is based on review of structural calculations in accordance with the following standard:

AISC LRFD-93, *Load and Resistance Factor Design Specifications for Structural Steel Buildings*

2.0 DESCRIPTION AND USE OF PRODUCT

2.1 GENERAL DESCRIPTION

The 3¹/₂-inch and 4-inch Dean Lightweight Columns are intended for use in wood frame construction (i.e., Type 5 construction) as a support for girders and beams.

Dean Lightweight Columns consist of either a 3¹/₂-inch or a 4-inch (89 or 102 mm), outside diameter, 16 gage tubular steel pipe filled with concrete at the manufacturing plant. The columns are available in lengths ranging from 2 feet to 23 feet (610 to 7010 mm). The steel pipe is manufactured from low carbon steel complying with the requirements of ASTM A513 with a yield strength of 32,000 psi (1532 kPa) and ultimate strength of 45,000 psi (2155 kPa). The tube is filled with concrete at the manufacturer's plant with concrete having a minimum 28 day compressive strength of 3,000 psi (144 kPa). The columns are then painted with one coat of primer.

Each Dean Lightweight Column is supplied with 9 gage low carbon steel plates placed on the top and bottom of the column. The plates have two ⁵/₁₆-inch-diameter (7.9 mm) holes and four raised lugs which correspond to the diameter of the column (See Figure 1 of this report). The plates are tack welded to the column at four equidistant points until the columns are permanently installed, at which time the plates are welded into place in accordance with the manufacturer's installation instructions.

2.2 USE AND APPLICATION

The Dean Lightweight Column is to be installed vertically, either end up, supported by a footing capable of carrying the imposed load as required by the code. The number of columns, the spacing, connection details and the footing are to be determined by a registered design professional. The applied axial load for a given column length shall not exceed the compressive values specified in Table 1 of this report.

3.0 CONDITIONS OF USE

This report is limited to the applications and products as stated in this report. The ICC-ES Subcommittee on National Codes intends that the report be used by the code official to determine that the report subject complies with the code requirements specifically addressed, provided that this product is installed in accordance with the following conditions:

- 3.1** The Dean Lightweight Columns shall be fabricated and installed in accordance with this report. Column plate attachment shall be welded, nailed, bolted, or lagged to structural members and the footing below, as determined by the registered design professional. The design of members and elements to which the column is attached is beyond the scope of this report.
- 3.2** All permit applications specifying Dean Lightweight Columns shall be accompanied by structural calculations which indicate the concentric axial applied load exerted on the columns is less than or equal to the allowable axial capacity specified in Table 1 of this report. These structural calculations shall be signed and sealed by a registered design professional.
- 3.3** The minimum compressive strength of the concrete shall be 3,000 psi (144 kPa) at 28 days and the concrete shall comply with the requirements of ACI 318.
- 3.4** The column shall be field tack welded to the top and bottom plates in accordance with the manufacturer's installation instructions.

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- 3.5 Top plate sizing and bolt specification are beyond the scope of this report.
- 3.6 Column applied loads for a given column length shall be concentric and shall not exceed the allowable design load given in Table 1 of this report.
- 3.7 Installations of Dean Lightweight Columns which will be directly exposed to the weather shall receive an additional coat of paint, enamel or other approved protective coatings unless encased in concrete made of non-corrosive aggregates.
- 3.8 The 3¹/₂-inch-diameter (89 mm) Dean Lightweight Column shall be limited to Type 5 construction less than three stories or 40 feet (12192 mm) in height.
- 3.9 Special Inspections of the column installation and manufacturing processes shall be provided for columns used in other than Use Group R-3 buildings. The inspections shall be conducted by a special inspector provided by the owner of the building under construction. The special inspector must be qualified to perform the inspections and approved by the code official. The inspections must be of a nature, and conducted at such frequency, as is necessary to ensure the Dean Lightweight Columns compliance with the requirements of Code Section 1705.2 of the BOCA[®] *National Building Code/1999*.
- 3.10 This report is subject to periodic re-examination. For information on the current status of this report, contact the ICC-ES.

4.0 INFORMATION SUBMITTED

- 4.1 A report titled, "*Column Load Calculations for 3.5-inch outside diameter and 4-inch outside diameter composite columns with 3,000 psi Concrete*" signed and sealed by Joseph F. Mulcahy, P.E. The report provided the structural analysis of the columns in accordance with AISC LRFD provisions and modified to allowable design values as indicated in footnote 1 to Table 1 of this report. See Table 1 for allowable design values.
- 4.2 A written copy of the procedure used by Dean Column for the inspection of raw goods and the manufacture of concrete-filled steel pipe columns was submitted. The procedure describes each item to be inspected and names the person responsible for that inspection.

5.0 INFORMATION REQUIRED ON CONSTRUCTION DOCUMENTS

To aid in the use of this report, the following represents the minimum level of information to be reflected on construction documents in order to determine compliance with this research report.

- 5.1 The language, "See ICC-ES Legacy Report No. 94-53."
- 5.2 All permit applications utilizing Dean Lightweight Columns shall be accompanied by structural calculations which are performed by a registered design professional. The calculations shall include, but not be limited to, the following:
 - 5.2.1 The applied loads imposed upon the column by the components it supports.

5.2.2 The ability of the Dean Lightweight Column to sustain the applied loads consistent with Table 1 of this report.

5.2.3 The ability of all connections between the column and the components framing into it, including the steel top and bottom plates, to transfer all the imposed applied loads from the components supported by the column to the column, and from the column to its supporting footing.

5.2.4 The design of the footing which will support the Dean Lightweight Column.

- 5.3 The manufacturer shall provide the user of this report with complete instructions on the proper installation of Dean Lightweight Columns.

6.0 PRODUCT IDENTIFICATION

All Dean Lightweight Columns manufactured in accordance with this research report shall be marked at the plant with the identifying language "See ICC-ES Legacy Report No. 94-53."

TABLE 1—ALLOWABLE AXIAL CAPACITY¹

COLUMN LENGTH (feet)	3-1/2-inch COLUMN (lbs)	4-inch COLUMN (lbs)
2.0	19900	24700
3.0	19100	24400
4.0	18500	23400
5.0	17600	22400
6.0	16500	21300
7.0	15200	20000
8.0	14000	18700
9.0	12600	17300
10.0	11300	15800
11.0	9900	14400
12.0	8700	12900
13.0	7500	11500
14.0	6400	10200
15.0	5600	8870
16.0	4900	7800
17.0	4400	6900
18.0	3900	6160
19.0	3500	5530
20.0	3100	4990
21.0	-NA-	4520
22.0	-NA-	4140
23.0	-NA-	3770

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb. = 0.45 kg.

¹ Column capacities have been determined by AISC LRFD procedures, as such a $\phi = .85$ and a load factor of 1.6 has been utilized to convert column strength capacities to an allowable load for each column length and size; allowable axial capacity =

$$\frac{\phi P_n}{1.6}$$

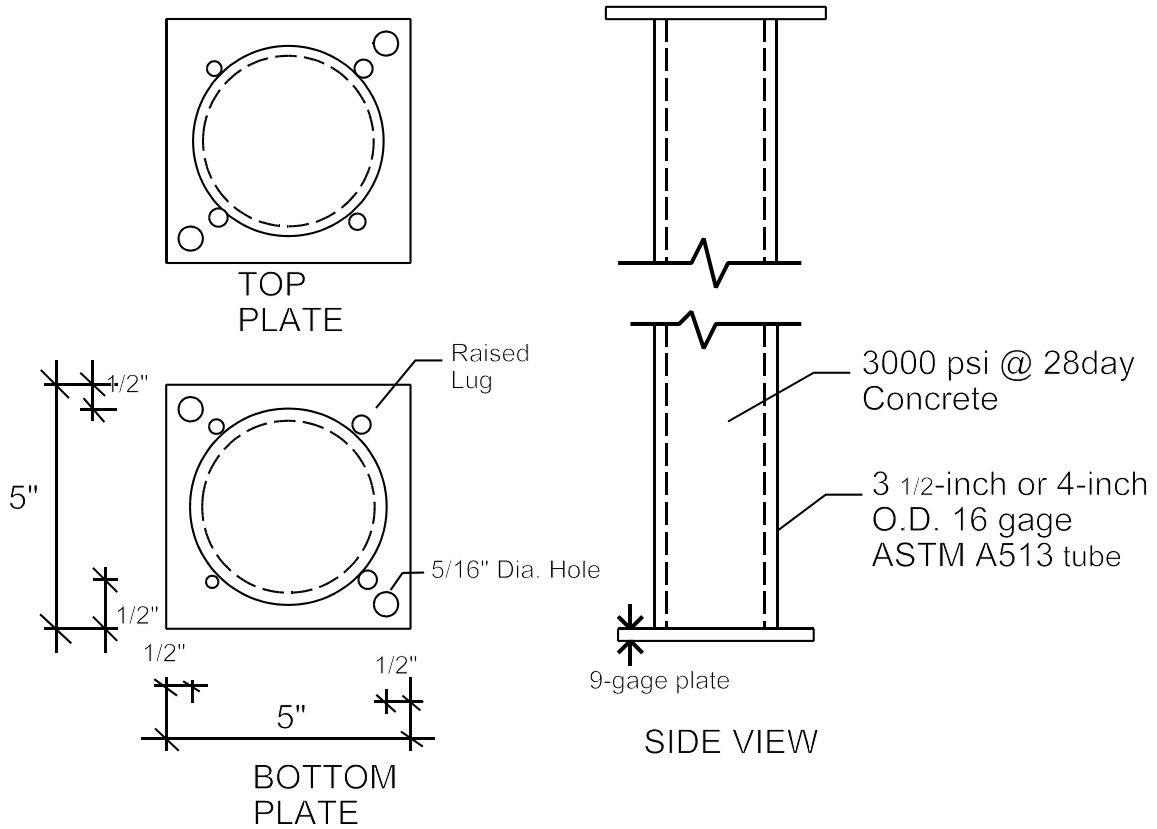


Figure 1* — DEAN LIGHTWEIGHT COLUMN

*THIS DRAWING IS FOR ILLUSTRATION PURPOSES ONLY. IT IS NOT INTENDED FOR USE AS A CONSTRUCTION DOCUMENT FOR THE PURPOSE OF DESIGN, FABRICATION OR ERECTION.