SBC ASSOCIATION

Research Report

Floor Truss Ribbon Board Load Path

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Structural Building Components Association (SBCA)

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Table of Contents

Introduction: ..... **page 3**

Testing: ..... **page 4**

Testing Results: ..... **page 4**

Assumptions: ..... **page 5**

Analysis: ..... **page 6**

Conclusion: ..... **page 7**

References: ..... **page 7**

Appendix A ..... **page 8**

Introduction:

Recently a question was asked as to the need for intermediate blocking between wall bottom plate(s) and bearing walls in installations where walls are installed on top of bottom chord bearing floor trusses using a ribbon board as shown in Figure 2.15a of the *Wood Frame Construction Manual 2012*. (Note - Figure 2.15a refers to the ribbon board as “Band”; see Figure 1 below).

Currently, the capacity of a ribbon board and its system through the composite of the ribbon board, floor sheathing and bottom plate of the wall has not been ascertained. In order to provide better guidance, a series of tests were conducted at the Structural Building Component Research Institute (SBCRI) in order to determine the capacity of the ribbon board system.

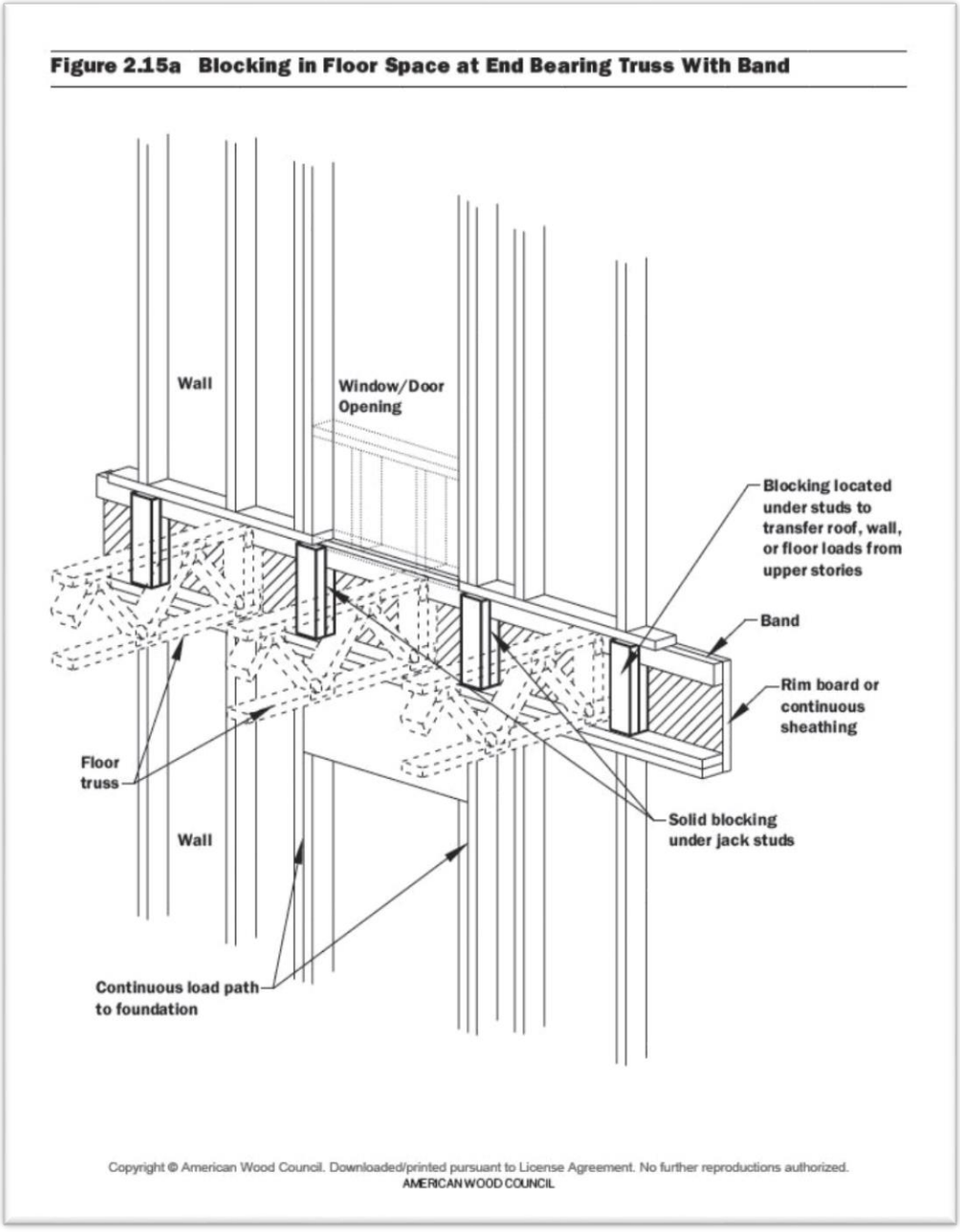


Figure 1: *WFCM 2012 Figure 2.15a*

Testing:

Floor truss end sections assembled with ribbon boards, 23/32" floor sheathing, and 2x4 wall bottom plates were tested. Each tested assembly was loaded from above to simulate the wall load on each stud as shown in Figure 2. 2x4 and 2x6 ribbon board assemblies were tested without using construction adhesive to attach the floor sheathing. An additional set of 2x4 ribbon board assemblies was tested with the floor sheathing installed using construction adhesive.

Figure 2: Ribbon Board System Testing

Testing Results:

Average maximum loads for each of the three test configurations is shown in Table 1.

Ribbon Board Assembly Test Results					
Ribbon Board Size	**Floor Sheathing Size**	**Floor Sheathing Glued**	**Average Maximum Load (lbs)**	**Average Maximum Load (PLF)**	**Maximum Allowable Load w/ Safety Factor of 2.0 (PLF)**
2x4	23/32"	No	14,569	3,642	1,821
2x4	23/32"	Yes	15,457	3,864	1,932
2x6	23/32"	No	17,894	4,474	2,237

Table 1: Test Results

Assumptions:

Construction

The configuration for this analysis is assumed to be 36' clear span roof trusses with 24" overhangs spaced at 24" on-center. These dimensions are based on the maximum span for prescriptive framing. Lumber species used throughout the construction of the roof, wall and floor is assumed to be either SPF, HF, DF or SP. The roof trusses are assumed to be bearing on a 10' tall by $3^1/_2$" deep stud wall with stud spacing at 24" on-center. The walls are assumed to have a minimum double 2x4 top plate and a minimum single 2x4 bottom plate which have design values equal to or greater than visually graded No. 2 lumber. Additionally, the ribbon board is assumed to be constructed of minimum 2x4 material which has design values equal to or greater than No. 2 visually graded lumber. See Figure 3 for additional information regarding construction requirements.

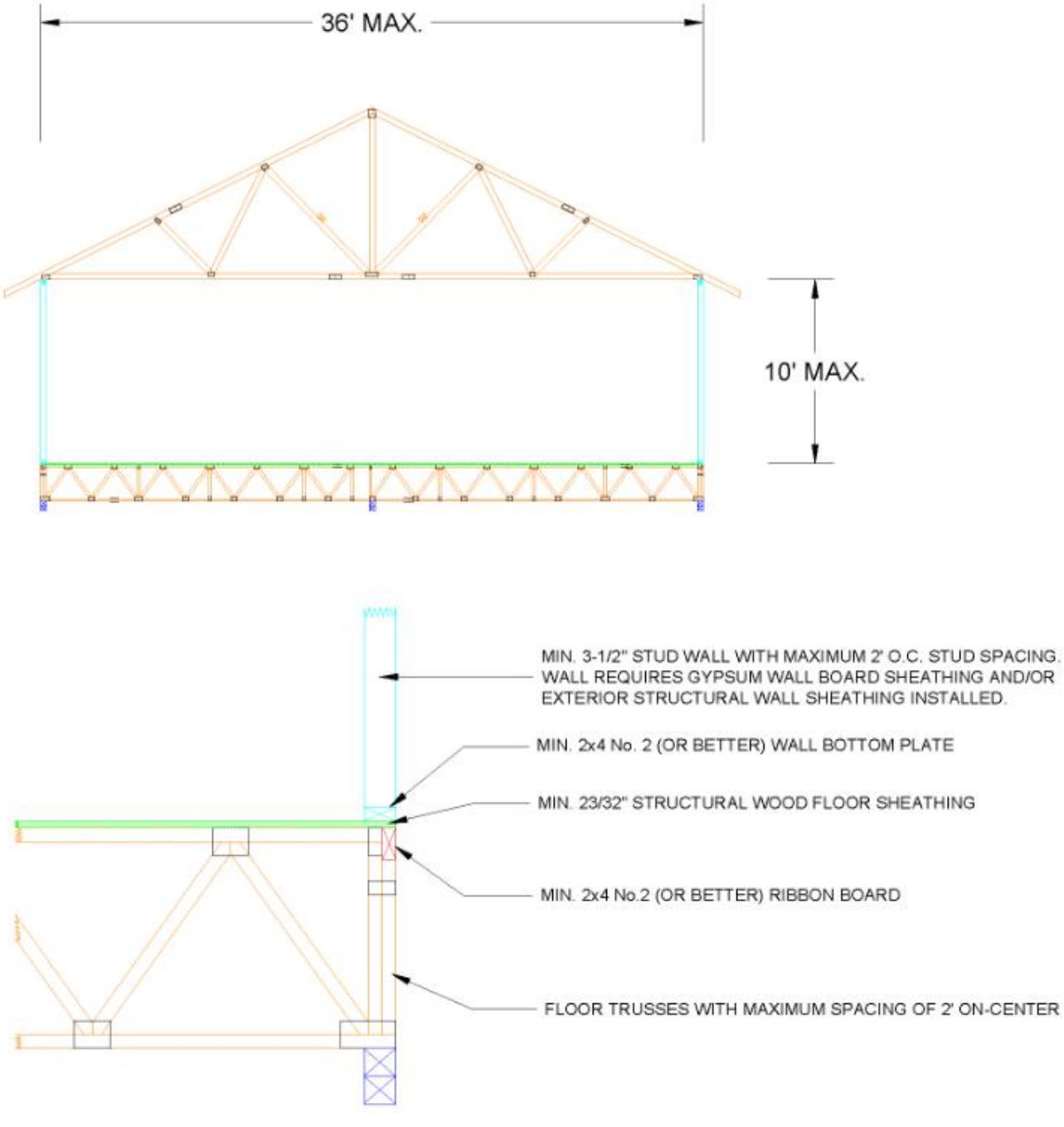


Figure 3: Construction Requirements

Loading

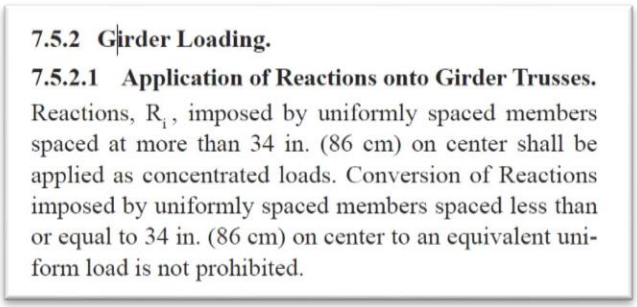
To provide a general analysis that will be applicable to a majority of situations encountered in the continental US, certain assumptions were made, which are listed in Table 1. Loading for the purpose of analyzing the capacity of the ribbon board was based on standard loads from the *IRC 2012* and lumber design values from the NDS 2015, as shown in Table 2.

Construction/Loading Assumptions	
Description	**Value Assumed**
Ground Snow Load	70 PSF
Top Chord Dead Load	10 PSF
Bottom Chord Dead Load	10 PSF
Maximum Roof Truss Span	36'
Maximum Roof Overhangs	2'
Maximum Stud Spacing	2' On-center
Maximum Wall Height	10'
Wall Dead Load	10 PSF
Lumber Species	SPF, HF, DF and/or SP
Sheathing Requirements	Interior Gypsum Wall Board and/or Exterior structural wood sheathing installed per IRC 2012
Enclosure Category	II
Importance Factor, I	1.0
Thermal Factor	1.1
Exposure Category	C
Exposure Factor	1.0

Table 1: Assumptions

Analysis:

Per *ANSI/TPI 1-2014* section 7.5.2.1 (Figure 4), all loads being applied from roof trusses to wall and wall to ribbon board are considered to be applied as uniform PLF loads. All roof and wall loads are assumed to be uniform with no concentrated loads on the trusses or walls present. With the assumptions established in Table 1, the load carried by the ribbon board can be determined using *ASCE 7-10* (see Appendix A for calculations used). The 36' roof will apply a load of 1478 PLF to each wall. The dead load of the wall will increase the load 100 PLF given a 10' tall wall. The combination of the roof load and wall load applies a load of 1578 PLF to the bottom plate of the wall, into the floor sheathing and then to the ribbon board. The tested allowable load for the combined section of the wall bottom plate, ¾" structural floor sheathing and the 2x4 ribbon board with no glue used to attached the floor sheathing is 1821 PLF, greater than the 1578 PLF required.



7.5.2 Girder Loading.

7.5.2.1 Application of Reactions onto Girder Trusses.

Reactions, R_i, imposed by uniformly spaced members spaced at more than 34 in. (86 cm) on center shall be applied as concentrated loads. Conversion of Reactions imposed by uniformly spaced members spaced less than or equal to 34 in. (86 cm) on center to an equivalent uniform load is not prohibited.

Figure 4: *ANSI/TPI 1-2014* Section 7.5.2.1

Conclusion:

From these calculations, it can be determined that intermediate blocking under all wall studs as shown in Figure 2.15a of the *Wood Frame Construction Manual 2012* is not required given the loading and construction requirements do not exceed the assumptions shown in Table 1. Any project specific variables that reduce the loading, as well as better materials, will make the strength of the composite wall bottom plate, floor sheathing and ribbon board more conservative.

Situations that exceed the assumptions shown in Table 1 such as concentrated loads or portal frames will require special considerations for proper support. It is the responsibility of the building designer to verify the capacity of all structural interfaces.

References:

American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-10).

American Wood Council, National Design Specification® for Wood Construction (AWC/NDS), 2015.

American Wood Council, Wood Frame Construction Manual for One and Two-Family Dwellings (WFCM), 2012.

International Code Council, International Residential Code (IRC), 2012.

American National Standard, National Design Standard for Metal Plate Connected Wood Truss Construction (ANSI/TPI 1-2014)

Structural Building Components Association (SBCA), SBCRI-16-0120 Ribbon Board Assembly Vertical Load Testing, 2016.

Appendix A

Calculations for Loading

$$P_f = 0.7*C_e*C_t*I_s*P_g$$
$$= 0.7*1*1.1*1*70$$
$$= 53.9$$

$$Lt_R = \Sigma P_R$$
$$= ((53.9+10+10)(36+2+2))/2$$
$$= 1478 \text{ PLF}$$

$$Lt_W = \Sigma P_W$$
$$= 10 * 10$$
$$= 100 \text{ PLF}$$

$$\Sigma L = Lt_R + Lt_W$$
$$= 1478 + 100$$
$$= 1578$$