DIVISION OF BUILDING SAFETY

IDAHO BUILDING CODE BOARD
VIDEOCONFERENCE MEETING

AUGUST 21, 2018

IDAHO BUILDING CODE BOARD

Agenda Item No. 01 **Agenda and Minutes**

PRESENTER: Andrew Bick, Chairman

OBJECTIVE: Approve the Idaho Building Code Board's August 21, 2018 agenda and June 19, 2018 draft minutes.

ACTION: Consent

BACKGROUND:

PROCEDURAL HISTORY:

ATTACHMENTS: Tentative Agenda and Draft Minutes

TENTATIVE AGENDA

NOTICE OF PUBLIC HEARING/MEETING

IDAHO BUILDING CODE BOARD
VIDEOCONFERENCE MEETING

Division of Building Safety
1090 East Watertower Street, Suite 150, Meridian
1250 Ironwood Drive, Suite 220, Coeur d'Alene
2055 Garrett Way, Building 1, Suite 4, Pocatello
dbs.idaho.gov – (208) 332-7137

Tuesday, August 21, 2018
9:30 a.m. – 12:30 p.m. (MDT)

(Note: North Idaho - Meeting Commences @ 8:30 a.m. PDT)

9:30 a.m. **CALL TO ORDER** – Andrew Bick, Chairman

- Roll Call & Introductions
- Recognition – Board Members Michael Arrington, Mel Leviton, Scott Buck, and Dennis Schaffner
- Welcome – Board Members Nick Guho, Stan Browning, Phil Roberts, and Building Program Manager Jeff Egan
- Open Forum

CONSENT AGENDA

1. Approval of the August 21, 2018 Agenda and June 19, 2018 Board Meeting Minutes – Andrew Bick

ACTION AGENDA

2. Conduct public hearing, negotiated rulemaking and vote on proposed amendments to the building codes, and IDAPA rules – Andrew Bick

   a. Adopt the 2018 IRC, IBC, and IECC with Current Residential Amendments Remaining in Place – Andrew Bick

   b. Delete IDAPA 07.03.01.004.02.p (Chapter 11 Energy Efficiency) from the adopted version of the IRC – Spencer Holm, Deputy Attorney General

   c. Amend the 2015 IECC Commercial Provisions--Table C404.5.1 Piping Volume and Maximum Piping Lengths – Jason Blais, Board Member

d. Amend IRC section R202, abbreviations, and chapter 6 to provide for extended plate walls and foam plastic insulating sheathing – Rob Brooks, DowDuPont Building Solutions

3. Additional Building Code Board Meetings – Andrew Bick

INFORMATIONAL AGENDA

4. Code Review Cycles – Andrew Bick

5. Program Manager Report – Jeff Egan, Building Program Manager

6. Administrator Report – Chris L. Jensen, Administrator
   a. Financial Report

12:00 p.m. ADJOURN

For additional agenda information, refer to the packet, available one week prior to this meeting, at the DBS's central and regional offices and https://dbs.idaho.gov/boards/bcboard/bcmeetings.html.

All times, other than beginning, are approximate and scheduled in accordance to Mountain Daylight Time (MDT), unless otherwise noted. Agenda items may shift depending on the Idaho Building Code Board preference. 08/21/2018r

IDAHO BUILDING CODE BOARD
VIDEOCONFERENCE MEETING

Tuesday – June 19, 2018 – 9:30 a.m. (MDT)

Division of Building Safety
1090 East Watertower Street, Suite 150, Meridian
1250 Ironwood Drive, Suite 220, Coeur d'Alene
2055 Garrett Way, Building 1, Suite 4, Pocatello

*DRAFT MINUTES OF THE JUNE 19, 2018 MEETING

NOTE: The following report is not intended to be a verbatim transcript of the discussions at the meeting, but to record the significant features of those discussions.

Chairman Andrew Bick called the meeting to order at 9:32 a.m. (MDT)

Board Members Present:
Andrew Bick, Chairman
Scott Buck, Vice-Chairman (Teleconference)
Allen Jensen
Dennis Schaffner
Kent Soelberg
Chuck Bleth
Jason Blais

DBS Staff Members Present:
Chris L. Jensen, Administrator
Ron Whitney, Deputy Administrator
Spencer Holm, Deputy Attorney General
Arlan Smith, Building Program Manager
Larry Jeffres, Regional Manager, Region 1
Patrick Grace, Regional Manager, Region 2
Jeff Egan, Regional Manager, Region 3
Renee Bryant, Administrative Assistant 2

- **Open Forum**
  Idaho Building Code Collaborative – Johanna Bell, Association of Idaho Cities Policy Analyst, asked the direction the Collaborative should take with the vetting and code adoption process.

- **Approval of the June 19, 2018 Agenda**
  MOTION: Jason Blais made a motion to accept the agenda as presented. Chuck Bleth seconded. All in favor, motion carried.

- **Approval of the April 17, 2018 Board Meeting Minutes**
  MOTION: Allen Jensen made a motion to approve the minutes as written. Kent Soelberg seconded. All in favor, motion carried.

- **Negotiated Rulemaking**
  Adopt the 2018 IRC, IBC, and IECC with Current Residential Amendments Remaining in Place – This topic was brought forth to begin discussion on the adoption of future building codes, as well as to possibly bring the codes into tandem with codes under the purview of the Division's other boards. Suggestions were: 1) Analyze the entire code by breaking it down into sections, and have mini-meetings, subcommittees or groups review it, and 2) Wait for another state to adopt the code, find all the mistakes, and then adopt the addendum.

Delete IDAPA 07.03.01.004.02.p (Chapter 11 Energy Efficiency) from the Adopted Version of the IRC – House Bill 547 precipitated the deletion of IDAPA 07.03.01.004.02.p, Chapter 11 *Energy Efficiency*, as well as references to energy tables in the International Residential Code (IRC). The Division will make the necessary changes, and bring the draft rule to the August 2018 Board meeting for review and possible approval.

ACTION: The topic *Delete IDAPA 07.03.01.004.02.p (Chapter 11 Energy Efficiency) from the Adopted Version of the IRC* will be placed on the August 21, 2018 board meeting agenda as an action item.

Amendment Proposal--2015 IECC Commercial Provisions--Table C404.5.1 Piping Volume and Maximum Piping Lengths – Engineering firms have complained the hot water piping in commercial applications; specifically, the maximum piping length allowed in public lavatory faucets, is too restrictive. The proposal would remove the Public Lavatory Faucets column in Table C404.5.1 *Piping Volume and Maximum Piping Lengths*, replacing it with a new column.

Amend IRC Section 202, Abbreviations, and Chapter 6 to Provide for Extended Plate Walls and Foam Plastic Insulating Sheathing – Rob Brooks, DowDuPont Building Solutions Representative, explained the use and positive aspects of the new "Extended Plate and Beam" wall system. The system is for seismic zones A, B, and C, and one- and two-family dwellings. Although not yet recognized by the IRC, developers hope to get approval at upcoming code hearings.

- **Create Subcommittees--Residential/Commercial/Energy and Additional Building Code Board Meetings**

  Addressed together were the topics *Create Subcommittees--Residential/Commercial/Energy* and *Additional Building Code Board Meetings*. Although both are methods to review the residential, commercial and energy codes for possible adoption at the 2020 legislature, it was determined, the Board would arrange for three additional "working" meetings in November, December, and January. For clarity, and to abide by the open meeting laws, there will be no quorum of the Board, and each code (residential, commercial, energy) will be reviewed separately.

  MOTION: Chuck Bleth made a motion to schedule three additional board meetings as "working" meetings in November, December, and January, with dates determined at the October Board meeting. Allen Jensen seconded. All in favor, motion carried.

- **Code Review Cycles**

  There is nothing in statute on how often to review code cycles. Three years has been the standard based on when the International Code Council comes out with their code cycles. Over the years, stakeholders have expressed a three-year cycle is too quick and too often, causing them to spend too much money on new code books.

The Idaho Building Contractors Association supports adopting new IRC releases no less than a six-year code cycle after proper review and vetting.

The Idaho Association of Building Officials has discussed this topic and six years is too long; however, it needs to be more than three years.

The Chairman asked everyone to talk to their constituents, and the topic *Code Review Cycles* be placed on the August meeting agenda. In the future, the Chairman would like to either send a letter of recommendation or a vote from the Board to the legislature for their decision-making process.

ACTION: The topic *Code Review Cycles* will be placed on the August 21, 2018 Board meeting agenda as an informational item.

- **Program Manager Report**

  Building Program – Following are changes to the program: 1) Dissolution of the contract with the city of Meridian, 2) New small city contracts, and 3) Retirement of Building Program Manager Arlan Smith.

- **Administrator Report**

  Financial Report – Briefly addressed with the Idaho Building Code fund, fiscal year 2018 financial statement, as of May 31, 2018.

  City of Meridian – The Division is not renewing its contract with the city of Meridian; however, will honor the original three-year contract and work through September 30, 2018.

  Construction – Construction on several large commercial projects will and/or have begun in eastern Idaho. The cost, per project, ranges from $35 million to $4 billion.

  Statistics – Administrator Chris L. Jensen provided a statistical analysis of the Division's activities in 2017.

  School Inspections – With no funding, the DBS's Industrial Safety Program inspects schools yearly in an advisory role. The Division's Safety and Security Task Force accompanies the industry safety inspectors every third year, recommending how to make the schools safer and more security.

  Kootenai County--Residential Codes – In April 2018, Kootenai County Board of Commissioners signed an ordinance to make building permits optional for any residential buildings that are on five acres or more. At the May 2018 primary election, it was purported the two commissioners that voted for the opt-out were defeated, and the two new commissioners are committed to bringing residential codes back into the County.

- **Adjournment**

  MOTION: Chuck Bleth made a motion to adjourn the meeting. Jason Blais seconded. All in favor, motion carried.

The meeting adjourned at 11:56 a.m. (MDT)

ANDREW BICK, CHAIRMAN IDAHO BUILDING CODE BOARD	CHRIS L. JENSEN, ADMINISTRATOR DIVISION OF BUILDING SAFETY
DATE	DATE

***These DRAFT minutes are subject to possible correction and final approval by the Idaho Building Code Board. 08/16/2018rb**

IDAHO BUILDING CODE BOARD

Agenda Item No. 02a Adopt the 2018 IRC, IBC, and IECC with Current Residential Amendments Remaining in Place

PRESENTER: Andrew Bick, Chairman

OBJECTIVE: Adopt the 2018 IRC, IBC, and IECC with Current Residential Amendments Remaining in Place.

ACTION: Vote

BACKGROUND: **April 2018** – This topic was included on the agenda in the event interested parties wanted to present draft proposals to adopt the 2018 codes.

When questioned, Deputy Administrator Ron Whitney confirmed the Division received documentation on the analysis between the 2012, 2015, and 2018 codes from Patrick Sullivan, city of Nampa; however, never received any amendments.

Due to misunderstandings, reviewed was the timeline of the negotiated rulemaking process for submittal of proposed amendments to the 2019 legislative session. A suggestion was to hold the two public hearings, the June Board meeting and tentatively scheduled meeting in August. With no opposition, the Chairman agreed to the August 19, 2018 meeting.

June 2018 – This topic was brought forth to begin discussion on the adoption of future building codes, as well as to possibly bring the codes into tandem with codes under the purview of the Division's other boards. Suggestions were: 1) Analyze the entire code by breaking it down into sections, and have mini-meetings, subcommittees or groups review it, and 2) Wait for another state to adopt the code, find all the mistakes, and then adopt the addendum.

ATTACHMENTS: FHA News and Updates Memo

FHA INFO #18-27
July 3, 2018

FHA Single Family Housing NEWS

TO: All FHA-Approved Mortgagees and Servicers
All Other Stakeholders in FHA Transactions

NEWS AND UPDATES

Elimination of FHA Inspector Roster

Today, the Federal Housing Administration (FHA) published in the *Federal Register*, a final rule (Docket No. FR-5457-F-02) that streamlines the inspection requirements for FHA single family mortgage insurance by eliminating the regulations for the FHA Inspector Roster (Roster).

This final rule — which follows a February 6, 2013, proposed rule — recognizes the sufficiency and quality of inspections carried out by International Code Council (ICC) certified Combination Inspectors (CI) and Residential Combination Inspectors (RCI) and other qualified individuals. As a result, FHA acknowledges there is no longer a need to maintain and administer its own standardization process for inspectors.

This final rule becomes effective August 2, 2018.

Quick Links

- View the *Federal Register* notice — *Streamlining Inspection Requirements for Federal Housing Administration (FHA) Single Family Mortgage Insurance: Removal of the FHA Inspector Roster* — in the *Federal Register* at: https://www.federalregister.gov/documents/2018/07/03/2018-14212/streamlining-inspection-requirements-for-federal-housing-administration-fha-single-family-mortgage

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Resources

Contact the FHA Resource Center:

- Visit our online knowledge base to obtain answers to frequently asked questions 24/7 at www.hud.gov/answers.
- E-mail the FHA Resource Center at answers@hud.gov. Emails and phone messages will be responded to during normal hours of operation, 8:00 AM to 8:00 PM (Eastern), Monday through Friday on all non-Federal holidays.
- Call 1-800-CALLFHA (1-800-225-5342). Persons with hearing or speech impairments may reach this number by calling the Federal Relay Service at 1-800-877-8339.

FHA INFO Archives:	Visit the FHA INFO Archives to access FHA INFO messages issued from 2012 to the present.
Subscribe/Unsubscribe Instructions:	To subscribe to the Single Family FHA INFO mailing list you can use this link: FHA INFO or send a request by email to: answers@hud.gov Bulk subscriptions: To sign up your entire office or a large group, send the list of

	email addresses (in the format below) to: answers@hud.gov aaa@xyz.com bbb@xyz.com ccc@xyz.com To Unsubscribe follow the unsubscribe instructions on that page.	
Resource Links:	FHA Archived Webinars Career Opportunities Contracting Opportunities Events & Training FHA Forms FHA Homeownership Centers FHA Mortgagee Letters	Foreclosure Assistance Grant Opportunities HUD Homes - Property Listings HUD.gov Making Home Affordable Presidentially-Declared Major Disaster Areas Visit our Single Family Home Page

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IDAHO BUILDING CODE BOARD

Agenda Item No. 02b Delete IDAPA 07.03.01.004.02.p (Chapter 11 Energy Efficiency) from the Adopted Version of the IBC

PRESENTER: Andrew Bick, Chairman

OBJECTIVE: Remove IDAPA 07.03.01.004.02.p (Chapter 11 Energy Efficiency) from the adopted version of the IBC.

ACTION: Vote

BACKGROUND: House Bill 547 precipitated the deletion of IDAPA 07.03.01.004.02.p, Chapter 11 *Energy Efficiency*, as well as references to energy tables in the International Residential Code (IRC). The Division will make the necessary changes, and bring the draft rule to the August 2018 Board meeting for review and possible approval.

PROCEDURAL HISTORY:

ATTACHMENTS: IDAPA 07.03.01

IDAPA 07
TITLE 03
CHAPTER 01

07.03.01 – RULES OF BUILDING SAFETY

000. LEGAL AUTHORITY.
The Idaho Building Code Board of the Division of Building Safety is authorized under Section 39-4107, Idaho Code, to promulgate rules concerning the enforcement and administration of the Idaho Building Code Act. (3-30-06)

001. TITLE AND SCOPE.

01. Title. These rules shall be cited as IDAPA 07.03.01, "Rules of Building Safety," Division of Building Safety. (3-30-06)

02. Scope. These rules prescribe the criteria for enforcement and administration of the Idaho Building Code Act by the Idaho Building Code Board and the Building Bureau of the Division of Building Safety. (3-30-06)

002. WRITTEN INTERPRETATIONS.
In accordance with Section 67-5201(19)(b)(iv), Idaho Code, this agency has statements that pertain to the interpretation of the rules of this chapter. These statements are available for review and copying at the offices of the Division of Building Safety. (3-30-06)

003. ADMINISTRATIVE APPEALS.
This chapter does not provide for administrative relief of the provisions contained herein. (3-30-06)

004. ADOPTION AND INCORPORATION BY REFERENCE.
Under the provisions of Section 39-4109, Idaho Code, the codes enumerated in this Section are hereby adopted and incorporated by reference into IDAPA 07.03.01, "Rules of Building Safety," Division of Building Safety. Pursuant to Section 39-4109, Idaho Code, the effective date of any edition of the codes adopted in this Section, or any amendments identified thereto, shall be January 1 of the succeeding year following legislative approval of the rulemaking establishing the edition or amendment. Copies of these documents may be reviewed at the office of the Division of Building Safety. The referenced codes may be obtained from International Code Council, 5360 Workman Mill Road, Whittier, California 90601-2298 or the International Code Council at http://www.iccsafe.org. (3-20-14)

01. International Building Code. 2015 Edition with the following amendments: (3-29-17)

a. Delete section 305.2.3 and replace with the following: Twelve (12) or fewer children in a dwelling unit. A facility such as the above within a dwelling unit and having twelve (12) or fewer children receiving such day care shall be classified as a Group R-3 occupancy or shall comply with the International Residential Code. (3-20-14)

b. Delete section 308.6.4 and replace with the following: Persons receiving care in a dwelling unit. A facility such as the above within a dwelling unit and having twelve (12) or fewer children receiving day care or having five (5) or fewer persons receiving custodial care shall be classified as a Group R-3 occupancy or shall comply with the International Residential Code. (3-20-14)

c. Delete section 310.5 and replace with the following: Residential Group R-3. Residential Group R-3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-4, E or I, including: (3-29-17)

i. Buildings that do not contain more than two (2) dwelling units; (3-20-14)

ii. Boarding houses (nontransient) with sixteen (16) or fewer occupants; (3-20-14)

iii. Boarding houses (transient) with ten (10) or fewer occupants; (3-20-14)

iv. Care facilities that provide accommodations for five (5) or fewer persons receiving care; (3-20-14)

v. Congregate living facilities (nontransient) with sixteen (16) or fewer occupants; (3-20-14)

vi. Congregate living facilities (transient) with ten (10) or fewer occupants; or (3-20-14)

vii. Dwelling units providing day care for twelve (12) or fewer children. (3-20-14)

viii. Lodging houses with five (5) or fewer guest rooms. (3-29-17)

d. Delete section 310.5.1 and replace with the following: Care facilities within a dwelling. Care facilities for twelve (12) or fewer children receiving day care or for five (5) or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the International Residential Code. (3-20-14)

e. Delete the last paragraph of section 2107.2.1 Lap Splices, and replace with the following: In regions of moment where the design tensile stresses in the reinforcement are greater than eighty percent (80%) of the allowable steel tension stress, FS, the lap length of splices shall be increased not less than fifty percent (50%) of the minimum required length, but need not be greater than 72 db. Other equivalent means of stress transfer to accomplish the same fifty percent (50%) increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by fifty percent (50%). (3-28-18)

f. Add footnote (f) in the header row of the table column labeled "Drinking Fountains" of Table 2902.1 Minimum Number of Required Plumbing Fixtures, and add footnote (f) under Table 2902.1 to state the following: Drinking fountains are not required for an occupant load of thirty (30) or fewer. (3-29-17)

g. Delete footnote (e) contained under Table 2902.1 Minimum Number of Required Plumbing Fixtures and replace with the following: For business occupancies, excluding restaurants, and mercantile occupancies with an occupant load of thirty (30) or fewer, service sinks shall not be required. (3-29-17)

02. International Residential Code. 2012 Edition with the following amendments: (3-20-14)

a. Delete exception No. 1 contained under IRC section R101.2 - Scope. (3-20-14)

b. Delete exception No. 2 contained under IRC section R101.2 - Scope, and replace with the following: Owner-occupied lodging houses with five (5) or fewer guestrooms shall be permitted to be constructed in accordance with the International Residential Code for One- and Two-family Dwellings. (4-11-15)

c. Delete item No. 7 contained under the "Building" subsection of IRC section R105.2 - Work exempt from permit, and replace with the following: Prefabricated swimming pools that are not greater than four (4) feet (one thousand, two hundred nineteen (1219) mm) deep. (4-7-11)

d. Add the following item No. 11 at the end of the "Building" subsection of IRC section R105.2 - Work exempt from permit: Flag poles. (3-20-14)

e. Delete IRC section R109.1.3 and replace with the following: Floodplain inspections. For construction in areas prone to flooding as established by Table R301.2(1), upon placement of the lowest floor, including basement, the building official is authorized to require submission of documentation of the elevation of the lowest floor, including basement, required in section R322. (3-29-10)

f. IRC Table R302.1(1) Exterior Walls -- delete Table R302.1(1) and replace with the following:

TABLE R302.1(1)
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour-tested in accordance with ASTM E 119 or UL263 with exposure from both sides	< 3 feet
	Not fire-resistance rated	0 hours	≥ 3 feet
Projections	Fire-resistance rated	1 hour on the underside	≥ 2 feet to < 3 feet
	Not fire-resistance rated	0 hours	≥ 3 feet
Openings in Walls	Not allowed	N/A	< 3 feet
	25% maximum of wall area	0 hours	≥ 3 feet to < 5 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	≥ 3 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable (4-11-15)

g. Delete the exception contained under IRC section R302.2 -- Townhouses, and replace with the following two (2) exceptions: (3-25-16)

i. When provided with an automatic fire sprinkler system per section R313.1, a common one (1)-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 is permitted for townhouses if such walls do not contain plumbing or mechanical equipment, ducts, or vents in the cavity of the common wall. The wall shall be rated for fire exposure from both sides, and shall extend to and be tight against exterior walls and the underside of the roof sheathing. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4. (3-25-16)

ii. Two (2) one (1)-hour fire-resistance-rated wall assemblies (as specified in Section R302.1) or a common two (2)-hour fire-resistance-rated wall assembly tested in accordance with ASTM E 119 or UL 263 are permitted for townhouses. If two (2) one (1)-hour fire-resistance-rated walls are used, plumbing and electrical installations within the wall cavity shall conform to fire-resistance penetration requirements in accordance with section R302.4 through R302.4.2 for each of the two (2) one (1)-hour rated walls penetrated. The two (2)-hour fire-resistance-rated common wall shall not contain plumbing or mechanical equipment, ducts or vents within its wall cavity. The wall shall be rated for fire exposure from both sides, and shall extend to and be tight against the exterior walls and the underside of the roof sheathing. Penetrations of electrical outlet boxes shall be in accordance with Section R302.4. (3-25-16)

h. Delete IRC section R303.4 and replace with the following: R303.4 Mechanical Ventilation. Dwelling units shall be provided with whole-house mechanical ventilation in accordance with Section M1507.3

Exception: Where the air infiltration rate of a dwelling unit is equal to 5 air changes per hour or greater when tested with a blower door at a pressure of 0.2 inch w.c. (50 pa) in accordance with Section N1102.4.1.2.

(4-11-15)

i. Delete the exception contained under IRC section R313.1 -- Townhouse automatic fire sprinkler systems, and replace with the following: Exception: Automatic residential fire sprinkler systems shall not be required in townhouses where either two (2) one (1)-hour fire-resistance-rated walls or a common two (2)-hour fire-resistance rated wall, as specified in exception 2 of section R302.2 is installed between dwelling units or when additions or alterations are made to existing townhouses that do not have an automatic residential fire sprinkler system installed. (3-25-16)

j. Delete IRC section R313.2. (3-29-10)

k. Add the following to IRC section R315.3 - Where required in existing dwellings: Exceptions: 1. Work involving the exterior surfaces of dwellings, such as, but not limited to, replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck or electrical permits, are exempt from the requirements of this section; and 2. Installation, alteration or repairs of noncombustion plumbing or mechanical systems are exempt from the requirements of this section. (3-20-14)

l. Delete IRC section R322.1.10. (3-29-10)

m. Delete IRC section R322.2.2 subparagraph 2.2, and replace with the following: The total net area of all openings shall be at least one (1) square inch (645 mm2) for each square foot (0.093 m2) of enclosed area, or the opening shall be designed and the construction documents shall include a statement that the design and installation of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing the automatic entry and exit of floodwaters. (3-20-14)

n. Delete IRC section R501.3 and its exceptions. (3-20-14)

o. Delete IRC section R602.10 and replace with the following: Wall bracing. Buildings shall be braced in accordance with this section or, when applicable section R602.12, or the most current edition of APA System Report SR-102 as an alternate method. Where a building, or portion thereof, does not comply with one (1) or more of the bracing requirements in this section, those portions shall be designated and constructed in accordance with section R301.1. (3-20-14)

~~**p.** Chapter 11 [RE] Energy Efficiency. The following sections and tables of chapter 11 shall be amended in accordance with the requirements contained below in Subsection 004.04 of these rules which correspond to the appropriate section: (3-20-14)~~

~~i. Table N1102.1.1 (Table R402.1.1) Insulation and Fenestration Requirements by Component; (3-20-14)~~

~~ii. Table N1102.1.3 (Table R402.1.3 Equivalent U-Factors; (3-20-14)~~

~~iii. Table N1102.2.6 (Table R402.2.6) Steel-Frame Ceiling, Wall and Floor Insulation (R-Value); (3-20-14)~~

~~iv. Section N1102.4.1 (R402.4.1) Building Thermal Envelope; (3-20-14)~~

~~v. Section N1102.4.1.1 (R402.4.1.1) Insulation; (3-20-14)~~

~~vi. Table N1102.4.1.1 (Table R402.4.1.1) Air Barrier and Insulation Installation; (3-20-14)~~

~~vii. Section N1102.4.1.2 (R402.4.1.2) Testing Option; (3-20-14)~~

~~viii. Add Section N1102.4.1.3 (R402.4.1.3) - Visual Inspection Option; (3-20-14)~~

~~ix. Add Section N1102.6 (R402.6) Residential Log Home Thermal Envelope; (3-20-14)~~

~~x. Add Table N1102.6 (Table R402.6) Log Home Prescriptive Thermal Envelope Requirements by Component; and (3-20-14)~~

~~xi. Section N1104.1 (R404.1) Lighting Equipment. (3-20-14)~~

pq. Add an Appendix R, titled Tiny Homes to include the following provisions: (3-28-18)

i. Section AR101 Scope. This appendix shall be applicable to tiny houses used as single dwelling units. Tiny houses shall comply with this code except as otherwise stated in this appendix. (3-28-18)

ii. Section AR102 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions. (3-28-18)

(1) Tiny House. A dwelling that is four hundred (400) square feet (thirty-seven (37) m) or less in floor area excluding lofts. (3-28-18)

(2) Escape and Rescue Roof Access Window. A skylight or roof window designed and installed to satisfy the emergency escape and rescue opening requirements in Section R310. (3-28-18)

(3) Landing Platform. A landing provided as the top step of a stairway accessing a loft. (3-28-18)

(4) Loft. A floor level located more than thirty (30) inches (762 mm) above the main floor and open to it on at least one (1) side with a ceiling height of less than six (6) feet eight (8) inches (2032 mm), used as a living or sleeping space. (3-28-18)

(iii) Section AR103 Minimum Ceiling Height. Habitable space and hallways in tiny houses shall have a ceiling height of not less than six (6) feet eight (8) inches (2032 mm). Bathrooms, toilet rooms, and kitchens shall have a ceiling height of not less than six (6) feet four (4) inches (1930 mm). Obstructions shall not extend below these minimum ceiling heights including beams, girders, ducts, lighting and other obstructions. Exception: Ceiling heights in lofts are permitted to be less than six (6) feet eight (8) inches (2032 mm). (3-28-18)

iv. Section AR104 Lofts. (3-28-18)

(1) AR104.1 Minimum loft area and dimensions. Lofts used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections AR104.1.1 through AR104.1.3. (3-28-18)

(a) AR104.1.1 Minimum area. Lofts shall have a floor area of not less than thirty-five (35) square feet (3.25 m). (3-28-18)

(b) AR104.1.2 Minimum dimensions. Lofts shall be not less than five (5) feet (1524 mm) in any horizontal dimension. (3-28-18)

(c) AR104.1.3 Height effect on loft area. Portions of a loft with a sloping ceiling measuring less than three (3) feet (914 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft. Exception: Under gable roofs with a minimum slope of 6:12, portions of a loft with a sloping ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft. (3-28-18)

(2) AR104.2 Loft Access. The access to and primary egress from lofts shall be any type described in Sections AR104.3 through AR104.6. (3-28-18)

(3) AR104.3. Stairways. Stairways accessing lofts shall comply with this code or with Sections AR104.3.1 through AR104.3.5. (3-28-18)

(a) AR104.3.1 Width. Stairways accessing a loft shall not be less than seventeen (17) inches (432 mm)

in clear width at or above the handrail. The minimum width below the handrail shall be not less than twenty (20) inches (508 mm). (3-28-18)

(b) AR104.3.2 Headroom. The headroom in stairways accessing a loft shall be not less than six (6) feet two (2) inches (1880 mm), as measured vertically, from a sloped line connecting the tread or landing platform nosings in the middle of their width. Exception: The headroom for a landing platform, where stairways access lofts, shall be not less than four (4) feet six (6) inches (1372 mm). (3-28-18)

(c) AR104.3.3 Treads and Risers. Risers for stairs accessing a loft shall be not less than seven (7) inches (178 mm) and not more than twelve (12) inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas: (3-28-18)

(i) The tread depth shall be twenty (20) inches (508 mm) minus 4/3 of the riser height, or (3-28-18)

(ii) The riser height shall be fifteen (15) inches (381 mm) minus 3/4 of the tread depth. (3-28-18)

(d) AR104.3.4 Landing Platforms. The top tread and riser of stairways accessing lofts shall be constructed as a landing platform where the loft ceiling height is less than six (6) feet two (2) inches (1880 mm) where the stairway meets the loft. The landing platform shall be eighteen (18) inches to twenty-two (22) inches (457 to 559 mm) in depth measured from the nosing of the landing platform to the edge of the loft, and sixteen (16) to eighteen (18) inches (406 to 457 mm) in height measured from the landing platform to the loft floor. (3-28-18)

(e) AR104.3.5 Stairway Handrails. Handrails shall comply with Section R311.7.8. (3-28-18)

(f) AR104.3.6 Stairway Guards. Guards at open sides of stairways shall comply with Section R312.1. (3-28-18)

(4) AR104.4 Ladders. Ladders accessing lofts shall comply with Sections AR104.4.1 and AR104.4.2. (3-28-18)

(a) AR104.4.1 Ladder Size and Capacity. Ladders accessing lofts shall have a rung width of not less than twelve (12) inches (305 mm) and ten (10) inches (254 mm) to fourteen (14) inches (356 mm) spacing between rungs. Ladders shall be capable of supporting a two hundred (200) pound (75 kg) load on any rung. Rung spacing shall be uniform within 3/8-inch (9.5 mm). (3-28-18)

(b) AR104.4.2 Ladder Incline. Ladders shall be installed at seventy (70) to eighty (80) degrees from horizontal. (3-28-18)

(5) AR104.5 Alternating Tread Devices. Alternating tread devices accessing lofts, and handrails of alternating tread devices shall comply with sections 1011.14.1 and 1011.14.2 of the International Building Code, excluding the exception. The clear width at and below the handrails shall be not less than twenty (20) inches (508 mm). (3-28-18)

(6) AR104.6. Ships Ladders. Ships ladders accessing lofts, and treads and handrails of ships ladders shall comply with sections 1011.15.1 and 1011.15.2 of the International Building Code. The clear width at and below handrails shall be not less than twenty (20) inches (508 mm). (3-28-18)

(7) AR104.7 Loft Guards. Loft guards shall be located along the open side of lofts. Loft guards shall not be less than thirty-six (36) inches (914 mm) in height or one (1)-half of the clear height to the ceiling, whichever is less. (3-28-18)

v. SECTION AR105. Emergency Escape and Rescue Openings. Tiny houses shall meet the requirements of Section R310 for emergency escape and rescue openings. Exception: Escape and rescue roof access windows in lofts used as sleeping rooms shall be deemed to meet three (3) requirements of Section R310 where installed such that the bottom of the opening is not more than forty-four (44) inches (1118 mm) above the loft floor, provided the escape and rescue roof access window complies with the minimum opening area requirements of Section

R310. (3-28-18)

03. International Existing Building Code. 2015 Edition. (3-29-17)

04. International Energy Conservation Code. 2015 Edition with the following amendments: (3-29-17)

a. Delete the Residential Provisions of the 2015 International Energy Conservation Code (IECC) set forth in chapters 1 [RE] through 6 [RE], including Appendix RA (pages R-1 through R-57), and replace with the Residential Provisions of the 2012 IECC set forth therein in chapters 1 [RE] through 5 [RE] (pages R-1 through R-47) and as such provisions may be further amended herein these rules. (3-29-17)

b. Add the following as new subsection C101.5.3: Industrial, electronic, and manufacturing equipment. Buildings or portions thereof that are heated or cooled exclusively to maintain the required operating temperature of industrial, electronic, or manufacturing equipment shall be exempt from the provisions of this code. Such buildings or portions thereof shall be separated from connected conditioned space by building thermal envelope assemblies complying with this code. (3-25-16)

c. Add the following exception No. (10) under section C403.3 Economizers (Prescriptive): Unusual outdoor air contaminate conditions – Systems where special outside air filtration and treatment for the reduction and treatment of unusual outdoor contaminants, makes an air economizer infeasible. (3-29-17)

d. Delete the values contained in Table R402.1.1 ~~(Table N1102.1.1)~~ for climate zone "5 and Marine 4" and climate zone "6" and replace with the following:

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

Climate Zone	Fenestration U- Factor	Skylight U-factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value	Crawlspace Wall R-Value
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13

~~(3-20-14)~~(_____)

e. Add the following footnote to the title of Table R402.1.1 - Insulation and Fenestration Requirements by Component: [k.] For residential log home building thermal envelope construction requirements see section R402.6. (3-25-16)

f. Delete the values contained in Table R402.1.3 ~~(Table N1102.1.3)~~ for climate zone "5 and Marine 4" and climate zone "6" and replace with the following:

TABLE R402.1.3
EQUIVALENT U-FACTORS

Climate Zone	Fenestration U-factor	Skylight U-factor	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Crawlspace Wall R-Value

5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065

~~(3-20-14)~~( )

g. Delete Table R402.2.6 ~~(Table N1102.2.6)~~ and replace with the following:

TABLE R402.2.6
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

Wood Frame R-value Requirement	Cold-formed Steel Equivalent R-value[a]
	Steel Truss Ceilings[b]
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 +3
R-49	R-38 + 5
	Steel Joist Ceilings[b]
R-30	R-38 in 2 x 4 or 2 x 6 or 2 x 8 R-49 in any framing
R-38	R-49 in 2 x 4 or 2 x 6 or 2 x 8 or 2 x 10
	Steel-Framed Wall
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
	Steel Joist Floor
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation R-value is listed first, followed by continuous insulation R-value.
b. Insulation exceeding the height of the framing shall cover the framing.

~~(3-25-16)~~( )

h. Delete section R402.4.1 ~~(N1102.4.1)~~ and replace with the following: Building thermal envelope. The building thermal envelope shall comply with sections R402.1.1 and either section R402.4.1.2 or R402.4.1.3. The sealing methods between dissimilar materials shall allow for differential expansion and

contraction. ~~(3-25-16)~~( )

i. Delete section R402.4.1.1 ~~(N1102.4.1.1)~~ and replace with the following: Installation. The components of the building thermal envelope as listed in Table R402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table R402.4.1.1, as applicable to the method of construction. ~~(3-25-16)~~( )

j. Delete the criteria requirement for the "Fireplace" component of Table R402.4.1.1 ~~(Table N1102.4.1.1)~~ - Air Barrier and Insulation Installation, and replace with the following: An air barrier shall be installed on fireplace walls. ~~(3-20-14)~~( )

k. Delete section R402.4.1.2 ~~(N1102.4.1.2)~~ and replace with the following: Testing option, Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven (7) air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances. During testing: ~~(3-25-16)~~( )

i. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed; (3-20-14)

ii. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft and flue dampers; (3-20-14)

iii. Interior doors shall be open; (3-20-14)

iv. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed; (3-20-14)

v. Heating and cooling system(s) shall be turned off; (3-20-14)

vi. HVAC ducts shall not be sealed; and (3-20-14)

vii. Supply and return registers shall not be sealed. (3-20-14)

l. Add the following as section R402.4.1.3 ~~(N1102.4.1.3)~~: Visual inspection option, Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table R402.4.1.1, applicable to the method of construction, are field verified. Where required by code official an approved party independent from the installer of the insulation shall inspect the air barrier and insulation. ~~(3-25-16)~~( )

m. Add the following section: R402.6 ~~(N1102.6)~~ Residential Log Home Thermal Envelope. Residential log home construction shall comply with sections R401 (General), R402.4 (Air Leakage), R402.5 (Maximum Fenestration U-Factor and SHGC), R403.1 (Controls), R403.2.2 (Sealing), R403.2.3 (Building Cavities), sections R403.3 through R403.9 (referred to as the mandatory provisions), Section R404 (Electrical Power and Lighting Systems), and either i., ii., or iii. as follows: ~~(3-25-16)~~( )

i. Sections R402.2 through R402.3, R403.2.1, R404.1 and Table R402.6; (3-25-16)

ii. Section R405 Simulated Performance Alternative (Performance); or (3-25-16)

iii. REScheck (U.S. Department of Energy Building Codes Program). (4-7-11)

n. Add Table R402.6 ~~(Table N1102.6)~~ Log Home Prescriptive Thermal Envelope Requirements by Component to be used only in accordance with item i. of section R402.6 above to appear as follows:

TABLE R402.6
LOG HOME PRESCRIPTIVE THERMAL ENVELOPE REQUIREMENTS BY COMPONENT

For SI: 1 foot = 304.8 mm.

Climate Zone	Fenestration U-factor[a]	Skylight U-factor	Glazed Fenestration SHGC	Ceiling R-value	Min. Average Log Size In Inches	Floor R-value	Basement Wall R-value[d]	Slab R-value & Depth[b]	Crawl Space Wall R-value[d]
5, 6 - High efficiency equipment path[c]	0.32	0.60	NR	49	5	30	15/19	10, 4 ft.	10/13
5	0.32	0.60	NR	49	8	30	10/13	10, 2 ft.	10/13
6	0.30	0.60	NR	49	8	30	15/19	10, 4 ft.	10/13

a. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

b. R-5 shall be added to the required slab edge R-values for heated slabs.

c. 90% AFUE natural gas or propane, 84% AFUE oil, or 15 SEER heat pump heating equipment (zonal electric resistance heating equipment such as electric base board electric resistance heating equipment as the sole source for heating is considered compliant with the high efficiency equipment path).

d. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

~~(3-25-16)~~( )

o. Delete section R404.1 ~~(N1104.1)~~ and replace with the following: Lighting equipment (Mandatory). A minimum of fifty percent (50%) of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps or a minimum of fifty percent (50%) of the permanently installed lighting fixtures shall contain only high efficacy lamps. ~~(3-20-14)~~( )

05. References to Other Codes. Where any provisions of the codes that are adopted in this Section make reference to other construction and safety-related model codes or standards which have not been adopted by the involved authority having jurisdiction, to the extent possible, such reference should be construed as pertaining to the equivalent code or standard that has been duly adopted by such jurisdiction. (3-29-10)

005. OFFICE -- OFFICE HOURS -- STREET ADDRESS -- MAILING ADDRESS -- TELEPHONE, FACSIMILE AND WEB ADDRESS.
The principal place of business of the Division of Building Safety is in Meridian, Idaho. The office is located at 1090 E. Watertower St., Meridian, Idaho and is open from 8 a.m. to 5 p.m., except Saturday, Sunday and legal holidays. The mailing address is: Division of Building Safety, 1090 E. Watertower St., Meridian, Idaho 83642. The telephone number of the office is (208) 334-3896. The facsimile number of the office is (208) 855-9399. The Department website at http://dbs.idaho.gov. (3-30-06)

006. PUBLIC RECORDS ACT COMPLIANCE.
The rules contained herein have been promulgated according to the provisions of Title 67, Chapter 52, Idaho Code

IDAHO BUILDING CODE BOARD

Agenda Item No. 02c Amend the 2015 IECC Commercial Provisions--Table C404.5.1 Piping Volume and Maximum Piping Lengths

PRESENTER: Jason Blais, Board Member

OBJECTIVE: Modify Table C404.5.1 Piping Volume and Maximum Piping Lengths in the 2015 IECC.

ACTION: Vote

BACKGROUND: Board Member Blais was approached by the mechanical/plumbing engineer community expressing concerns for the piping volume and maximum piping lengths in Table C404.5.1 of the 2015 IECC.

The proposal would remove the Public Lavatory Faucets column in Table C404.5.1 *Piping Volume and Maximum Piping Lengths*, replacing it with a new column.

PROCEDURAL HISTORY:

ATTACHMENTS: Application for Review of a Proposed Statewide Amendment to State Adopted Codes

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Agenda Item 2c

DIVISION OF BUILDING SAFETY
APPLICATION FOR REVIEW OF A PROPOSED STATEWIDE AMENDMENT TO STATE ADOPTED CODES
2015 Code Adoption Cycle

Log#_____
(Office Use Only)

PLEASE FOLLOW INSTRUCTIONS ON PAGE FIVE

1. State Building Code to be Amended:

☐ International Building Code	✓ International Energy Conservation Code
☐ International Residential Code	☐ International Mechanical Code
☐ International Fuel Gas Code	☐ National Electrical Code
☐ International Existing Building Code	☐
☐ Idaho State Plumbing Code	☐

Section Table C404.5.1 **Page** C-70

2. Applicant Name (Specific local government, organization or individual):

Jason Blais (on behalf of several Mechanical/Plumbing Engineer Firms)

3. Signed:

	City of Boise Building Official	6-5-18
Proponent	**Title**	**Date**

4. Designated Contact Person:

Jason Blais	City of Boise Building Official
Name	**Title**

Address:	City of Boise – Planning & Development Services (PDS)
	P.O. Box 500
	Boise, ID 83701

(208) 608-7097

Office Phone **Cell** **Fax**

E-mail address: jblais@cityofboise.org

5. Proposed Code Amendment. Use 'legislative format' including both old and new language. **See instructions on page five for specific details.** Please attach a separate sheet for each separate proposal.

2015 IECC	Table C404.5.1	C-70
Code	**Section**	**Page**

Please note number of additional pages:

Repeal the "Public lavatory faucets" column in **Table C404.5.1 Piping Volume and Maximum Piping Lengths** and replace with a new column as noted below:

TABLE C404.5.1
PIPING VOLUME AND MAXIMUM PIPING LENGTHS

NOMINAL PIPE SIZE (inches)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)		
		~~Public lavatory faucets~~	Public lavatory faucets	Other fixtures and appliances
1/4	0.33	~~6~~	31	50
5/16	0.5	~~4~~	N/A - non-standard size	50
3/8	0.75	~~3~~	17	50
1/2	1.5	~~2~~	10	43
5/8	2	~~1~~	7	32
3/4	3	~~0.5~~	5	21
7/8	4	~~0.5~~	N/A - non-standard size	16
1	5	~~0.5~~	3	13
1 1/4	8	~~0.5~~	2	8
1 1/2	11	~~0.5~~	1	6
2 or larger	18	~~0.5~~	1	4

Supporting Data for Statewide Amendment Proposals. This information is required for all statewide amendment proposals. **Attach supporting documentation, as necessary; incomplete proposals will not be accepted.**

The governing boards require supporting data on any amendment proposal to show:

1. **That it meets basic criteria – See Part I to specify how this proposal meets the criteria for code amendment.**
2. **The intended effect – See Part II to describe the purpose of the proposed amendment, including the benefits and the problems addressed.**
3. **The potential impacts or benefits to business – See Part III/Types of Construction, to explain how methods in construction businesses, industries and services would be affected.**
4. **The potential impacts on enforcement procedures, See Part III/Types of Services Required, to provide some analysis of the impacts on code enforcement in local jurisdictions.**
5. **Economic costs and benefits – Use the Table in Part IV of this form to estimate the costs and benefits of the proposal on construction practices, users and/or the public, the enforcement community, and operation and maintenance.**

Part I ♦ Background information on amendment.

Code references: Table C404.5.1 Title: Piping Volume and Maximum Piping Lengths

Related Codes: No

(Does this amendment change other related codes?)

Proponent: Jason Blais Phone: (208) 608-7097 Date: 6/5/18

NOTE: Amendments to the state building code must be based on one of the following criteria; please indicate the pertinent rationale for the proposed amendment by selecting from the list below:

- ☐ (1) The amendment is needed to address a critical life/safety need.
- ☐ (2) The amendment is needed to address a specific state policy or statute.
- ☐ (3) The amendment is needed for consistency with state or federal regulations.
- ✓ (4) The amendment is needed to address a unique character of the state.
- ☐ (5) The amendment corrects errors and omissions.

Part II ♦ Amendment Benefit:

PROBLEM(S) ADDRESSED (Describe the intended effect of the proposed code amendment):

Have been approached by the mechanical/plumbing engineer community (several firms) expressing concerns for the piping volume and maximum piping lengths in Table C404.5.1 of the 2015 IECC. Issues expressed are noted below.

The Commercial Energy Efficiency section of the 2015 *International Energy Conservation Code* (IECC), Table C404.5.1 requires very short lengths of domestic hot water piping from hot water source to a public lavatory. A typical ½" hot water connection for a public lavatory is limited to 2 feet maximum. The industry standard is to provide circulating hot water near the plumbing wall for a public lavatory, but typically not down into the wall. The overburdensome design considerations and costly construction requirements, based on Table C404.5.1, include the following:

1. Circulating hot water pipe must now be routed down inside the wall to within 2 feet of a lavatory.

2. When more than one lavatory is located along a wall, a standard 4" or 6" thick interior wall will not allow a waste vent pipe to rise vertically behind the lavatory while a circulating hot water piping is routed horizontally within the wall cavity to within 2' of each lavatory. This results in design and construction challenges where even thicker non-typical walls are now being required for public lavatories. This also can then affect room sizes or accessibility clearances in the design.

3. To avoid challenges of this issue, some designers are having more small point of use water heaters being installed directly under lavatories, which are not as efficient-especially with multiples, typically do not support the full hot water demand and can be an ongoing operation and maintenance item for building owners with questionable longevity of these units.

The design considerations and construction cost increases, resulting from the very short lengths of hot water piping required by Table C404.5.1, are significant compared to the minimal energy and water savings that will be realized.

While still taking energy and water savings into consideration, we propose an engineered alternative where the maximum pipe length be extended in an amended Table C404.5.1. The proposed lengths are based on providing circulating hot water piping within 15 seconds of a public lavatory and a flow rate of 0.5 gallons per minute (gpm) at the lavatory. The result is a maximum of 1/8 gallon, or 16 ounces, of hot water.

PRIMARY REASON FOR AMENDMENT: (Describe how the amendment meets one of the criteria listed above)

The proposal aligns with accepted mechanical/plumbing engineering practice and design in Idaho while still taking into consideration energy and water savings. Again, the proposed lengths are based on an alternative engineered design providing circulating hot water piping within 15 seconds of a public lavatory and a flow rate of 0.5 gallons per minute (gpm) at the lavatory. The result is a maximum of 1/8 gallon, or 16 ounces, of hot water.

The proposed lengths are based on the volume of water per foot of pipe for Type L copper pipe as shown in the Table below. The proposed lengths are calculated by dividing 1/8 gallon by the gallons per foot for each pipe size. The proposed lengths will apply to both copper pipe and PEX tubing. The lengths are calculated based on the most restrictive volume of water per foot of copper pipe.

NOMINAL PIPE SIZE (inches)	Type L Copper (gal/ft.)
1/4	0.004
5/16	-
3/8	0.0075
1/2	0.0121
5/8	0.0181
3/4	0.0251
7/8	-
1	0.0429
1 1/4	0.065
1 1/2	0.092
2 or larger	0.161

TYPE OF BENEFITS PROJECTED:

Part III ♦ Amendment Impacts or Benefits:

TYPES OF CONSTRUCTION: ☒ New Construction ☒ Alteration/Tenant Improvement/Repair
☐ Residential-Single Family ☒ Residential-Multi Family ☒ Commercial ☒ Industrial

List businesses/industries affected by amendment:

Manufacturers: _____
Specific Construction Contractors & Trades: Plumbing/mechanical Engineers
Construction Supply Industry: _____
Specialty Trades: Plumbing Contractors
Types of Buildings: Commercial/multi-family
Fire Protection Industry: _____

Types of Services Required:

☐ **Reporting:** Brief Description _____
☐ **Record Keeping:** Brief Description _____
☐ **Other:** Brief Description _____
☐ **Indirect Cost to Industry:** Indicate whether there are multiple sources to obtain the equipment, material or service required by this proposal. If not, provide a justification of the benefit versus small business impact.

Part IV ♦ Amendment Costs and Benefits

Building Type	Construction[1]			Enforcement[2]			Operations & Maintenance[3]		
	Costs	% impact[4]	Benefits[5]	Costs	% impact	Benefits	Costs	% impact	Benefits
Residential Single family	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Multi-family			Alternate design, reduces costs			Alternate design, another option			
Commercial/ Retail									
Industrial									
Institutional									

1 $ / square foot of floor area or other cost. Attach data. Construction costs are costs prior to occupancy, and include both design and direct construction costs that impact the total cost of the construction to the owner/consumer.

2 Cost per project plan. Attach data. Enforcement costs include governmental review of plans, field inspection, and mediated litigation required for enforcement.

3 Cost to building owner/tenants over the life of the project.

4 Cost differential over a specific size project or range of projects as determined by the proponent. Provide sufficient cost and benefit detail to clarify the impact to the Council. All data should be created and referenced to third party reputable sources for verification.

5 Note sectors with measurable benefit from Part II, including benefits to a) the user, b) the public, c) the industry, and/or d) the economy; use e) for all of the above.

IDAHO BUILDING CODE BOARD

Agenda Item No. 02d Amend IRC Section R202, Abbreviations, & Chapter 6 to Provide for Extended Plate Walls and Foam Plastic Insulating Sheathing

PRESENTER: Rob Brooks, DowDuPont Building Solutions

OBJECTIVE: Include extended plate walls and foam plastic insulating sheathing to IRC section R202, abbreviations, and chapter six (6).

ACTION: Vote

BACKGROUND: **April 2018** – Rob Brooks, DowDuPont Building Solutions Representative, presented a proposal to add new definitions and abbreviations to IRC Section 202, as well as add a new section to IRC Chapter 6 on the Extended Plate and Beam Wall System. Mr. Brooks stated the system is for residential homes and considered a life safety provision that belongs in code and not as a separate technical note. The system is not yet recognized; however, the developers hope to place it as a group B code change proposal of the IRC for the next code cycle. The Chairman requested, and Mr. Brooks agreed, to bring to the June meeting the fasteners used to attach the OSB through the ridged roam onto the 2x4 studs. This topic to be addressed at the June meeting as a second hearing, and a third hearing/vote at the August meeting.

June 2018 – Rob Brooks, DowDuPont Building Solutions Representative, explained the use and positive aspects of the new "Extended Plate and Beam" wall system. The system is for seismic zones A, B, and C, and one- and two-family dwellings. Although not yet recognized by the IRC, developers hope to get approval at upcoming code hearings.

ATTACHMENTS: Application for Review of a Proposed Statewide Amendment to State Adopted Codes and Supporting Documentation

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Agenda Item 2d

Submit Reset Print

DIVISION OF BUILDING SAFETY
APPLICATION FOR REVIEW OF A PROPOSED STATEWIDE AMENDMENT TO STATE ADOPTED CODES
2012 Code Adoption Cycle

Log# _____
(Office Use Only)

PLEASE FOLLOW INSTRUCTIONS ON PAGE FIVE

1. State Building Code to be Amended:

- ☐ International Building Code
- ☑ International Residential Code
- ☐ International Fuel Gas Code
- ☐ International Existing Building Code
- ☐ Idaho State Plumbing Code
- ☑ International Energy Conservation Code
- ☐ International Mechanical Code
- ☐ National Electrical Code
- ☐
- ☐

Section IRC 202, new 602.13, IECC Table R402.1.1 **Page** _____

2. Applicant Name (Specific local government, organization or individual):
Rob Brooks, representing DowDuPont Building Solutions

3. Signed:
Rob Brooks — Consultant — 4/13/18
Proponent **Title** **Date**

4. Designated Contact Person:
Same
Name **Title**

Address: 1513 S Willow Lake Pl
Eagle, ID 83616

Office Phone: 208-501-5449 **Cell:** 208-880-4142 **Fax:** _____

E-Mail address: rob@rtbrooks.com

5. Proposed Code Amendment. Use 'legislative format' including both old and new language. **See instructions on page five for specific details.** Please attach a separate sheet for each separate proposal.

Code IRC, IECC **Section** _____ **Page** _____

Please note number of additional pages:

* See attached

Supporting Data for Statewide Amendment Proposals. This information is required for all statewide amendment proposals. **Attach supporting documentation, as necessary; incomplete proposals will not be accepted.**

The governing boards require supporting data on any amendment proposal to show:

1. **That it meets basic criteria – See Part I to specify how this proposal meets the criteria for code amendment.**
2. **The intended effect—See Part II to describe the purpose of the proposed amendment, including the benefits and the problems addressed.**
3. **The potential impacts or benefits to business—See Part III/Types of Construction, to explain how methods in construction businesses, industries and services would be affected.**
4. **The potential impact on enforcement procedures, See Part III/Types of Services Required, to provide some analysis of the impacts on code enforcement in local jurisdictions.**
5. **Economic costs and benefits – Use the Table in Part IV of this form to estimate the costs and benefits of the proposal on construction practices, users and/or the public, the enforcement community, and operation and maintenance.**

Part I ◆ Background information on amendment.

Code References: New R602.13 Title: Extended Plate Wall

Related codes: IRC, IECC (Does this amendment change other related codes?)

Proponent: Rob Brooks Phone: 208-880-4142 Date: _____

NOTE: Amendments to the state building code must be based on one of the following criteria; please indicate the pertinent rationale for the proposed amendment by selecting from the list below:

- ☐ (1) The amendment is needed to address a critical life/safety need.
- ☑ (2) The amendment is needed to address a specific state policy or statute.
- ☐ (3) The amendment is needed for consistency with state or federal regulations.
- ☐ (4) The amendment is needed to address a unique character of the state.
- ☐ (5) The amendment corrects errors and omissions.

Part II ◆ Amendment Benefit:

PROBLEM(S) ADDRESSED (Describe the intended effect of the proposed code amendment):

* see attached documentation

PRIMARY REASON FOR AMENDMENT: (Describe how the amendment meets one of the criteria listed above)

* see attached documentation

TYPE OF BENEFITS PROJECTED:

Part III ◆ Amendment Impacts or Benefits:

TYPES OF CONSTRUCTION: ☑ New Construction ☐ Alteration/Tenant Improvement/Repair
☑ Residential-Single Family ☑ Residential-Multi Family ☐ Commercial ☐ Industrial

List businesses/industries affected by amendment:

Manufacturers: Wood framing components, rigid and cavity insulation manufacturers
Specific Construction Contractors & Trades: Framing contractors, residential builders, insulation contractors
Construction Supply Industry: Wood framing components, rigid insulation
Specialty Trades: _____
Types of Buildings: residential single- and multi-family
Fire Protection Industry: _____

Types of Services Required:

☐ **Reporting:** Brief Description _____
☐ **Record Keeping:** Brief Description _____
☑ **Other:** Brief Description inspection of this system can be accomplished during framing inspection
☑ **Indirect Cost to Industry:** Indicate whether there are multiple sources to obtain the equipment, material or service required by this proposal. If not, provide a justification of the benefit versus small business impact.

Part IV ◆ Amendment Costs and Benefits

Building Type	Construction[1]			Enforcement[2]		Operations & Maintenance[3]		
	Costs	% impact[4]	Benefits[5]	% impact	Benefits	Costs	% impact	Benefits
Residential								
Single family								
Multi-family								
Commercial/ Retail								
Industrial								
Institutional								

1 $ / square foot of floor area or other cost. Attach data. **Construction** costs are costs prior to occupancy, and include both design and direct construction costs that impact the total cost of the construction to the owner/consumer.

2 Cost per project plan. Attach data. **Enforcement** costs include governmental review of plans, field inspection, and mediated litigation required for enforcement.

3 Cost to building owner/tenants over the life of the project.

4 Cost differential over a specific size project or range of projects as determined by the proponent. Provide sufficient cost and benefit detail to clarify the impact to the Council. All data should be created and referenced to third party reputable sources for verification.

5 Note sectors with measurable benefit from Part II, including benefits to a) the user, b) the public, c) the industry, and/or d) the economy; use e) for all of the above.

IRC

Add new definitions to Section R202

EXTENDED PLATE WALL (EPW). A wood framing method for constructing exterior walls using top and bottom plates that are wider than the width of the studs such that rigid foam sheathing can be inset between the top and bottom plates, and between the studs and the exterior wood structural panel sheathing. Sheathing is fastened directly to the bottom and top plates and through the rigid foam sheathing to the studs.

FOAM PLASTIC INSULATING SHEATHING (FPIS). A rigid foam board typically made from extruded polystyrene (XPS), expanded polystyrene (EPS) or Polyisocyanurate (PIC) and used to provide a layer of continuous insulation for house walls or other components.

Add new abbreviations

EPW Extended Plate Wall

FPIS Foam Plastic Insulating Sheathing

Add new section to IRC Chapter 6.

602.13 Extended Plate Wall (EPW). Framing, wood structural panel sheathing, connections, wall bracing, and anchorage for the EPW shall be in accordance with all applicable provisions of Sections R602.1 through R602.12 as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Category A, B, and one and two-family dwellings in C. EPW shall be constructed by one of three framing combinations per Table R602.13.1.

Table R602.13.1 Braced Wall Wood Framing Construction Requirements for EPW

EPW Configuration	Nominal Lumber Dimensions		Thickness
	Studs	Plates	Rigid Foam[2]
2x4/2x6	2x4	2x6	2-in.
2x6/2x8	2x6	2x8	1-3/4-in.
2x6/2x7.5[1]	2x6	2x7.5[1]	2-in.

[1]Actual 7.5-in. width plates are available as engineered lumber.

[2] Rigid foam thickness is achieved by installing one or more layers of foam.

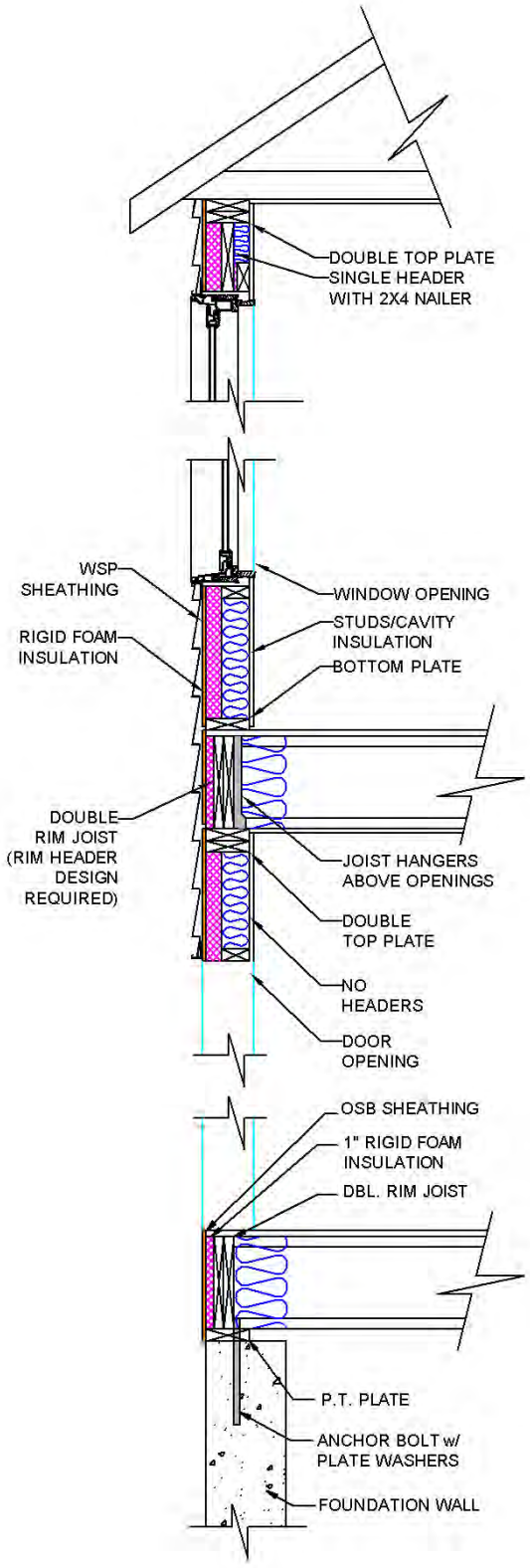


Figure R602.13.1 Extended Plate Wall (EPW) System, section view

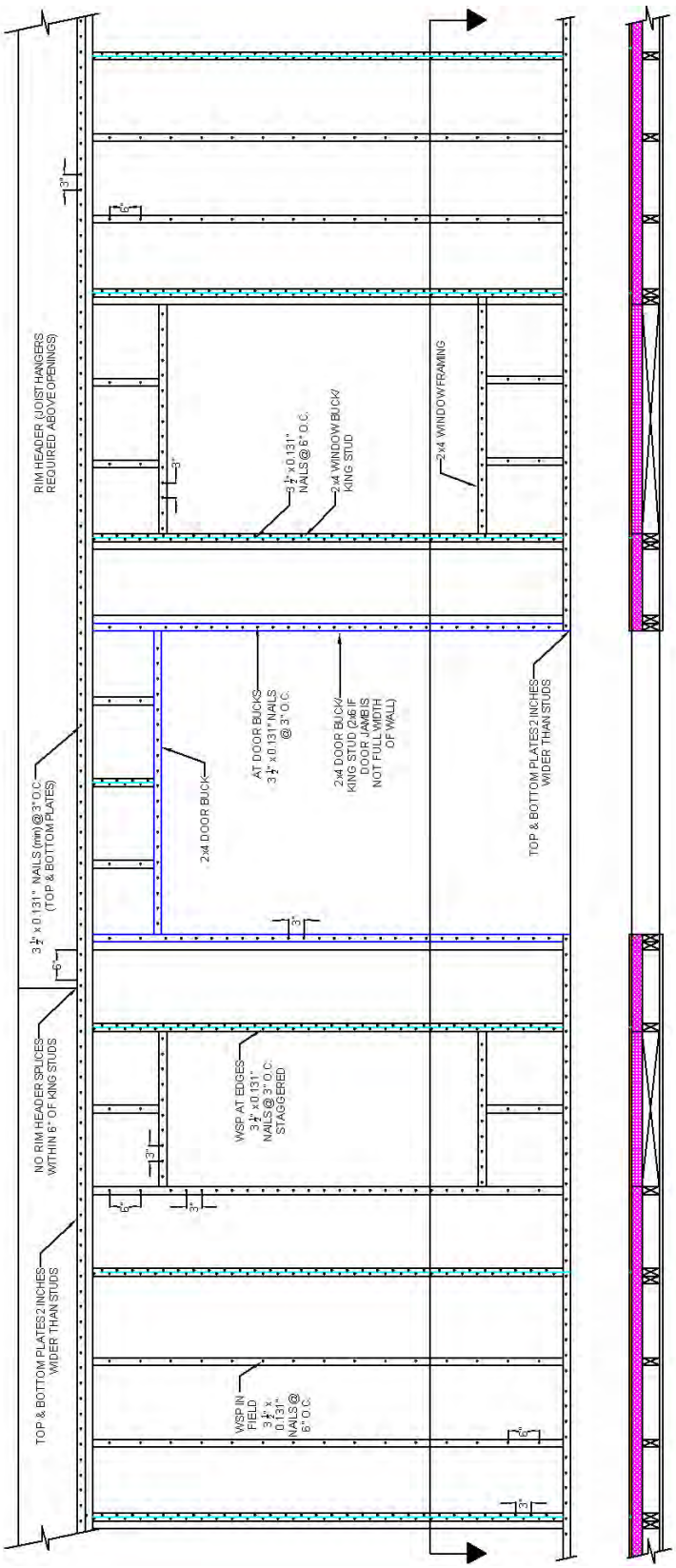


Figure R602.13.2 EP&B Wall, Interior Elevation View

602.13.1 Plates. The bottom and double top plate shall be wider than the width of the studs by not more than 2 inches, in accordance with Table R602.13.1 and Figure R602.13.1 and Figure R602.13.2.

602.13.2 Wood structural panel sheathing attachment. Wood structural panel (WSP) sheathing of thickness from 3/8-in. to 15/16-in. shall be installed vertically and attached to wall plates and studs per Table R602.13.4.

602.13.3 Horizontal joints in wood structural panels. Where used as part of wall bracing, each wood structural panel shall be continuous between the extended top and bottom plates. Blocking of panel edges shall not be an acceptable alternative to continuous vertical wood structural panels for the EPW. The vertical joint between two wood structural panels shall occur only at the location of a stud and shall be fastened through FPIS in accordance with perimeter nailing per Table R602.13.4.

602.13.4 Wall Bracing. Wall bracing shall be in accordance with the WSP Bracing Method in Table R602.10.4 except the fasteners' diameters and spacing shall be in accordance with Table R602.13.4. All provisions applicable to the use of the WSP Bracing Method, including provisions for mixing bracing methods, shall be applicable to EPW.

Table R602.13.4 Braced Wall Fastener Requirements for EPW

Minimum nail length and diameter	Maximum Fastener Spacing	
	At Perimeter of WSP[1]	In Field of WSP
3-1/2-in. x 0.131 in.	3-in. oc	6-in. oc

1. Perimeter nailing includes fastening of panel edges directly to top and bottom plates and through FPIS to studs.

602.13.4.1 Simplified Wall Bracing. With the exception of Section R602.12.2 Item 2 and Section R602.12.3 Item 1, provisions of Section R602.12 shall be applicable to the EPW. The fastening schedule for wood structural panels shall be in accordance with the additional requirements of Table R602.13.4.

602.13.5 Rim joist. Rim joists supporting an EPW shall be single or double-member solid-sawn or engineered lumber. Single member rim joists shall be inset by 1 inch. Double member rim joists are permitted to be installed flush to the exterior face of the wall, or inset by 1 inch from the exterior face of the wall to provide space for exterior rigid insulation. Rim joists are permitted to be inset by 2 inches from the exterior framing surface to provide space for exterior rigid insulation only if the WSP sheathing spans from the top plate all the way to the sill plate and is fastened to the sill plate in accordance with schedule of Table R602.13.4. The aspect ratio for braced wall panels in this case shall be based on the entire length of the WSP sheathing from the top plate to the sill. The minimum bearing length requirements for the floor joists shall be satisfied or joists shall be supported with metal hangers.

602.13.6 Rim joist used as rim header. Solid-sawn or engineered lumber single or double member rim joists are permitted to support EPW above openings as rim board headers in accordance with the provisions of R602.7.2 or an equivalent alternative and no additional headers are required at openings. Rim headers shall not have splice joints over an opening and the first splice joint to each side of the opening shall occur a minimum of 6-in. away from the opening edge and past the outermost king studs. Floor joists above such openings shall be supported with metal hangers selected by a licensed professional based on design loads.

602.13.6 Headers. Where the rim joist is not used as a header, construct headers in accordance with Section R602.7.

602.13.7 Door bucks. Where door jamb depth is less than the thickness of the EPW, the rough opening of the door framing shall be constructed using extended studs of width equal to the top and bottom plates of the EPW to allow full attachment of the door jamb to the framing. Where door jamb depth equals the thickness of the EPW, no changes in framing are required, as shown in Figure R602.13.2. All other provisions of IRC Section R609 shall be applicable to the EPW.

602.13.8 Foam plastic sheathing. Foam plastic insulative sheathing (FPIS) shall comply with ASTM C578 or ASTM C1289, with a minimum compressive strength of 15 psi.

602.13.8.1 Foam plastic sheathing installation. Foam plastic sheathing with a maximum total thickness of 2 inches shall be cut to stud length and installed flat against the exterior stud plane of the EPW, between extended top and bottom plate(s). Total combined permeance of FPIS and any attached vapor retarder facer or film shall not exceed 1.5 perms. Any one-sided vapor retarder FPIS facer or film shall be oriented to the interior side. Spray foam is permitted to be applied to the interior cavity side of the foam plastic. FPIS shall be installed vertically, and the vertical joint between panels of rigid foam sheathing shall not occur at the same stud where there is a joint between wood structural panels; vertical FPIS joints must be offset from vertical WSP joints by at least one stud bay.

602.13.9 Cold-Formed Steel Wall Framing. EPW is not an approved framing method for cold-formed steel framing members.

602.13.10 Wall Coverings. Interior and exterior coverings and wall finishes for the EPW shall be in accordance with all applicable provisions of Sections R701 through R703 as modified by the provisions of Section R602.13.11 through R602.13.14.

602.13.11 Interior Wall Coverings - Vapor Retarder. A vapor retarder on the interior side of the EPW frame shall be in accordance with Section R702.7 except:

1. Class I vapor retarder shall not be permitted.
2. Class II vapor retarder shall be kraft paper or an approved equivalent.
3. Class III vapor retarders for EPW shall be permitted in accordance with Table R602.13.1.
4. Where spray foam is installed to the interior cavity side of the foam plastic sheathing, it is permitted to use combined rigid foam and spray foam R-value for use with Table R602.13.1.

Table R602.13.1 CLASS III VAPOR RETARDERS FOR EPW

Climate Zone	Permitted Use of Class III Vapor Retarders		
	2x4/2x6 EP&B	2x6/2x8 EP&B	2x6/2x7.5* EP&B
CZ 5	Permitted	Permitted	Permitted
CZ 6	Permitted	Design Required	Design Required
CZ 7	Permitted	Design Required	Design Required

602.13.12 Exterior Wall Coverings. EPW shall provide the building with a weather-resistant exterior wall envelope and shall include water resistance as described in Section R703.1.1, wind resistance as described in Section R703.1.2, and a water-resistive barrier as described in Section R703.2.

602.13.13 Flashing. Flashing for EPW shall comply with the provisions of Section 703.4. Fluid applied membranes for pan flashing at exterior window and door openings shall not be installed in EPW. Mechanically attached, self-adhered flexible membrane pan flashing shall be installed as described in Section R703.4 item 1.1., shall span from framing across both the rigid foam layer and the WSP layer, and extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage.

602.13.14 Cladding Attachment. Cladding attachment over EPW shall comply with the provisions of Section 703.3 including Table R703.3.2.

IECC

Add new definitions to Section R202

EXTENDED PLATE WALL (EPW). A wood framing method for constructing exterior walls using top and bottom plates that are wider than the width of the studs such that rigid foam sheathing can be inset between the top and bottom plates, and between the studs and the exterior wood structural panel sheathing. Sheathing is then fastened directly to the bottom and top plates and through the rigid foam to the studs.

FOAM PLASTIC INSULATING SHEATHING (FPIS). A rigid foam board typically made from extruded polystyrene (XPS), expanded polystyrene (EPS) or Polyisocyanurate (PIC) and used to provide a layer of continuous insulation for house walls or other components.

Add new abbreviations

EPW Extended Plate Wall

FPIS Foam Plastic Insulating Sheathing

Add new section to IECC Chapter 4

R402.1.6 Extended Plate Wall (EPW). EPW wall systems constructed in accordance with all applicable provisions of IRC Sections R602.1 through R602.13 and utilizing a layer of rigid foam shall satisfy the prescriptive minimum cavity and continuous insulation R-value requirements of Table R402.1.2 for wood frame walls. Use FPIS manufacturer's technical specifications for both cavity insulation and continuous insulation to determine the associated R-value per inch for meeting the thermal resistance minimum requirement of each layer according to the configurations of IRC Table R602.13.1.

Add footnote to IECC Table R402.1.2

l. EPW exterior wall systems utilizing cavity and continuous insulation of the required R-values shall satisfy the prescriptive minimum insulation requirement for Climate Zone 3-8.

TABLE R402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a, k]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation *R*-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

j. Reserved.

k. For residential log home building thermal envelope construction requirements, see Section R402.6.

ARES Consulting

Jay H. Crandell, P.E.
1236 Bast Lane • Shady Side, MD 20764 • 301.466.7420

June 11, 2018

TO: Ms. Renee Bryant (renee.bryant@dbs.idaho.gov)
IDAHO BUILDING CODE BOARD, Division of Building Safety

RE: EXTENDED PLATE WALL PROPOSAL, JUNE 19, 2018 BOARD MEETING

I am writing in support of the proposed code change submitted by Rob Brooks on behalf of Dow Building Solutions – The Dow Chemical Company at the April 17th building code board meeting (https://dbs.idaho.gov/boards/bcboard/bcmeetings.html). Consequently, this letter is intended to be directed to the building code board for consideration at their June 19th meeting.

I am an independent consulting engineer and have been intimately involved in development of new building technologies for the building industry and government agencies throughout my career, including their implementation in codes and standards such as the International Residential Code (IRC). In fact, I conducted the research and development resulting in the initial wall bracing provisions of the IRC and, specifically, the now popular continuous sheathing bracing method. I have also participated as a member of an ICC ad-hoc committee on wall bracing resulting in the current updated IRC wall bracing provisions.

I share the above background information only because it is directly relevant to my review of the subject code proposal requesting the State of Idaho's adoption of the extended plate and beam wall construction method. The Extended Plate Wall (EPW) uses familiar conventional wood framing technology and materials, but does so in a way that simplifies compliance with the energy code, improves moisture performance, and exceeds the minimum wall bracing requirements of the IRC. Consequently, this wall construction approach offers great value to the building industry and home consumers in Idaho.

I have reviewed the structural and vapor retarder code compliance provisions of this proposal and find them to exceed the minimum requirements for equivalency to the IRC. The proposal is applicable to the scope of buildings addressed in IRC Section R101.2, including one- and two-family dwellings and townhouses not more than three stories. In fact, the EPW technology is equally applicable to commercial light-frame buildings, although beyond the scope of the current proposal.

The basis for my structural evaluation is ICC-ES Acceptance Criteria AC-269.1 (copy supplied with the code change proposal) as commonly used for the purpose of evaluating alternative wall bracing methods for wood frame construction. I have also relied on the

provided testing and research report conducted for the US Department of Energy – Building America Program by the Home Innovation Research Labs (formerly the NAHB Research Center, Inc. for which I served as the Structures and Materials Director for 10 years). In every aspect, the structural performance of the EPW exterior wall system exceeded the minimum requirements of AC-269.1 and, consequently, exceeds the minimum requirements for use as a bracing method in accordance with the IRC and within Seismic Design Categories A, B, and C (excluding townhouses in SDC C). This seismic limitation, however, is not a limitation on the capability of the technology; it is only necessary because of limits to the scope of evaluation within AC-269.1. In summary, the EPW wall system is structurally sound and is suitable for inclusion in the IRC as proposed for adoption by the State of Idaho.

The vapor retarder provisions also meet or exceed minimum requirements in the IRC as confirmed by moisture performance data also reported in the above-mentioned research report. Consequently, the EPW proposal is expected to provide adequate moisture control and drying potential for all climates, including those in Idaho. In fact, the proposal exceeds minimum code practices in this regard by not permitting the use of a Class I vapor retarder which avoids the problem of low inward drying potential for walls. Instead, the proposal provides a means to use Class II (Kraft paper) which is a "smart" vapor retarder or Class III (latex paint) vapor retarder. Both of these options provide excellent water vapor control and drying potential when combined with the insulation strategy of the EPW wall system. Thus, the performance of the EPW walls system as proposed is expected to meet or exceed that of the minimum vapor retarder practices currently in the IRC Section R702.7.

Based on the above review and my professional opinion and experience, I strongly encourage the Idaho Building Code Board to adopt the EPW wall system as proposed. This technology will provide useful benefits to the building industry and home consumers in the State of Idaho.

Please feel free to contact me should you have any questions regarding this review and recommendation.

Sincerely,

Jay H. Crandell, P.E.
Consulting Engineer
(State of Maryland, Lic# 19936)

A Better Wall for Production Builders

Meet NAHB's new wall assembly, with a 77% better R-value than a standard 2x4 wall

BY MATTHEW MILLHAM

Designing a better wall system isn't particularly hard. Designing one with a chance of being accepted by production builders, on the other hand, has proven difficult—and that's a problem.

Demand for higher-performance wall systems is growing, partly because of more-stringent energy codes. But builders aren't adopting existing solutions—things like double-wall framing or thick layers of exterior rigid foam over wall sheathing—in significant numbers.

The National Association of Home Builders' (NAHB) Home Innovation Research Labs is trying to lure more builders into constructing high-efficiency walls with the development of its "Extended Plate and Beam" wall system.

Called EP&B for short, Extended Plate and Beam adapts methods that production builders—who build the majority of American homes—already know. At its most basic, EP&B consists of 2x4 studs between 2x6 top and bottom plates, and the extra 2-in. overhang is filled with rigid foam before structural sheathing is attached with long nails (see drawing right). From there, installing windows, doors, flashing, and cladding is largely the same as for a regular 2x6 wall.

The main advantage to production builders? Installing OSB or plywood outboard of the rigid foam removes the need for furring strips.

EP&B vs. other walls

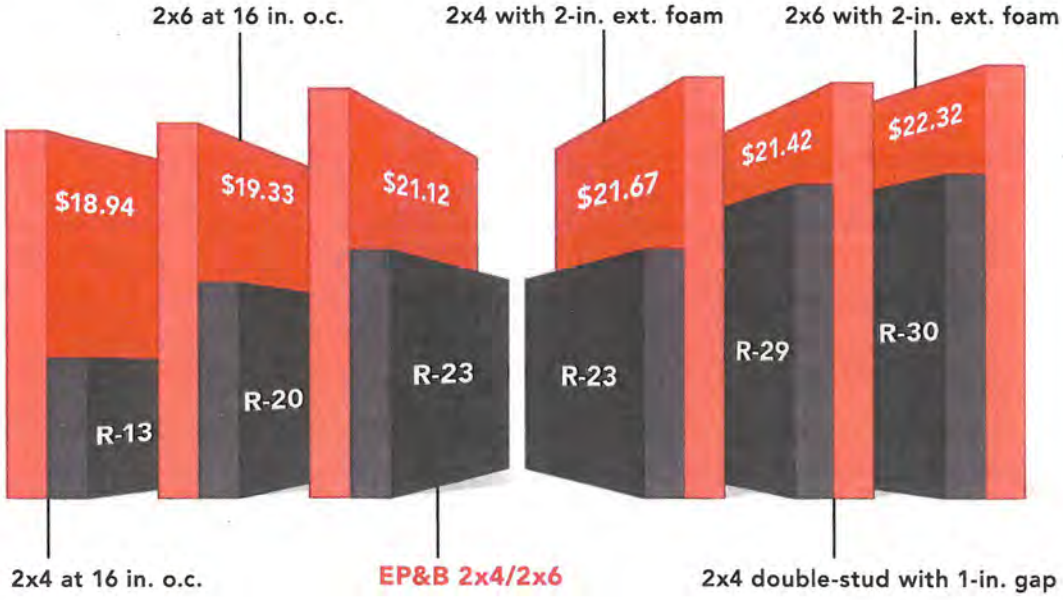
According to calculations made by the Home Innovation Research Labs, the EP&B system costs less to build than either a 2x6 wall with continuous exterior rigid foam or a double-stud wall.

In its most basic configuration, an EP&B wall with 2 in. of extruded polystyrene (XPS) foam and R-13 fiberglass batts has a nominal R-value of R-23. That's a 77% increase in R-value from a conventionally framed 2x4 wall with the same R-13 batt insulation and no foam.

Analysis published by the United States Department of Energy (DOE) estimates the cost of this particular wall assembly at $21.12 per sq. ft. of framing when sided with fiber cement—$2.18 more than a regular 2x4 wall, including materials and labor. In other words, for

COST COMPARISON

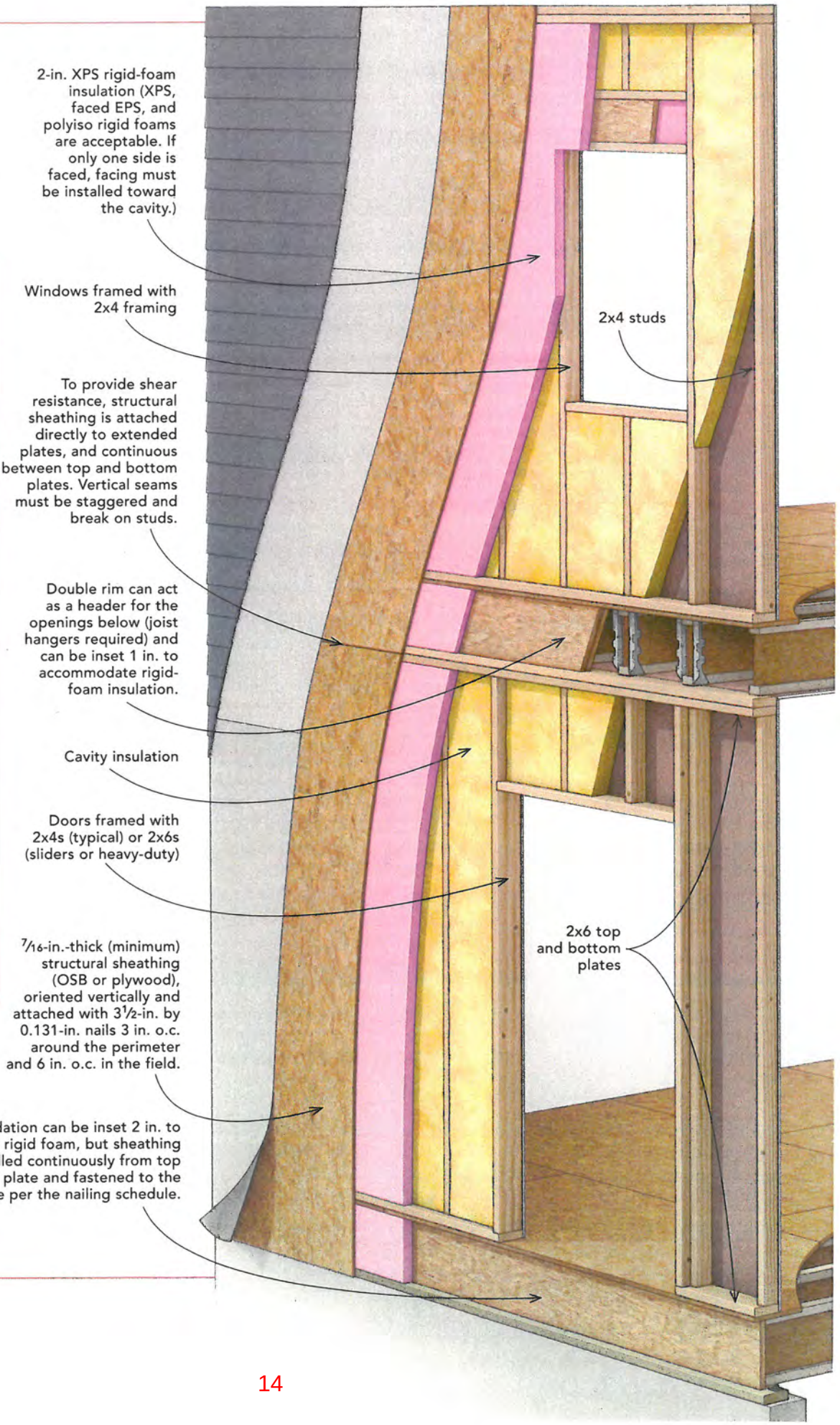
The EP&B wall's developers tested and compared the nominal R-value and cost per sq. ft. to construct various wall assemblies. Costs per sq. ft. and nominal R-values for walls clad in fiber-cement siding are shown here. By their analysis, their assembly costs more than standard 2x6 walls, but $0.55 per sq. ft. less than the International Energy Conservation Code's (IECC) prescriptive 2x4 wall with 2 in. of exterior rigid foam.



Drawings: Christopher Mills

EXTENDED PLATE AND BEAM WALL

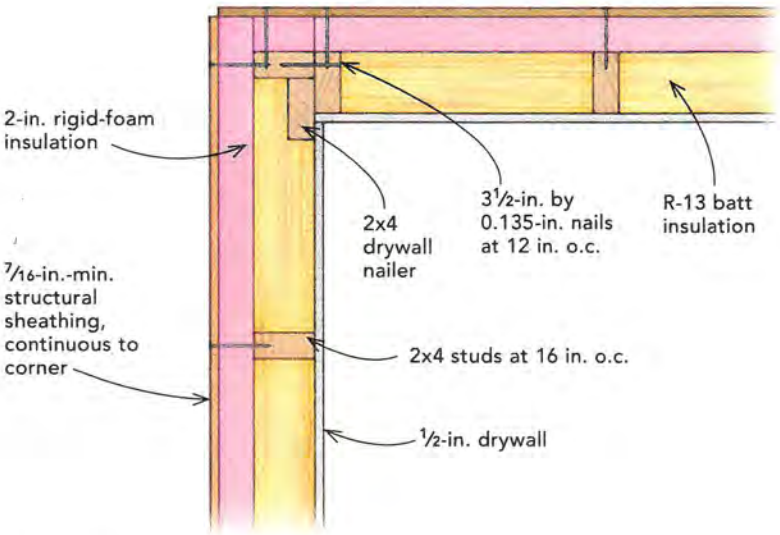
Designed to appeal to production builders, Extended Plate and Beam walls include a layer of rigid-foam insulation between the structural sheathing and the studs. At its most basic, the walls consist of 2x4 studs between 2x6 top and bottom plates. The plates are flush with the studs on the interior, but 2 in. proud of the studs on the exterior. This 2-in. overhang is filled with 2 in. of rigid-foam insulation, and the entire wall is skinned over with structural sheathing fastened with long nails.



CORNER DETAILS

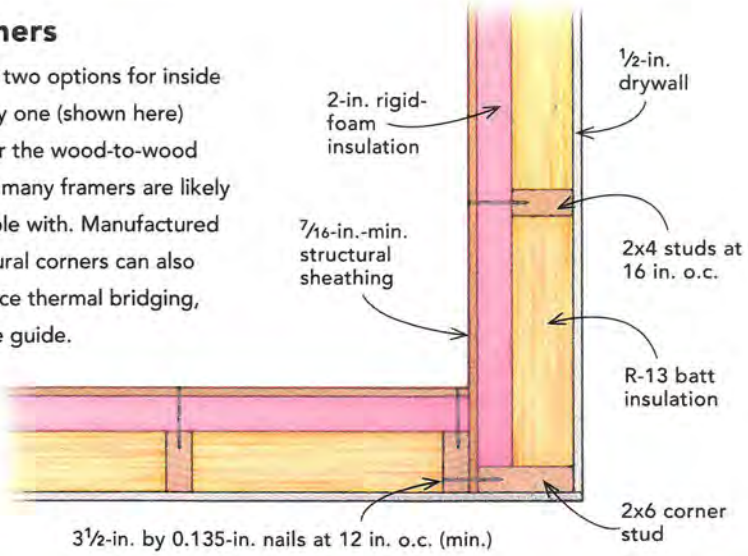
Outside corners

The Home Innovation Research Labs developed a guide to the Extended Plate and Beam wall system that details a handful of ways to connect inside and outside corners. For outside corners, there's only one option (shown here) that allows for rigid foam to wrap around the entire corner. Other options result in additional thermal bridging, or a significantly reduced R-value at the corners. Manufactured insulated structural corners can also be used to reduce thermal bridging, according to the guide.



Inside corners

The guide gives two options for inside corners, but only one (shown here) that provides for the wood-to-wood connection that many framers are likely to be comfortable with. Manufactured insulated structural corners can also be used to reduce thermal bridging, according to the guide.



For more information about Extended Plate and Beam walls, including a builder's guide and analysis of the concept, check out the Home Innovation Research Labs' website, homeinnovation.com. Visit GreenBuildingAdvisor.com for editor Martin Holladay's take on the EP&B system, covered in his weekly "Musings of an Energy Nerd" blog.

an 11.5% premium, they saw a 77% bump in nominal R-value.

Builders can also build an EP&B wall with 2x6 studs and 2x8 plates. But because a 2x8 is only 7¼ in. wide, the remaining overhang leaves room for only 1¾ in. of rigid foam, producing a nominal R-29 wall with XPS and fiberglass batts. (Builders can rip 2x10s down to 7½ in. to get a full 2 in. of foam and an R-30 wall.) By comparison, a standard 2x6 wall with fiberglass batts has a nominal R-value of R-20, according to DOE analysis.

While the system reduces thermal bridging at the studs, the rigid foam doesn't cover the plates (or, in its most basic configuration, the rim joists), resulting in more thermal bridging—and in most cases more air leakage—than systems with continuous insulation.

The devil is in the framing and fastening details

The Home Innovation Research Labs produced a manual, titled "A Builder's Guide: Extended Plate & Beam Wall System," which gives options for various framing details.

The manual notes that EP&B walls need 3½-in. nails every 3 in. on the edges of sheathing panels and every 6 in. along studs for adequate bracing. While this approach works in most of the country, it is not suitable for high-seismic or high-wind areas.

The "Beam" in Extended Plate and Beam refers to the rim joists, which can be doubled up so that structural headers over openings aren't necessary. Thermal bridging can be further reduced—by more than 95% overall, according to developers—if the rim is inset to accommodate rigid-foam insulation. Doing this can, however, add complexity.

Siding weighing less than 3 lb. per sq. in. can be fastened to the sheathing with standard nails, though heavier siding requires fasteners that extend to the studs.

Awaiting code approval

This system is not yet recognized by the International Residential Code, though its developers are hoping to get approval at upcoming code hearings.

Until codes change, local code officials may give this approach a thumbs-down unless a builder submits engineering documents validating the system's soundness. □

Matthew Millham is an associate editor. Contributions by Martin Holladay, editor of GreenBuildingAdvisor.com.

MASTER CLASS IN MOLDINGS: THE RIGHT TRIM FOR EVERY ROOM

Fine Homebuilding

DESIGN • BUILD • REMODEL

Easy, elegant mantel

Secret to a flawless wiped finish

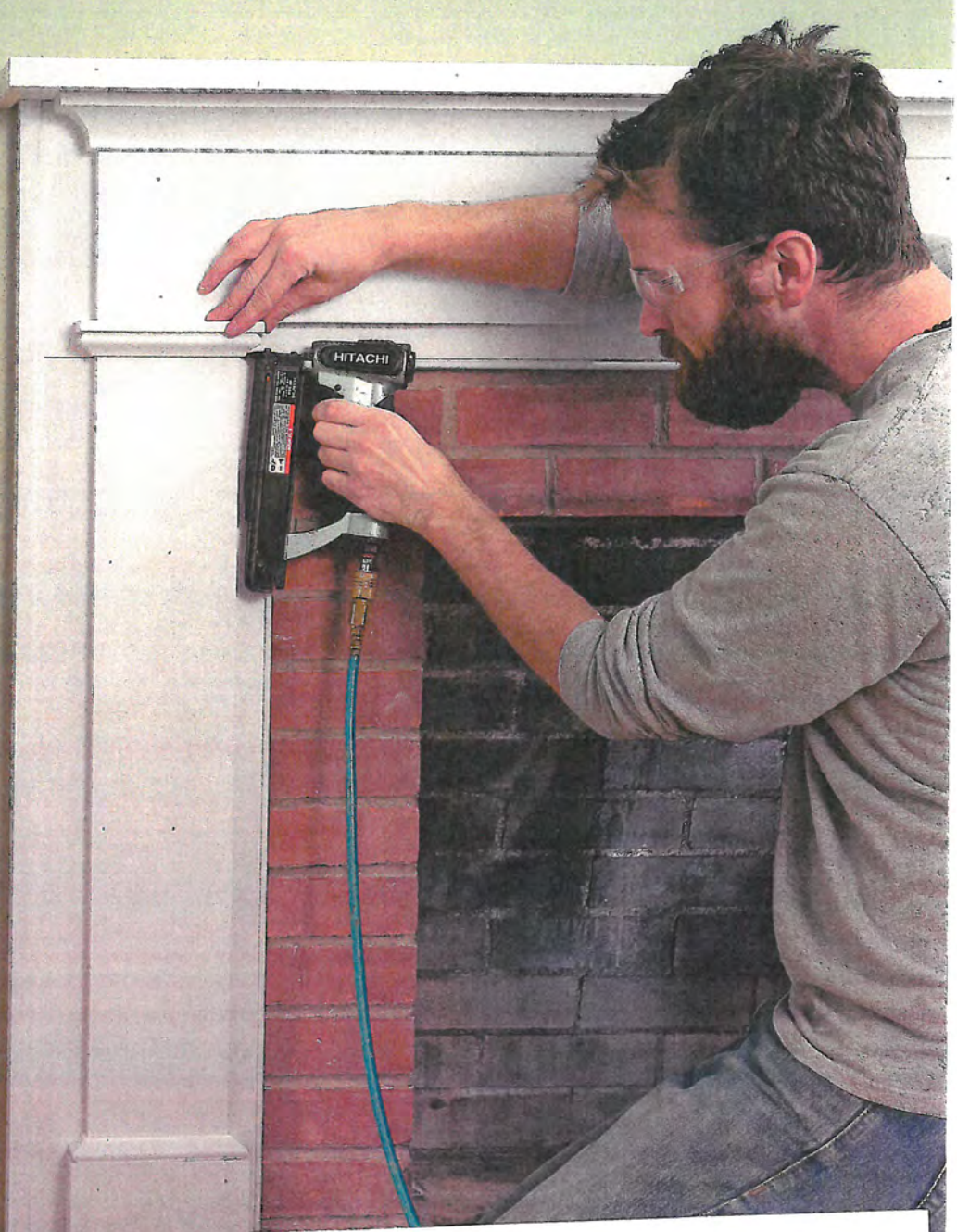
Choose the right rigid foam

STEP BY STEP

Repair a wood window sash

Inside a modern mountain cabin

Install a wall-hung toilet



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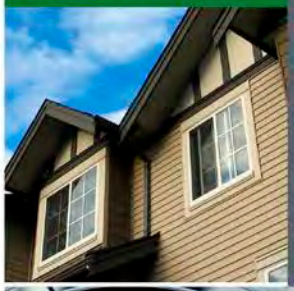

EXTENDED PLATE & BEAM WALL SYSTEM

CONSTRUCTION AND CODE ASSESSMENT

February 2018

DRAFT REPORT

Building AMERICA
U.S. Department of Energy

NOTICE

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Extended Plate & Beam Wall System Construction and Code Assessment

Prepared for:

U.S. Department of Energy's Building America Program

Office of Energy Efficiency and Renewable Energy

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January 2018

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The work presented in this EERE Building America report does not represent performance of any product relative to regulated minimum efficiency requirements.

The laboratory and/or field sites used for this work are not certified rating test facilities. The conditions and methods under which products were characterized for this work differ from standard rating conditions, as described.

Because the methods and conditions differ, the reported results are not comparable to rated product performance and should only be used to estimate performance under the measured conditions.

Foreword

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Preface

This report was prepared by Home Innovation Research Labs for the U.S. Department of Energy/Office of Energy Efficiency and Renewable Energy/Buildings Technologies Office with industry cost-share support from Dow Chemical Company and the American Chemistry Council.

The aim of the Building America program is to develop market-ready solutions that improve energy efficiency, durability, quality, affordability and comfort for new and existing houses. Specifically, this study is intended to address the objectives of the Building America Moisture Risk Management and High-Performance Envelope Systems Roadmap by demonstrating and validating durability, constructability and cost-effectiveness aspects of the Extended Plate and Beam wall system for new construction housing projects using both field-framing and factory panelization methods.

Since 2012 the International Energy Conservation Code (IECC) has required an R-5 or R-10 layer of continuous insulation (c.i.) for all walls in climate zones 6, 7 and 8, and c.i. is one of two prescriptive solutions for climate zones 4 and 5. While foam plastic insulating sheathing (FPIS) as continuous exterior insulation has been used by a small cohort of high-performance builders for approximately two decades, by 2015 the practice had achieved only about 11% market penetration for all thicknesses of foam. Constructability challenges associated with exterior foam are presumed to be a barrier to adoption. Potentially, 60% to 80% of residential builders in the targeted climate zones are candidates for adopting the EP&B wall system, as local jurisdictions begin to require the most recent codes.

This report includes calculations indicating EP&B's thermal performance equivalency to 2015 IECC minimum code walls and laboratory test results indicating EP&B's structural performance equivalency to current IRC braced wall methods. The report presents proposed code language and other support documentation for submission of EP&B to the ICC for inclusion in the next code cycle as a prescriptive braced wall method and a prescriptive insulated wall system.

Acknowledgments

Home Innovation Research Labs acknowledges the U.S. Department of Energy Building America program, American Chemistry Council, and the Dow Chemical Company for their invaluable support.

Nomenclature

c.i.	Continuous insulation—generally a rigid or semi-rigid board insulation material installed exterior to the wall cavity.
CZ	Climate Zone, as defined by the International Energy Conservation Code
DOE	United States Department of Energy, a federal agency that conducts and solicits research on energy efficiency topics, and includes the Building America program
EPS	Expanded Polystyrene, a type of rigid foam sheathing suitable for use in the EP&B wall system with the addition of a film
EP&B	Extended Plate & Beam, a light frame wall system under development at Home Innovation Research Labs
FPIS	Foam Plastic Insulating Sheathing- a rigid foam board typically made from extruded polystyrene (XPS), expanded polystyrene (EPS) or Polyisocyanurate (PIC) and used to provide a layer of continuous insulation for house walls or other components. In this report, FPIS generally refers to rigid foam installed as continuous insulation exterior to the wood sheathing, or in place of the wood sheathing.
Rigid Foam	FPIS used primarily as an insulation material, rather than for the purpose of sheathing. In an EP&B wall, the rigid foam is installed between the framing and the OSB.
High-R	Building America program reference to wall systems with high thermal resistance, exceeding energy code minimum requirements
ICF	Insulated Concrete Forms
IECC	International Energy Conservation Code
IRC	International Residential Code
o.c.	On center – the measurement for lumber with dimension, e.g., studs, whose 1-1/2-in. width means that 16-in. o.c. installation leaves a 14-1/2-in. stud bay.
OSB	Oriented Strand Board, a manufactured wood sheathing product
PIC	Polyisocyanurate, a type of rigid foam sheathing suitable for use in the EP&B wall system
SIP	Structural Insulated Panel
R-value	Quantitative measure of resistance to conductive heat flow (hr·°F·ft2/Btu)
U-value	Quantitative measure of thermal conductance: Btu /(hr·°F·ft2) (the inverse of R-value)
WSP	Wood Structural Panel — the layer of wood sheathing (plywood or OSB) that provides shear and racking strength when properly attached to wall framing
XPS	Extruded Polystyrene, a type of rigid foam sheathing suitable for use in the EP&B wall system

Executive Summary

Home Innovation Research Labs studied the Extended Plate and Beam Wall system over a two-year period from mid-2015 to mid-2017 to determine the wall's structural and thermal performance, moisture durability, constructability, and cost-effectiveness for use as a high-R enclosure system for energy code minimum and above-code performance in climate zones 4 through 8.

The geometry of typical residential wall configurations was analyzed to determine the thermal bridging constituted by the extended plates of the EP&B wall. This ratio was used in ASHRAE parallel path calculations to determine the theoretical thermal performance of EP&B walls. The results were then compared to the theoretical performance of 2015 IECC walls constructed with the typical foam over-sheathing method of installing continuous insulation exterior to the wood structural paneling. The extended plates of the EP&B framing method constitute an area-based thermal bridge of approximately 4.6%, yet with typical materials choices and framing factors, EP&B meets the IECC *Table R402.1.4 Equivalent U-Factors.*

Laboratory tests based on AC269.1 confirmed EP&B walls' strength and stiffness performance for IRC intermittent and continuous braced wall equivalency. The calculated Allowable Design Racking Shear Load Value for EP&B walls is 256 plf (lbs/ft) for SPF framing. As a point of comparison, the minimum acceptable IRC-WSP braced wall is listed at 184 plf.

EP&B thermal transfer calculations and structural test results are presented here with suggested language, tables and figures to provide the basis for inclusion of the EP&B wall in the next ICC code cycle as a prescriptive IRC braced wall and prescriptive IECC insulated wall.

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Introduction and Background

The residential building industry has been searching to expand the list of available options for increasing the thermal resistance of walls for several decades. Although multiple high-R wall construction methods have been developed over the last 25 years, their market adoption rate remains low, due in part to their added complexity and variations from standard details. The EP&B wall system is a solution that can be appealing to a large swath of typical builders looking to improve their homes' thermal performance while minimizing many of the common risks and concerns associated with high-R envelope systems.

Any residential builder transitioning to a higher performing wall system will require construction details and methods that are based on common and accepted industry practices, and the validation of test results and code compliance. This is apparent based on the low diffusion of alternative wall systems such as Structural Insulated Panels (SIPs) or Insulated Concrete Forms (ICF) - wall technologies that have a long history of good performance in the building industry. The transition time for builders to make significant changes to construction practices is known to extend over dozens of years. The EP&B wall system was developed as an opportunity to reduce this long transition timeframe by maintaining industry accepted construction practices while employing design features that increase the thermal performance of the wall by over 50%, specifically by the inclusion of a layer of nearly continuous rigid foam insulation.

Beginning with IECC 2012, climate zones 6, 7, & 8 all require 2-in. c.i. with a 2x4 wall. In climate zones where 2-in of exterior insulation has not yet been incorporated as a prescriptive minimum thermal requirement it is estimated that 40% to 80% of builders who have not yet transitioned to high-R wall systems will soon need to make a decision about how to comply with new energy codes. That decision is likely to include 2-in continuous insulation; however, these builders have previously declined to choose from among a number of high-performing alternatives that have been available for the past decade or more.

A leading approach to increasing the R-value of walls is the prescriptive method of adding rigid insulation outboard of the sheathing, an approach that was demonstrated over 40 years ago but still remains underutilized with only about 11% nationwide market penetration as of 2015. The specific transition barriers to widespread adoption of this particular method include the lack of a nailing base to support the cladding, drainage plane and window flashing, and the concern with the possible creation of dual vapor barriers leading to moisture problems in colder climates.

EP&B walls integrate rigid foam sheathing with standard framing practices into a cost-effective system that preserves many conventional construction features and minimizes builder risk. The rigid foam insulation board is installed between the 2x4 framing and the wood structural panel (WSP), with top and bottom plates extending to the exterior plane of the rigid foam. This method keeps over 95% of the wall area free of thermal bridging and retains the WSP as an exposed nailing surface, maintaining common methods and materials for framing, air sealing, insulation, drainage plane and siding attachment. The extended plates in conjunction with the wood sheathing mounted at the exterior plane of the wall protect the foam during transit, making EP&B uniquely suited to factory wall panelization, in addition to field-framing.

Since 2013 EP&B walls have been the subject of several research projects which drove improvements to various details (rim design, fastening schedule, plate extensions and nail length), resulting in an optimized design which balances structural performance, first cost, energy efficiency and constructability.

EP&B Building Code Applicability

DOE's Building America program sponsored structural testing of EP&B walls based on ICC Acceptance Criteria AC269.1 as well as field tests for constructability. All structural testing was conducted on the final, recommended EP&B configuration of 3-1/2-in. nails in a 3/6 perimeter/field WSP nailing pattern using 2x4 studs and 2x6 bottom and double top plates. This configuration resulted from developmental improvements

based on current and previous research, culminating with the two field test houses of the current Building America research project.

Thus far, isolated local building inspectors in several jurisdictions where field tests have been conducted have approved the EP&B system as detailed. Structural P.E.s may now use the EP&B shear strength design value to develop engineered designs using EP&B in any climate zone. The inclusion of EP&B as a prescriptive IRC braced wall method per the International Residential Code and as a prescriptive solution for the IECC would be the strongest inducement to deep market adoption of the method, and would provide a legitimate, low-cost, low-risk alternative to the continuous insulation technique of over-sheathing with FPIS.

Research results confirm that the EP&B wall can be readily constructed using traditional methods, and can perform equivalently to or better than a standard IRC code-minimum wall with respect to structural, thermal and moisture performance.

This report provides language and rationale that can readily be incorporated in the International Residential Code (IRC) to identify and detail EP&B as a prescriptive approach for an IRC braced wall, and in the International Energy Conservation Code (IECC) to meet minimum thermal performance requirements.

EP&B Justification as a Prescriptive Code Solution

EP&B walls can be constructed in three framing configurations:

1. 2x4 studs with 2x6 plates, and a 2-in. rigid foam layer
2. 2x6 studs with 2x8 plates, and a 1-3/4-in. rigid foam layer
3. 2x6 studs with true 2x7.5-in. plates, and a 2-in. rigid foam layer (2x10's are vertically ripped to exact 7.5-in. width)

Intermittent Bracing

Section 4.1 of the acceptance criteria uses ASTM E72 testing for stiffness, deflection, and strength to qualify a wall for use as an intermittent braced wall. Three specimens must not exceed target deflections of 0.2 in and 0.6 in at 23% and 46% of peak load, respectively; must exceed 560 plf maximum unit shear; and must provide deflection of greater than 0.75 in. at the maximum shear load.

Further, to qualify for additional testing to determine potential use as an intermittent braced wall, the specimens must meet additional conditions of acceptance: no greater than 0.2 inches of deflection at a load of 200 plf, and no greater than 0.6 inches of deflection at a load of 400 plf. Table 1 shows that EP&B wall specimens met all criteria, individually and on average.

Table 1. EP&B Intermittent Bracing: AC 269.1 (ASTM E72) Conditions of Acceptance.

Wall Type	Max Shear Load (lb) (Peak	Net Deflection at Peak Load (in.)	Unit Shear, lbs/ft (plf)	Deflection at 23% load	Deflection at 46% load	Deflection at 200 plf	Deflection at 400 plf
AC269.1 Criteria 4.1:	>4,480	>0.75	>560	<0.2	<0.6	<0.2	<0.6
EPB-1	7,060	3.35	882	0.134	0.353	0.127	0.348
EPB-2	6,673	3.77	834	0.134	0.386	0.139	0.409
EPB-3	6,851	3.73	856	0.135	0.336	0.135	0.352
Average	***6,861***	***3.62***	***858***	***0.134***	***0.359***	***0.127***	***0.348***

Based on these results, the calculated Allowable Design Racking Shear Load Value for EP&B walls is 256 plf (lbs/ft) for SPF framing. As a point of comparison, the minimum acceptable IRC-WSP braced wall is listed at 184 plf (lbs/ft). See Appendix A for Acceptance Criteria test methodology, results and analysis.

Continuous Bracing

Section 4.2 of the acceptance criteria uses ASTM E564 testing for deflection and strength to qualify a wall for use as a continuous braced wall. A minimum of two 8x8 baseline wall specimens must not exceed target deflections of 0.2-in and 0.6-in at loads of 200 plf and 400 plf, respectively, and must exceed 560 plf maximum unit shear. See Table 2 for the passing results.

Table 2. EP&B Continuous Bracing: AC 269.1 Section 4.2 (ASTM E564) - Baseline

AC269.1 E564 Wall Type 1	Max Shear Load (lb) (Peak Horiz Racking Shear Load)	Net Defl at Peak Load (in.)	Max Unit Shear Lbs/Ft	Net Deflection at 200 plf	Net Deflection at 400 plf
Criteria 4.2:	n/a	n/a	≥ 560 plf	≤ 0.2 in.	≤ 0.6 in.
EPB Baseline 1-1	6181	2.62	773	0.148	0.506
EPB Baseline 1-2	5274	2.68	659	0.136	0.569
Average	***5728***	***2.64***	***716***	***0.142***	***0.537***

This average shear load is then used as a baseline reference for a set of one corner wall and five perforated wall types. Per AC269.1, a reduction factor is applied to each of wall types 2-7. See Table 3 for the passing results.

Table 3. EP&B Continuous Bracing: AC 269.1 Section 4.2 (ASTM E564) – Wall Types 2-7

Description	Max Shear Load (lb) (Peak Horiz Rack-ing Shear)	Net Defl at Peak Load (in.)	Max Unit Shear lbs/ft	Reduction Factor	Drift at Ref Shear Load ≤ 0.6 in.	Drift (Stiffness) Pass/Fail	Predicted Peak Racking Unit Shear Strength lbs/ft	Shear Strength Pass/Fail (max shear load > pred. peak)
Baseline AVG	5728	n/a	716			n/a		
Corner Rtn	6874	1.46	573	0.79	0.2224	Pass	566	Pass
Full-ht	5255	1.74	438	0.43	0.2571	Pass	308	Pass
Window	6480	3.65	540	0.65	0.3793	Pass	465	Pass
door	3281	3.18	246	0.29	0.4982	Pass	208	Pass
2 windows	5105	4.49	365	0.41	0.4527	Pass	294	Pass
wind & dr	4776	4.36	311	0.38	0.3590	Pass	272	Pass

Appendix A describes the equipment, methodology and details of the EP&B structural lab testing.

Thermal Performance

The rigid foam in EP&B walls can be any FPIS with minimum 15 psi compressive strength; typical R-values range from R-4 per inch to over R-6 per inch. These R-value market choices are the same as for the application of FPIS as exterior continuous insulation (the current prescriptive method.) EP&B walls do not quite meet the definition of "continuous insulation" due to the extended top and bottom plates which constitute a thermal bridge of 4.6% for any length wall (additional or redundant framing takes the form of 2x4 cripples, king and jack studs, and headers and sills.)

Framing factors (FF) vary widely. For standard light-frame wall construction with 16-in. o.c. stud spacing, the accepted FF range is from 15% to 25%.[1] Using R-10 c.i. and conservatively assigning 14.4% for stud framing and 4.6% for plate framing (total 19% FF), the ASHRAE parallel path thermal transfer calculation results in U-0.045 for the 2x4/2x6 framing configuration of EP&B, satisfying IRC *Table 402.1.4 Equivalent U-Factors*. Even using a more conservative framing factor of 23% (the value used in the energy simulation calculations of both REM/Rate and EnergyGuard) the U-factor is 0.46. All other EP&B framing configurations using R-10 c.i. exceed IECC minimums. See Appendix B for calculations.

Example Building Code Prescriptive Requirements

(Note – the name of the wall system has been modified from the Extended Plate and Beam to the Extended Plate Wall system. This was done to avoid confusion of a beam design or a beam requirement. Based on further laboratory testing, the original beam concept has been shown to be a non-critical part of the system design and thus is not required as part of the definition or code requirements.)

A draft example set of prescriptive IECC and IRC provisions for the EP&B wall system, based on the 2015 Codes, are outlined below, demonstrating how the EP&B wall system might be incorporated into the code. These examples indicate where EP&B prescriptive requirements would fit into the existing IRC and IECC code and how these example provisions might modify other sections of the IRC and IECC.

IRC

Add new definitions to Section R202

EXTENDED PLATE WALL (EPW). A wood framing method for constructing exterior walls using top and bottom plates that are wider than the width of the studs such that rigid foam sheathing can be inset between the top and bottom plates, and between the studs and the exterior wood structural panel sheathing. Sheathing is fastened directly to the bottom and top plates and through the rigid foam sheathing to the studs.

FOAM PLASTIC INSULATING SHEATHING (FPIS). A rigid foam board typically made from extruded polystyrene (XPS), expanded polystyrene (EPS) or Polyisocyanurate (PIC) and used to provide a layer of continuous insulation for house walls or other components. In this report, FPIS generally refers to rigid foam installed as continuous insulation exterior to the wood sheathing, or in place of the wood sheathing

Add new abbreviations

EPW Extended Plate Wall

FPIS Foam Plastic Insulating Sheathing

Add new section to IRC Chapter 6.

602.13 Extended Plate Wall (EPW). Framing, wood structural panel sheathing, connections, wall bracing, and anchorage for the EPW shall be in accordance with all applicable provisions of Sections R602.1 through R602.12 as modified by the provisions of Section R602.13. EPW shall be limited to Seismic Design Category A, B, and one and two-family dwellings in C. EPW shall be constructed by one of three framing combinations per Table R602.13.1.

[1] See page 23: "Assessment of Commonly-Used Code Compliance Simulation Software Relative to Cold Formed Steel Framing," Newport Partners

Table R602.13.1 Braced Wall Wood Framing Construction Requirements for EPW

EPW Configuration	Nominal Lumber Dimensions		Thickness Rigid Foam[2]
	Studs	Plates	
2x4/2x6	2x4	2x6	2-in.
2x6/2x8	2x6	2x8	1-3/4-in.
2x6/2x7.5[1]	2x6	2x7.5[1]	2-in.

[1]Actual 7.5-in. width plates are available as engineered lumber.

[2] Rigid foam thickness is achieved by installing one or more layers of foam.

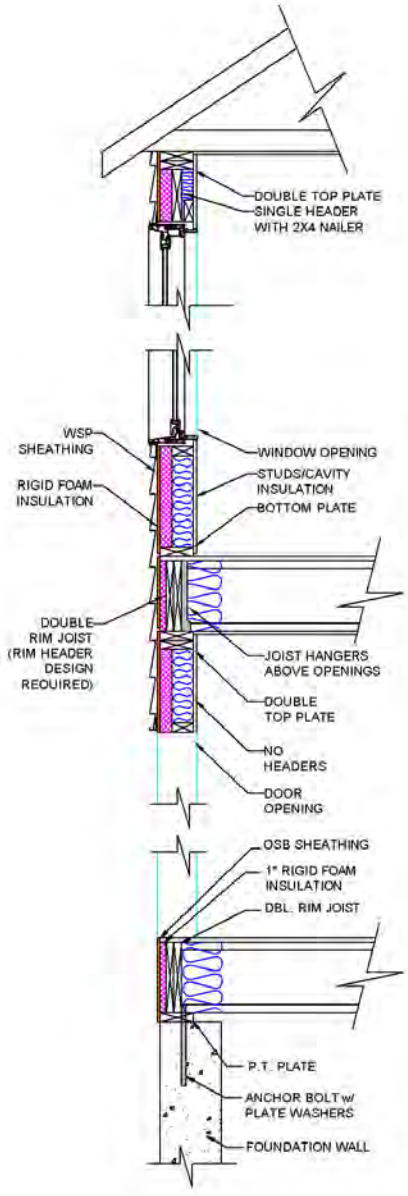

Figure R602.13.1 Extended Plate Wall (EPW) System, section view

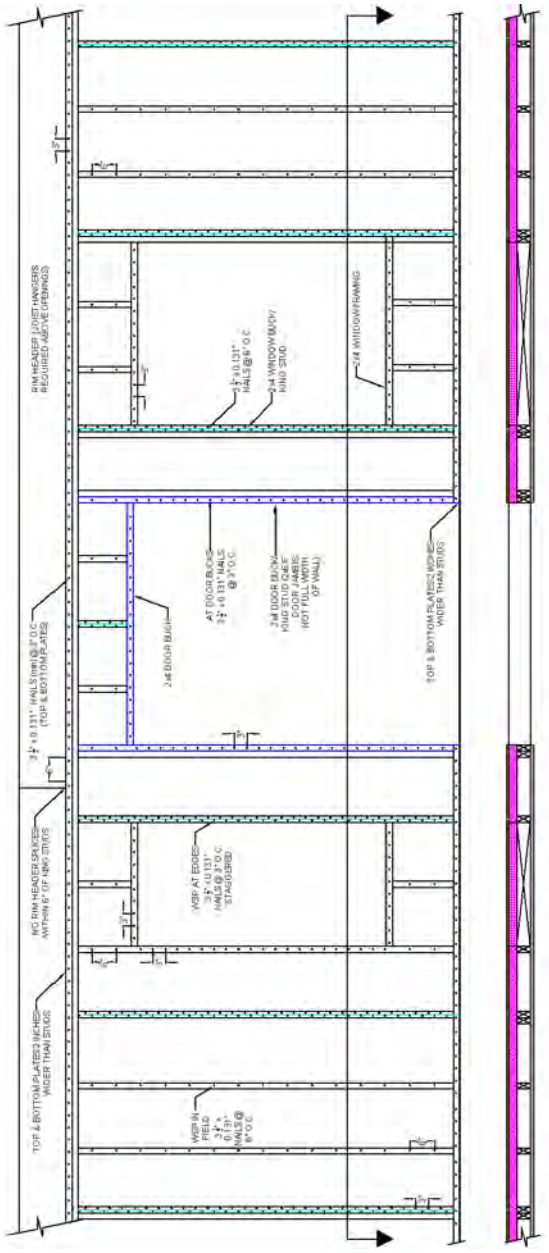

Figure R602.13.2 EP&B Wall, Interior Elevation View

602.13.1 Plates. The bottom and double top plate shall be wider than the width of the studs by not more than 2 inches, in accordance with Table R602.13.1 and Figure R602.13.1 and Figure R602.13.2.

602.13.2 Wood structural panel sheathing attachment. Wood structural panel (WSP) sheathing of thickness from 3/8-in. to 15/16-in. shall be installed vertically and attached to wall plates and studs per Table R602.13.4.

Commented [PG1]: Removed "Braced Wall Fastener Requirements for EPW"

602.13.3 Horizontal joints in wood structural panels. Where used as part of wall bracing, each wood structural panel shall be continuous between the extended top and bottom plates. Blocking of panel edges shall not be an acceptable alternative to continuous vertical wood structural panels for the EPW. The vertical joint between two wood structural panels shall occur only at the location of a stud.

602.13.4 Wall Bracing. Wall bracing shall be in accordance with the WSP Bracing Method in Table R602.10.4 except the fasteners' diameters and spacing shall be in accordance with Table R602.13.4. All provisions applicable to the use of the WSP Bracing Method, including provisions for mixing bracing methods, shall be applicable to EPW.

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Table R602.13.4 Braced Wall Fastener Requirements for EPW

Minimum nail length and diameter	Maximum Fastener Spacing	
	At Perimeter of WSP	In Field of WSP
3-1/2-in. x 0.131 in.	3-in. oc	6-in. oc

602.13.4.1 Simplified Wall Bracing. With the exception of Section R602.12.2 Item 2 and Section R602.12.3 Item 1, provisions of Section R602.12 shall be applicable to the EPW. The fastening schedule for wood structural panels shall be in accordance with the additional requirements of Table R602.13.4.

602.13.5 Rim joist. Rim joists (band joists) supporting an EPW shall be single or double-member solid-sawn or engineered lumber. Single member rim joists shall be inset by 1 inch. Double member rim joists are permitted to be installed flush to the exterior face of the wall, or inset by 1 inch from the exterior face of the wall to provide space for exterior rigid insulation. Rim joists are permitted to be inset by 2 inches from the exterior framing surface to provide space for exterior rigid insulation only if the WSP sheathing spans from the top plate all the way to the sill plate and is fastened to the sill plate in accordance with schedule of Table R602.13.4. The aspect ratio for braced wall panels in this case shall be based on the entire length of the WSP sheathing from the top plate to the sill. The minimum bearing length requirements for the floor joists shall be satisfied or joists shall be supported with metal hangers.

602.13.6 Rim joist used as rim header. Solid-sawn or engineered lumber single or double member rim joists (band joists) are permitted to support EPW above openings as rim board headers in accordance with the provisions of R602.7.2 or an equivalent alternative and no additional headers are required at openings. Rim headers shall not have splice joints over an opening and the first splice joint to each side of the opening shall occur a minimum of 6-in. away from the opening edge and past the outermost king studs. Floor joists above such openings shall be supported with metal hangers selected by a licensed professional based on design loads.

Commented [PG3]: Deleted "in such a case"

602.13.6 Headers. Where the rim joist is not used as a header, construct headers in accordance with Section R602.7.

602.13.7 Door bucks. Where door jamb depth is less than the thickness of the EPW, the rough opening of the door framing shall be constructed using extended studs of width equal to the top and bottom plates of the EPW to allow full attachment of the door jamb to the framing. Where door jamb depth equals the thickness of the EPW, no changes in framing are required, as shown in Figure R602.13.2. All other provisions of IRC Section R609 shall be applicable to the EPW.

602.13.8 Foam plastic sheathing. Foam plastic insulative sheathing (FPIS) shall comply with ASTM C578 or ASTM C1289, with a minimum compressive strength of 15 psi.

602.13.8.1 Foam plastic sheathing installation. Foam plastic sheathing with a maximum total thickness of 2 inches shall be cut to stud length and installed flat against the exterior stud plane of the EPW, between extended top and bottom plate(s). Total combined permeance of FPIS and any attached vapor retarder film shall not exceed 1.5 perms. Any one-sided vapor retarder FPIS film shall be oriented to the interior side. Spray foam with maximum permeance of 1.5 perms at the installed thickness is permitted to be applied to the interior cavity side of the foam plastic. FPIS shall be installed vertically, and the vertical joint between two panels of rigid foam sheathing shall not occur at the same stud where there is a joint between wood structural panels; vertical FPIS joints must be offset from vertical WSP joints by at least one stud bay.

602.13.9 Cold-Formed Steel Wall Framing. EPW is not an approved framing method for cold-formed steel framing members.

602.13.10 Wall Coverings. Interior and exterior coverings and wall finishes for the EPW shall be in accordance with all applicable provisions of Sections R701 through R703 as modified by the provisions of Section R602.13.

602.13.11 Interior Wall Coverings - Vapor Retarder. A vapor retarder on the interior side of the EPW frame shall be in accordance with Section R702.7 except:

1. Class I vapor retarder shall not be permitted.
2. Class II vapor retarder shall be kraft paper or an approved equivalent.
3. Vapor retarders for EPW shall be installed in accordance with Table R602.13.1.
4. Where spray foam is installed to the interior cavity side of the foam plastic sheathing, it is permitted to use combined rigid foam and spray foam R-value for use with Table R602.13.1.

Table R602.13.1 VAPOR RETARDERS FOR EPW

Climate Zone	Minimum Required Vapor Barrier	Rigid Foam Insulation Minimum R-Value		
		2x4/2x6 EP&B	2x6/2x8 EP&B	2x6/2x7.5* EP&B
CZ 1, 2, 3	None required.	0	0	0
CZ Marine 4 and Non-Marine 4	Class III	2.5	3.75	3.75
CZ 5	Class III	5	7.5	7.5
CZ 6	Class III	7.5	11.25	11.25
	Class II*	0	7.5	7.5
CZ 7	Class III	10	15	15
	Class II*	7.5	7.5	7.5
CZ 8	Class III	12.5	20	20
	Class II*	7.5	7.5	7.5
*See Table R702.7.1 to determine if vented cladding may be installed to allow the use of a Class III vapor retarder.				

Commented [PG4]: Note reformatting to more closely match existing IRC table.

602.13.12 Exterior Wall Coverings. EPW shall provide the building with a weather-resistant exterior wall envelope and shall include Water Resistance as described in Section R703.1.1, Wind Resistance as described in Section R703.1.2, and a Water Resistive Barrier as described in Section R703.2.

602.13.13 Flashing. Flashing for EPW shall comply with the provisions of Section 703.4. Fluid applied membranes for pan flashing at exterior window and door openings shall not be installed in EPW. Mechanically attached, self-adhered flexible membrane pan flashing shall be installed as described in Section R703.4 item

1.1. and shall span from framing across both the rigid foam layer and the WSP layer, and extend to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage.

602.13.14 Cladding Attachment. Cladding attachment over EPW shall comply with the provisions of Section 703.3 including Table R703.3.2.

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IECC

Add new definitions to Section R202

EXTENDED PLATE WALL (EPW). A wood framing method for constructing exterior walls using top and bottom plates that are wider than the width of the studs such that rigid foam sheathing can be inset between the top and bottom plates, and between the studs and the exterior wood structural panel sheathing. Sheathing is then fastened directly to the bottom and top plates and through the rigid foam to the studs.

FOAM PLASTIC INSULATING SHEATHING (FPIS). A rigid foam board typically made from extruded polystyrene (XPS), expanded polystyrene (EPS) or Polyisocyanurate (PIC) and used to provide a layer of continuous insulation for house walls or other components. In this report, FPIS generally refers to rigid foam installed as continuous insulation exterior to the wood sheathing, or in place of the wood sheathing

Add new abbreviations

EPW Extended Plate Wall

FPIS Foam Plastic Insulating Sheathing

Add new section to IECC Chapter 24

R402.1.6 Extended Plate Wall (EPW). EPW wall systems constructed in accordance with all applicable provisions of IRC Sections R602.1 through R602.13 and utilizing a layer of rigid foam shall satisfy the prescriptive minimum cavity and continuous insulation R-value requirements of Table R402.1.2 for wood frame walls. Use FPIS manufacturer's technical specifications for both cavity insulation and continuous insulation to determine the associated R-value per inch for meeting the thermal resistance minimum requirement of each layer according to the configurations of IECC Table R602.13.1.

Commented [PG6]: Deleted table title

Add footnote to IECC Table R402.1.2

j. EPW exterior wall systems utilizing cavity and continuous insulation of the required R-values shall satisfy the prescriptive minimum insulation requirement for Climate Zone (CZ) 3-8.

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h] [j]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h] [j]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h] [j]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h] [j]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h] [j]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. *U*-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall not be less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

e. There are no SHGC requirements in the Marine Zone.

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. The first value is cavity insulation, the second value is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

j. EPW exterior wall systems utilizing cavity and continuous insulation of the required R-values shall satisfy the prescriptive minimum insulation requirement for CZ 3-8.

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Appendix A
EP&B Structural Lab Testing

Equipment and Methodology

EP&B wall testing was begun in the fall of 2015, and proceeded under the version of AC269.1 that had been approved as of February 2013. Analysis was also done against the updated criteria of AC269.1 2017. Home Innovation Research Labs regularly performs construction testing using ICC published Acceptance Criteria. HI's equipment is calibrated and audited in accordance with ISO 17025:2005.

Figure 1. Reference Wall in Testing Apparatus Prepared for ASTM 72 Test

Test Methods and Materials

Tests were executed in general conformance with the provisions of ICC-ES AC269.1 Acceptance Criteria for Proprietary Sheathing Attached to Wood Light-Frame Wall Construction Used as Braced Wall Panels Under the IRC (IRC Evaluation – prescriptive bracing tables) as applicable to the specific objectives of this study. AC269.2 Acceptance Criteria for Proprietary Sheathing Jobsite-Attached to Wood Light-Frame Wall Construction Used as Shear Walls (IBC evaluation – engineered design values) procedures were used to develop the Allowable Design Racking Shear Load Values.

Racking shear performance testing of the EP&B wall system was conducted in two phases. Phase I of the test plan applies ASTM E72 Section 14 procedures per AC269.1 Section 4.1 to qualify the wall system for intermittent bracing. Phase II of the test plan applies ASTM E564 procedures per AC269.1 Section 4.2 to qualify the wall system for continuous bracing.

Note that AC269 criteria are developed for evaluation of proprietary sheathing materials; OSB-braced walls were used as the basis for developing most of the evaluation criteria for AC269. The EP&B wall system as tested used OSB as exterior structural sheathing. The purpose of this evaluation is not to verify the performance of OSB sheathing. The purpose is to verify that the EP&B assembly with a modified nailing schedule continues to meet the established strength and stiffness performance criteria for a minimum code

shear wall. Three dry specimens were tested for Section 4.1 conformance; wet tests were not necessary because the sheathing as a material is not the focus of the evaluation.

Per AC269.1, "Framing members receiving sheathing fasteners shall have a measured average specific gravity (oven-dry basis) not exceeding the nationally specified value plus 0.03 for the species of framing member in accordance with NDS Table 11.3.2A." All lumber was pre-qualified by estimating the specific gravity based on moisture content measured with a hand-held moisture meter, with appropriate species adjustment. Following destructive testing, multiple lumber samples from each specimen were weighed and dried in the oven to confirm average specific gravity. All lumber was within the specified range.

Intermittent Braced Wall: Test Protocol and Results

Testing for Intermittent Braced Walls follows Section 4.1 of AC269.1 in accordance with ASTM E72 regarding specimen construction and loading protocol using the testing apparatus described above.

Standard 2x6 (SPF) IRC CS-WSP reference walls were constructed in conformance with ASTM E72 and tested for comparison, only; these reference values are not required for AC269 equivalency. The 2x6 configuration was selected to match the framing material and finished wall thickness of the EP&B walls to allow for direct comparison. Sheathing for the 2x6 Standard Reference wall was attached using collated 2-3/8-in. clipped head nails with 6/12 in o.c. nail spacing. IRC reference walls were constructed with Spruce-Pine-Fir (SPF) lumber.

Shear test results are summarized in Table 4 for the three E72 EP&B specimens.

The averaged result of two 2x6 IRC reference walls having the same width as the tested EP&B specimens is included in for comparison only (not an Acceptance Criteria requirement).

Table 4. Maximum Unit Shear: AC 269.1. ASTM E72 – EPW and IRC 2x6 Walls

E72 Shear Capacity Comparison	Target	2x6 IRC Comparison Wall (SPF)	EPB (DFL)
Unit Shear (lbs/ft) min (set)	560	618 / 652	834 / 856 / 882
Unit Shear (lbs/ft) (average of set)		635	858
Unit Shear Avg (lbs/ft) Normalized to SPF		n/a	767
Ultimate Load (SF=3)		206	256
Drift Limit		284	268
Allowable Design Racking Shear Load Value, psf (lesser value: Ultimate Load vs Drift Limit)		206	256

All tested EP&B walls exceed the required shear strength criteria. The average maximum unit shear load in lbs/ft for the 3/6 EP&B walls as tested exceeds the 560 lbs/ft unit shear requirement by 298 lbs, 53%. The EP&B species-adjusted unit shear exceeds the requirement by 37%. For comparison, the average maximum unit shear load in lbs/ft for the 2x6 IRC reference walls exceeds the 560 lbs/ft requirement only by 75 lbs/ft, 13% (this test was for general reference only, and is not required by AC 269.1).

The calculated Allowable Design Racking Shear Load Value is 256 lbs/ft, the lesser of the loads determined based on the ultimate load limit and the drift limit, in accordance with Sections 4.2.3.1 and 4.2.3.2.

Columns 2 through 6 in Table 7 show that all tested EP&B walls exceed the AC 269.1 Conditions of Acceptance; each criterion's minimum and maximum is shown in italics below each column's header.

Although *AC 269.1 Table 1 Deflection (Stiffness) Criteria* are permitted to be reduced (per the species-reduced nominal unit shear value) to achieve compliance with the listed deflection limits for 23% and 46% load, this allowable adjustment was not required for the extended plate and beam walls.

The two columns at the right side of the tables show that the EP&B walls also meet the additional requirements necessary to be permitted to be evaluated as an alternative to the continuously sheathed wood structural panel bracing method (CS-WSP) per ASTM E 564.

Table 5. EPW Intermittent Bracing: AC 269.1 Section 4.1 (ASTM E72)

Wall Type	Max Shear Load (lb) (Peak	Net Deflection at Peak Load (in.)	Unit Shear, lbs/ft (plf)	Deflection at 23% load	Deflection at 46% load	Deflection at 200 plf	Deflection at 400 plf
AC269.1 Criteria 4.1	>4,480	>0.75	>560	<0.2	<0.6	<0.2	<0.6
EPB-1	7,060	3.35	882	0.134	0.353	0.127	0.348
EPB-2	6,673	3.77	834	0.134	0.386	0.139	0.409
EPB-3	6,851	3.73	856	0.135	0.336	0.135	0.352
Average	***6,861***	***3.62***	***858***	***0.134***	***0.359***	***0.127***	***0.348***

Figure 2 shows the deflection curves for the three EP&B baseline walls.

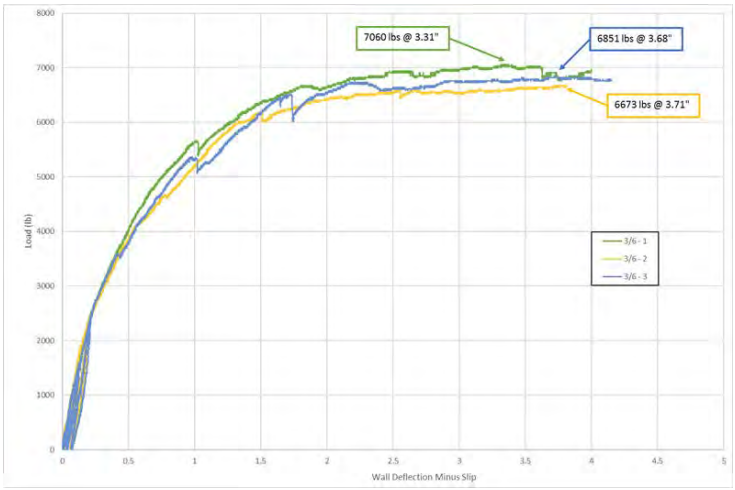

Figure 2. Maximum Loads: E72 Test – EPW Baseline

Continuous Braced Wall: Test Protocol and Results

Testing for Continuously Sheathed Braced Walls follows Section 4.2 of AC269.1 regarding specimen construction, wall type test matrix and loading protocol. The racking shear tests were conducted in accordance with ASTM E564. Loading was applied in a single, continuous phase using the test apparatus described above.

Based on E72 qualification, the E564 baseline tests were performed on EP&B wall samples for types 1 (baseline), wall type 2 (12-ft. wall section with corner returns) and wall types 3-7 (perforated walls having various combinations and sizes of window and door openings.)

Table 6 summarizes the E564 test results for the Extended Plate wall type 1, the baseline, including maximum recorded (peak) shear load, net deflection at peak shear load, maximum unit shear and the maximum net deflections at two target loads: 200 plf and 400 plf. The column headers for the last three parameters show the

thresholds required by the acceptance criteria. If only two tests are performed, each specimen must pass all criteria. When three or more tests are performed, the average of all specimens must pass all criteria.

Table 6. EPW Continuous Bracing: AC 269.1 Section 4.2 (ASTM E564) – Baseline

E564 Wall Type 1	Max Shear Load (lb) (Peak Horiz Racking Shear Load)	Net Defl at Peak Load (in.)	Max Unit Shear Lbs/Ft	Net Deflection at 200 plf	Net Deflection at 400 plf
AC269.1 Criteria 4.2:	n/a	n/a	≥ 560 plf	≤ 0.2 in.	≤ 0.6 in.
EPB Baseline 1-1	6181	2.62	773	0.148	0.506
EPB Baseline 1-2	5274	2.68	659	0.136	0.569
Average	***5728***	***2.65***	***716***	***n/a***	***n/a***

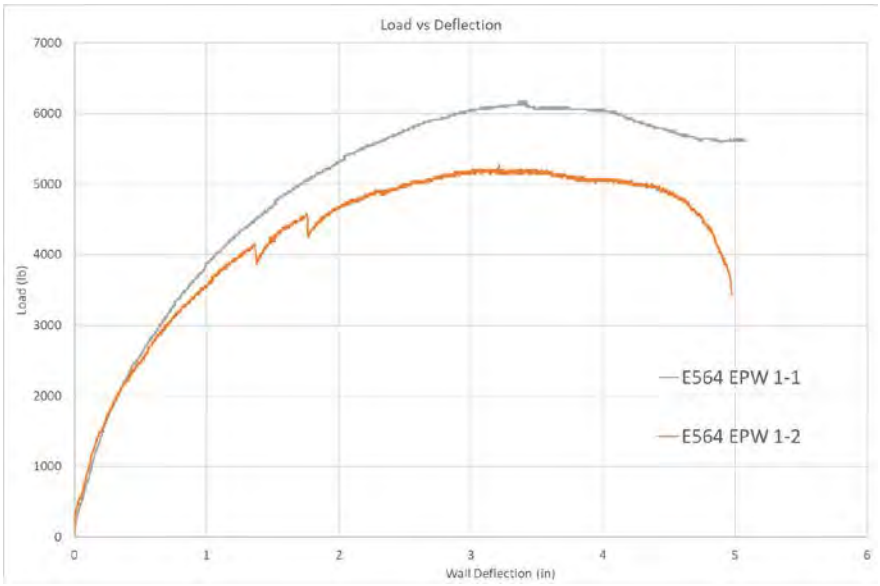

Figure 3. Shear Load Deflection Curves: E564 Test – Baseline EP&B Walls

The AC269.1 Section 4.2 ASTM E564 criteria are self-referencing, i.e., the average maximum shear for wall type 1 specimens is used to develop the wall type 2-7 reference values for racking shear strength, per the AC protocol. All EP&B walls were constructed with SPF lumber; per 4.2.1, so that no species adjustment is required for comparison to target performance values.

Figure 4 graphs the load deflection curves for the EP&B wall specimens of the ASTM E564 tests for IRC continuous braced wall equivalency. Tested values for wall types 3-7 meet all target performance values for both strength and stiffness (drift at reference shear load) per AC 269.1. See Table 7.

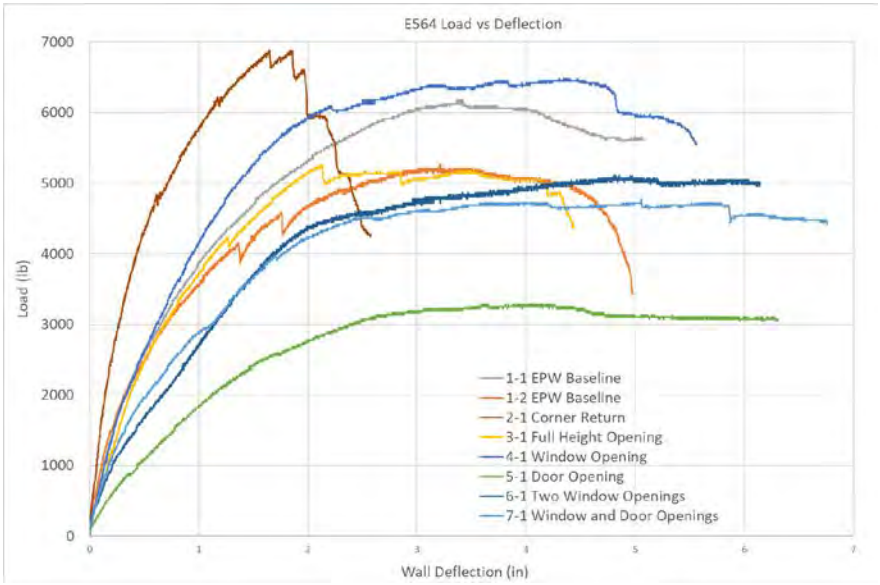

Figure 4. Load Deflection Curves: E564 Test – EP&B Walls

Table 7. EP&B Continuous Bracing: AC 269.1 Section 4.2 (ASTM E564) – Wall Types 2-7

Description	Max Shear Load (lb) (Peak Horiz Rack-ing Shear)	Net Defl at Peak Load (in.)	Max Unit Shear lbs/ft	Reduction Factor	Drift at Ref Shear Load ≤ 0.6 in.	Drift (Stiffness) Pass/Fail	Predicted Peak Racking Unit Shear Strength lbs/ft	Shear Strength Pass/Fail (max shear load > pred. peak)
Baseline AVG	5728	n/a	716	n/a	n/a	n/a	n/a	n/a
Corner Rtn	6874	1.46	573	0.79	0.2224	Pass	566	Pass
Full-ht	5255	1.74	438	0.43	0.2571	Pass	308	Pass
Window	6480	3.65	540	0.65	0.3793	Pass	465	Pass
door	3281	3.18	246	0.29	0.4982	Pass	208	Pass
2 windows	5105	4.49	365	0.41	0.4527	Pass	294	Pass
wind & dr	4776	4.36	311	0.38	0.3590	Pass	272	Pass

Both E564 baseline walls exceeded the 560 lbs/ft minimum shear strength requirement of Section 4.1 by 18% to 38%, respectively; the average shear strength for the specimen set was 28% above code minimum. This resulted in predicted ultimate racking shear capacity values for wall types 2-7 that are much higher than required for a minimally compliant wall to meet IRC braced wall equivalency.

The EP&B wall is intended to be used in the same fashion as a code-minimum IRC wall, yet there is no acceptance criteria other than AC269.1 to utilize for equivalency testing. When the racking shear load performance of EP&B wall types 2-7 is judged in relation to an IRC code-minimum wall, with nominal unit shear of 560 plf, wall types 2-7 exceed the shear strength targets by a range of 30% to 82%.

Table 8. EPW Continuous Bracing: Wall Types 2-7 with 560 plf (Code-Minimum) as Baseline

Description	Max Shear Load (lb) (Peak Horiz Racking Shear Load)	Max Unit Shear Lbs/Ft	Reduction Factor	Predicted Peak Racking Shear Strength at IRC minimum 560 plf	Shear Strength Pass/Fail (max shear load must exceed predicted peak)	Compare Net Shear Strength to IRC minimum 560 plf
Code Minimum	4480	560	n/a	n/a	n/a	n/a
Corner Rtn	6874	573	0.79	*442*	*Pass*	*129.5%*
Full-ht	5255	438	0.43	*241*	*Pass*	*181.8%*
Window	6480	540	0.65	*364*	*Pass*	*148.4%*
door	3281	246	0.29	*162*	*Pass*	*151.5%*
2 windows	5105	365	0.41	*230*	*Pass*	*158.8%*
wind & dr	4776	311	0.38	*213*	*Pass*	*146.4%*

Appendix B
Thermal Transfer Calculations

Framing Factors

Geometries of a typical 8-ft. x 12-ft. wall were examined to determine likely framing factors and the proportion of thermal bridging constituted by the extended top plates in the EP&B wall. (Table 9 - Table 11) The calculated values were then referenced against typical framing factors used in the industry.

Table 9. EP&B Framing Factor Calculations for Standard 16-in. o.c. Framing

Std. 16-in. o.c., double top plate	o.c.	qty	L	W	tot in2	tot ft2	tot wall area, ft2	framing portion
studs	16	10	92.625	1.5	1389.375	9.65	97.125	0.099
plates		3	144	1.5	648	4.50		0.046
Jacks		2	92.625	1.5	277.875	1.93		0.020
header & sill		2	48	1.5	144	1.00		0.010
Kings		2	66	1.5	198	1.38		0.014
connections, corners, bracing		2	92.625	1.5	277.875	1.93		0.020

Std. 16-in. o.c., double top plate	Plates	Non-Plates	Cavity	Reference
	4.6%	16.4%	79.0%	calculated
	4.6%	20.4%	75.0%	ASHRAE
	4.6%	18.4%	77.0%	REM/Rate, EnergyGauge

Table 10. EP&B Framing Factor Calculations for Standard 24-in. o.c. Framing

Std. 24-in. o.c., double top plate	o.c.	qty	L	W	tot in²	tot ft²	tot wall area, ft²	framing portion
studs	24	7	92.625	1.5	972.5625	6.75	97.125	0.070
plates		3	144	1.5	648	4.50		0.046
Jacks		2	92.625	1.5	277.875	1.93		0.020
header & sill		2	48	1.5	144	1.00		0.010
Kings		2	66	1.5	198	1.38		0.014
connections, corners, bracing		2	92.625	1.5	277.875	1.93		0.020

Std. 24-in. o.c., double top plate	Plates	Non-Plates	Cavity	Reference
	4.6%	13.4%	82.0%	calculated
	4.6%	17.4%	78.0%	ASHRAE
	4.6%	15.4%	80.0%	REM/Rate, EnergyGauge

Table 11. EP&B Framing Factor Calculations for Advanced Framing 24-in. o.c. Framing

OVE 24-in. o.c., double top plate	o.c.	qty	L	W	tot in²	tot ft²	tot wall area, ft²	framing portion
studs	24	7	92.625	1.5	972.5625	6.75	97.125	0.070
plates		3	144	1.5	648	4.50		0.046
Jacks		2	92.625	1.5	277.875	1.93		0.020
header & sill		1	48	1.5	72	0.50		0.005
Kings		2	66	1.5	198	1.38		0.014
connections, corners, bracing		1	92.625	1.5	138.9375	0.96		0.010

OVE, 24-in. o.c., double top plate	Plates	Non-Plates	Cavity	Reference
	4.6%	11.9%	83.5%	calculated
	4.6%	11.4%	84.0%	Building Science Corp, etc.

U-Factor Calculations

The total assembly U-factors of all three EP&B wall configurations were calculated using 4.6% for the thermal bridge of the extended plates. A cavity ratio of 77% (total framing factor of 23%) was used for all walls, including the five 2015 IECC code minimum walls for all climate zones. Table 12 shows the ASHRAE Parallel Path method calculation for the baseline 2x4/2x6 EP&B wall as an example.

Table 12. EP&B 2x4/2x6 Wall Calculated Thermal Performance, ASHRAE Parallel Path Method

EP&B 2x4/2x6 w/ XPS	Layer R-Value		Nominal	Actual
		Stud:	2" x 4"	3.5
		Plate:	2" x 6"	5.5
		Path 1	Path 2	Path 3
		Cavity	Studs	Plates
Int. film resistance	0.68	0.68	0.68	0.68
Gyp drywall, 1/2"	0.45	0.45	0.45	0.45
FG, 3.5" R-13	13	13.0		
Lumber, SPF	1.25		4.38	6.88
XPS, 2"	10	10.00	10.00	0.00
OSB, 7/16"	0.62	0.62	0.62	0.62
None	0	0.00	0.00	0.00
Airspace (behind diag-slat sid)	0.62	0.62	0.62	0.62
Siding - vinyl	0	0.00	0.00	0.00
Ext. film resistance (winter)	0.17	0.17	0.17	0.17
PARALLEL PATH nominal:	23.00			
Path Thermal Resistance, R		25.54	16.92	9.42
Path Thermal Conductivity, U (1/R)		0.0392	0.0591	0.1062
Percent of Assembly		77.0%	18.4%	4.6%
Total Assembly U-value	0.0459	0.04591	0.01088	0.00489
Total Assembly R-value (1/U)	21.8			

Table 13 compares the calculated U-factors and R-values for all the wall assemblies.

Table 13. EP&B 2x4/2x6 Wall Calculated Thermal Performance, ASHRAE Parallel Path Method

Wall System[a]	U-Value[b] Calc'd[c]	R-Value[d] Calc'd[c]	Framing Factor by path			
			cavity	cavity/c.i.	Lumber	Lumber (bridge)
2x4 Std. R13	0.083	12.0	77%	n/a	n/a	23%
2x4 Wall R13+5	0.057	17.6	0%	77%	23%	0%
2x6 Std. R20	0.059	17.0	77%	n/a	n/a	23%
2x4 Std. R13+10[e]	0.044	22.9	n/a	77%	23%	n/a
2x6 Std. R20+5	0.044	22.8	n/a	77%	23%	n/a
2x4/2x6 EP&B R13+10	0.046	21.8	n/a	77%	18.4%	4.6%
2x6/2x8 EP&B R20+8.75	0.039	25.8	n/a	77%	18.4%	4.6%
2x6/2x7.5* EP&B R20+10	0.037	27.0	n/a	77%	18.4%	4.6%
2x4/2x6 EP&B R13+10	*0.045*	*22.2*	*n/a*	*81%*	*14.4%*	*4.6%*

[a] Vinyl siding, #2 SPF lumber, 7/16 in. OSB, 1/2 in. gypsum drywall

[b] R-value in hr·°F·ft2/Btu

[c] Includes all layers, interior/exterior finishes and film factors

[d] U-value in Btu/(hr·°F·ft2)

[e] One layer of 1.5 in. rigid foam, with 1/2 in. foam layer alternating with 1/2 in. furring strips

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Newport Partners, (2007). *Assessment of Commonly-Used Code Compliance Simulation Software Relative to Cold Formed Steel Framing*, Steel Framing Alliance. Website accessed December 20, 2017: http://www.steelframing.org/PDF/energy/SFASoftwareReviews-September10.pdf

Bibliography

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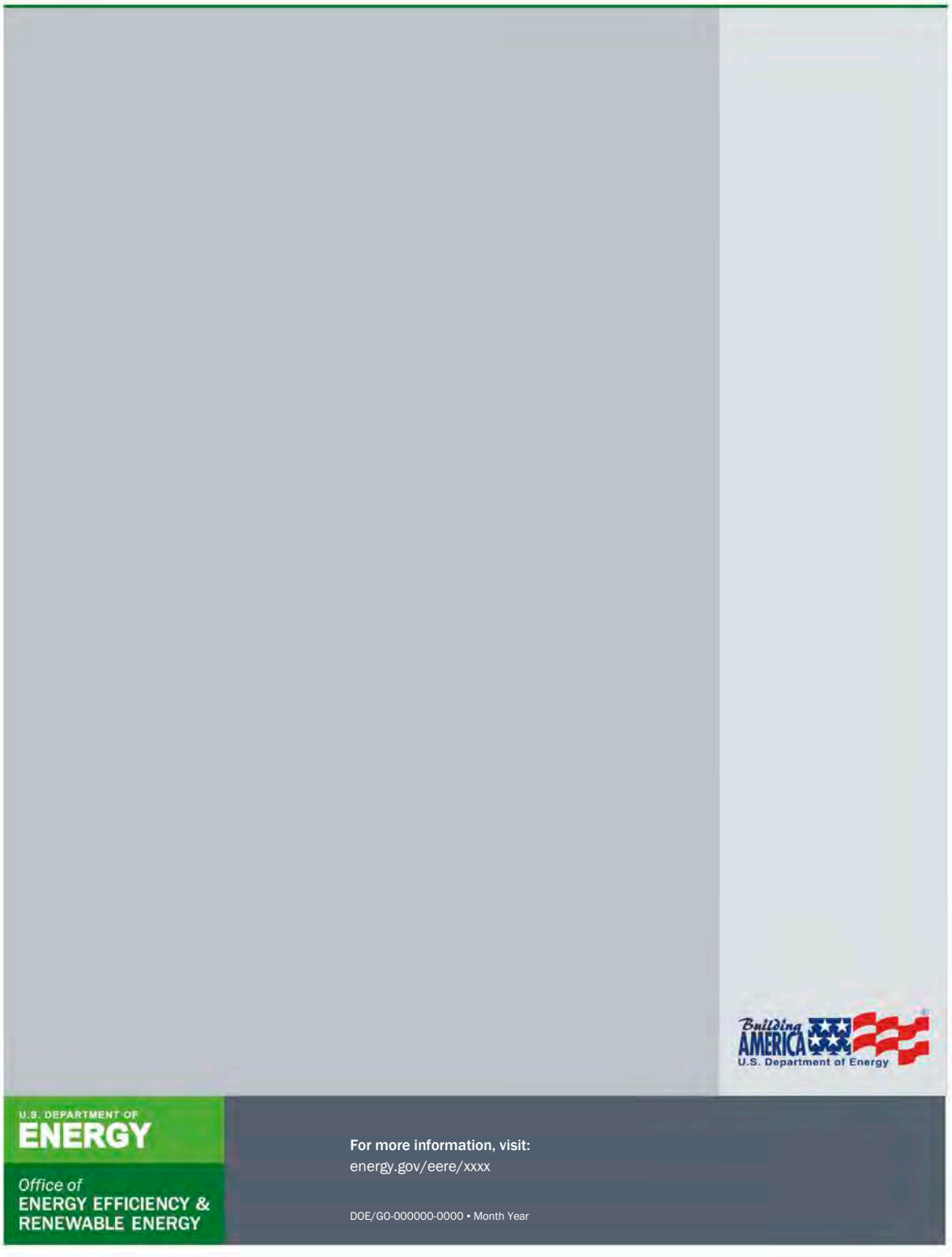
Provide two sections (or one section with two subsections)

1) Not used as rim header
    a. Double 1-1/8-in.
    b. Double 1-1/8-in. inset by 1 inch
    c. Single 1-1/8-in. inset by 1 inch
    d.
2) used as rim header
    a. in accordance with IRC rim header requirements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Extended Plate and Beam Construction Guide

March 2018

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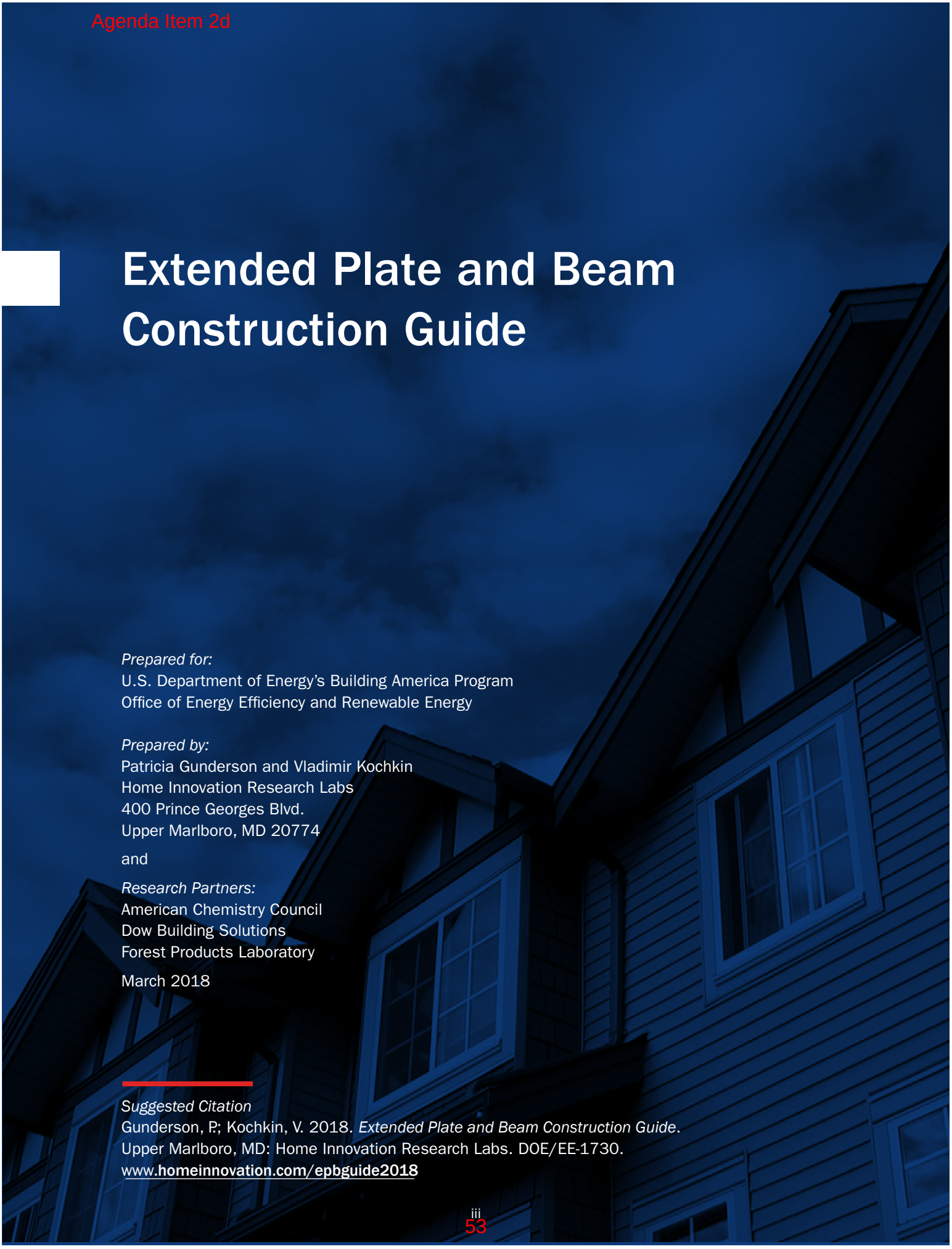

Prepared for:
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Office of Energy Efficiency and Renewable Energy

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The work presented in this EERE Building America report does not represent performance of any product relative to regulated minimum efficiency requirements.

The laboratory and/or field sites used for this work are not certified rating test facilities. The conditions and methods under which products were characterized for this work differ from standard rating conditions, as described.

Because the methods and conditions differ, the reported results are not comparable to rated product performance and should only be used to estimate performance under the measured conditions.

TABLE OF CONTENTS

TERMINOLOGY

c.i.	continuous insulation—generally a rigid or semi-rigid foam or fibrous sheathing material installed exterior to the wall cavity to provide an uninterrupted layer of insulation
ccSPF	closed-cell spray polyurethane foam
CZ	climate zone, as defined by the International Energy Conservation Code
EP&B	extended plate and beam—an advanced wall system developed by Home Innovation Research Labs
FPIS	foam plastic insulating sheathing, made from extruded polystyrene (XPS), expanded polystyrene (EPS), or polyisocyanurate (PIC)
High-R	Building America program reference to wall systems with high thermal resistance exceeding energy code minimum requirements
IECC	International Energy Conservation Code
IRC	International Residential Code for one- and two-family dwellings
o.c.	on center—in wood framing, the measured interval from the center of one thickness of lumber to the next.
OSB	oriented strand board—a manufactured wood panel made of laminated wood fibers, typically available in 4-ft. x 8-ft. sheets in various thicknesses
R-value	quantitative measure of resistance to conductive heat flow ([hr·°F·ft^2]/Btu)
WRB	water-resistive barrier—protects the building envelope from liquid water while allowing the diffusion of water vapor back out
WSP	wood structural panel—the layer of wood sheathing (plywood or OSB) that provides shear and racking strength when properly attached to wall framing

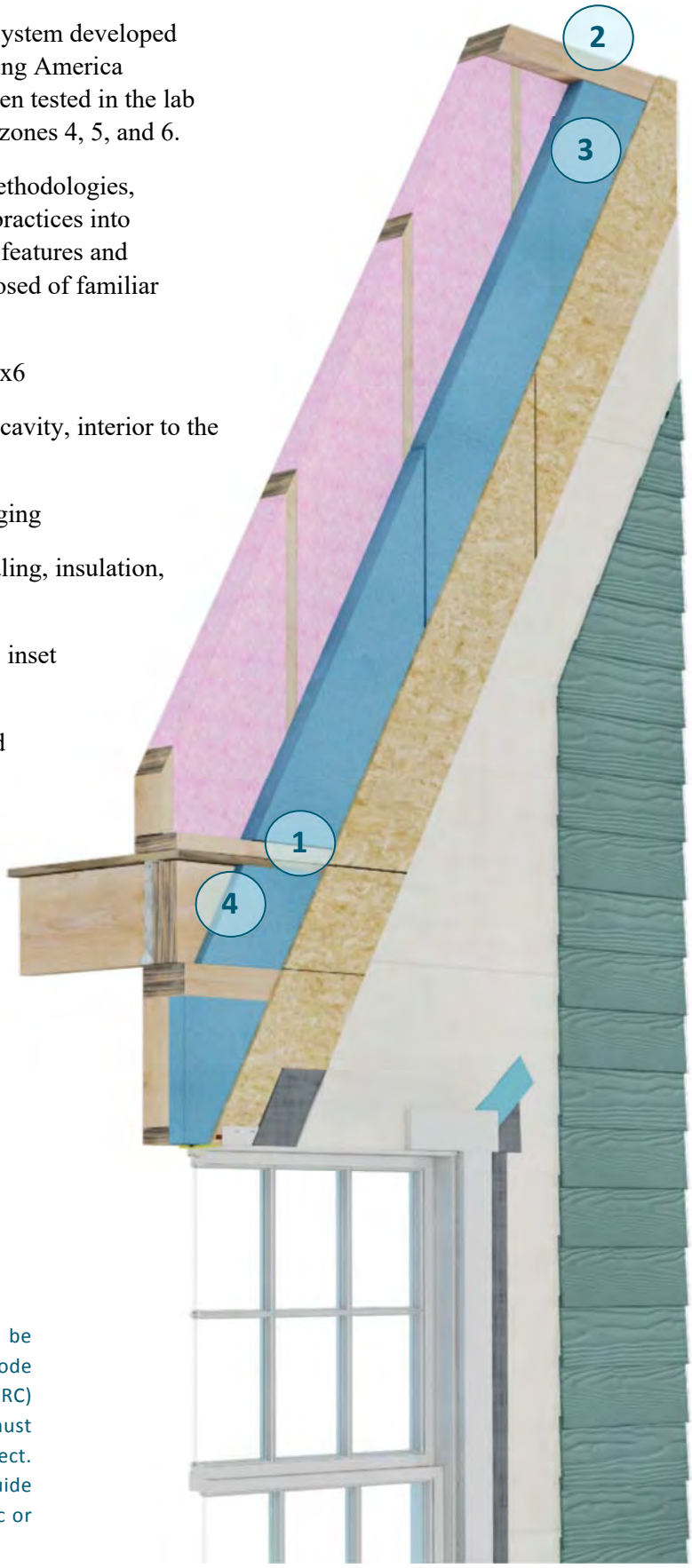
EP&B SYSTEM OVERVIEW

Extended Plate and Beam (EP&B) is an advanced wall system developed by Home Innovation Research Labs as part of the Building America Research Program. This innovative configuration has been tested in the lab and in four different demonstration buildings in climate zones 4, 5, and 6.

EP&B is based on tried-and-true lumber construction methodologies, integrating rigid foam sheathing with standard framing practices into a system that preserves many conventional construction features and minimizes builder risk. The EP&B wall system is composed of familiar wall materials but in a different configuration:

- 2x4 studs, with top and bottom plate extensions of 2x6
- 2-in. continuous insulation (c.i.) exterior to the wall cavity, interior to the wood structure panel (WSP)
- More than 95% of the wall area free of thermal bridging
- Common methods and materials for framing, air-sealing, insulation, drainage plane and siding attachment
- Double rim board (beam) that is also a header and is inset to provide space for a c.i. thermal break

This guide contains all the information you need to build a high-performing wall at reasonable cost and effort that meets or exceeds energy code prescriptive insulation requirements for all U.S. climate zones.



1. The bottom plate is one dimension larger than the studs.
2. The top plates are one dimension larger than the studs.
3. There is a layer of rigid insulation in the two-inch space between the stud framing and oriented strand board (OSB) sheathing.
4. Rim joist can be inset to provide space for a thermal break of c.i.

Prescriptive requirements for the EP&B wall system will be submitted for inclusion into building codes for the upcoming code development cycle. Until International Residential Code (IRC) approval, use of the EP&B wall system in a specific project must be in accordance with the professional design for that project. The specifications for the EP&B wall system provided in this guide are consistent with the scope of the IRC, save for high-seismic or high-wind areas.

DEMONSTRATING AND OPTIMIZING EP&B WALLS

Kevin L. Smith Construction, from left: Scott, Chad, Kevin, and Josh.

A completed EP&B demonstration home in Grand Rapids, Michigan.

The final recommended EP&B configuration uses two extended top plates, in addition to the extended bottom plate.

Circular saw blades are available for cutting rigid foam, which can reduce foam dust by 95%. *(Photo courtesy Bullet Tools)*

A 4+-in. panel pilot bit with a self-driving guide tip and at least 2-3/4-in. cutting depth can simplify cutting window and door openings. *(Photo courtesy CMT USA, Inc.)*

The Extended Plate and Beam Wall system has been under development for several years and extensively vetted through research sponsored by the U.S. Department of Energy, the U.S.F.S. Forest Products Laboratory, the New York State Energy Research and Development Authority, and industry sponsors including The American Chemistry Council and Dow Chemical. This guide is the result of a 2015-2017 DOE Building America Research project. The construction photographs are from observation site visits to two different demonstration projects in Grand Rapids, Michigan.

Home Innovation Research Labs extends our thanks to Arn and Kim from McIntyre Builders, Inc., and Kevin, Josh, Scott, and Chad from Kevin L. Smith Construction. These builder partners generously allowed us to document the entire construction process, responded to questions, and provided excellent feedback. As a result of their participation, several modifications were made to the EP&B configuration which will result in reduced complexity, lower cost, and faster build times.

Optimization

The EP&B field tests led to several improvements, which are detailed in this Guide. However, the photographs necessarily show the original, tested configuration. The first design for the EP&B wall extended only two of the three wall plates—the bottom and the second top plate—and used 4-in. nails with a slightly different fastening schedule. While this configuration was strong and minimized thermal bridging due to framing, improvements to complexity and cost were found. The new configuration extends all three plates and uses 3-1/2 in. nails which are readily available, reasonably priced, and fit into almost any nail gun that is currently in a framer's tool trailer. The WSP fastening follows a sheathing perimeter/field schedule that will be familiar to most framers. Having all plates be the same width reduces confusion on the job site—plates won't be mistaken for studs. Please keep these improvements in mind as you compare the photos from the field demonstration project to the illustrations, schematics and text in this guide.

Preparation

As a result of the 2-in. layer of foam plastic insulating sheathing (rigid foam), an EP&B wall requires nails that are longer than you may be used to, and a more frequent nailing schedule. Standard nail guns accommodate the 3 -1/2-in. nails, and this fastener can also be used at other framing locations, such as end-nailing studs and joining adjacent studs, which simplifies construction.

Plan on about twice as many nails for WSP attachment than you would normally use. But time and material savings in other aspects mean that an EP&B wall is typically less expensive per square foot and per equivalent R-value, compared to other methods which use rigid foam.

Before beginning, Gather some tools for working with foam – a utility knife, and 3-in. to 6-in. hand blade, a Skilsaw, table saw, and Sawzall. Two-inch foam does not snap cleanly enough for tightly-butted connections, and the field-test crew recommends using non-scored rigid foam if it's available in your area.

A pilot panel router bit with a self-driving guide tip and at least a 2-3/4-in. cutting length can be a real time-saver, allowing the foam and OSB to be cut in a single pass for openings.

EP&B Wall Layout

The EP&B configuration incorporates plates that are one lumber dimension wider than studs, so keep this in mind when placing the order from the yard. Otherwise, all takeoffs and materials are typical. Because studs and plates are different widths, the EP&B configuration can actually reduce error at the jobsite – pre-cut studs are unlikely to be mistaken for other framing lumber.

EP&B walls have been tested in two framing configurations:

- 2x4 studs with 2x6 plates, yielding a 6-in.-thick wall of R-23 to R-27; and
- 2x6 studs with 2x7.5* plates, yielding an 8-in.-thick wall of R-30 to R-33.

*The asterisk is used to indicate this dimension is actual, rather than nominal.
2x6/2x7.5* can use 16-in on center (o.c.) standard or 24-in. o.c. advanced framing.

Nominal 2x8 lumber is 7.25 in. wide, so a 2x8/2x6 combination does not yield enough gap for 2-in. rigid foam, which is the most readily-available and cost-effective thickness. Home Innovation estimated the costs of various solutions for a higher-R EP&B wall, and found that ripping 2x10s to an actual 7.5-in width is not only the least expensive solution, but rivals the 2x4/2x6 configuration on a per -sf basis, and is nearly 25% less expensive on an R-value basis.

The test crew laid out top and bottom plates along the deck edge, temporarily toe-nailed the bottom plate, then measured and marked the locations of studs, cripples, and openings. If building the 2x4/2x6 EP&B configuration, use 2x6s for this layout. If building a 2x6/2x7.5* configuration, use the 7.5-in. lumber ripped from 2x10s.

Top and bottom plates can be measured and marked together at the deck edge, and then the top plate can be shifted to the middle of the deck to make room for studs and headers. The crew tacked the 2x6 bottom plates to the deck so when they stand the wall up it doesn't slip over the edge. Markings face up and out.

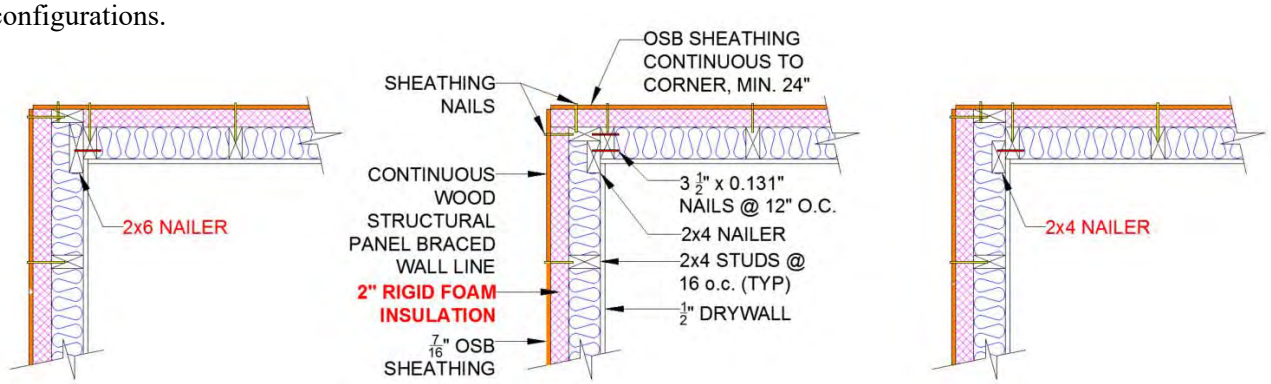
During the planning process, consider how the 2-in. rigid foam sheathing laps at outside and inside corners, and how it affects the construction order, the fastening of the corners, and the integrity of the thermal breaks.

If using an outside corner configuration that has a vertical framing member flush with the exterior plane of the wall, it's handy to orient those on the gable ends of the building, to add bearing capacity below the plates. This is a belt-and-suspenders approach—unlike with walls that have c.i. added to the exterior or those whose only sheathing is rigid foam, there is no need for a doubled truss at each gable end. The WSP is well-nailed to the double, extended top plate supported by typical studs—that combination can easily bear the limited self-load of the truss. The following figures show several acceptable outside corner configurations.

Temporarily nail bottom plate to deck.

Lay out 2x6 top and bottom plates at deck edge; mark stud locations.

Lay out studs and framing lumber according to plan. Remember that in the final recommended EP&B configuration, all three plates should be the same dimension.



Double headers have a 1-in. foam sandwich; single headers have a 2x4 nailer added at bottom for attaching window trim.

Move the top plate to the center of the floor deck, lay out studs, and cut a spacer from waste 2x4 to measure for 2-in. rigid foam.

Use the spacer when end-nailing studs to measure the gap for the foam layer.

Headers (Where Second-Floor Rim Header is Not Used)

Build headers according to plan. The crew used single hem-fir 1x's where possible, and added a 2x4 at the bottom with a layer of 1-in. rigid foam for nailing window trim. This maximizes space for insulation. They used double hem-fir for larger spans, with 1/2-in. rigid foam sandwiched in between the layers.

Framing

Mark out stud and cripple locations, measure and cut the lumber, and lay out the framing. Lay out studs and headers at the marked locations and cut cripples according to plan.

The EP&B wall configuration places the OSB sheathing at the outside plane of the wall, on top of the rigid foam and nailed to the extended plates at top and bottom. Full-width framing is not required at window and door openings. Hinges for swinging doors, and tracks for sliders are coincident with the stud and cripple depth, which bear the horizontal and vertical loads and torque.

The window's framing enclosure can bear on the OSB and span the rigid foam. Nails carry the bulk of the vertical load and the OSB bears the wind load. Full-depth framing can be added if extra strength is desired, but it is not necessary, and it increases thermal bridging due to framing.

The test crew's typical wall uses let-in bracing and rigid foam as the only sheathing. It's their habit to add a 1x6 sill at window openings to span the wall's width and support the window frame, and they did that in the EP&B test house as well. This is not required but may be preferred.

Lumber often has imperfections and may be twisted or bowed. A uniform gap is necessary for the rigid foam to rest against the studs and still allow the OSB to be attached flush to the face of the plates. The crew made 2-in. spacers out of scrap wood. By holding the spacer at the top of each stud end, flush with the face of the plate, they were able to end-nail each stud and ensure room for the FPIS so the wood sheathing could be nailed flush and flat over the rigid foam.

End-nail the headers and cripples. Lay in corners and nailers for interior partition wall connections. Cut, place, and fasten the 2x6 (or 2x7.25*) second top plate, leaving gaps to tie in the partition wall framing at the top of the wall and to tie corners and adjacent wall sections together.

Position studs and headers according to layout markings on plates. Remember that all plates will be one dimension wider than studs, unlike what is shown here.

End-nail headers and studs. Remember that all plates will be one dimension wider than studs, unlike what is shown here.

Leave gap in top plate for tying-in interior partition walls. Remember that all plates will be one dimension wider than studs, unlike what is shown here.

Planning: Insulating Rigid Foam Layer

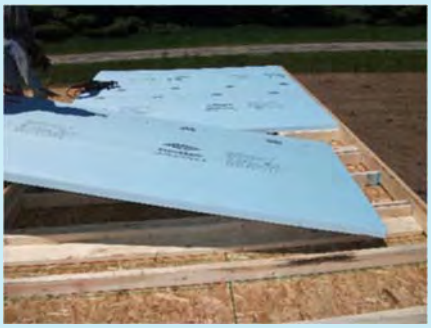
A table saw or circular saw is best for vertical cuts (rips) in the rigid foam sheathing that provides the thermal break. Cross-cut the foam to fit between the plates using the table saw; cut to match the full length of the studs. Consider the kerf and ensure that the rigid foam will be snug; 90-degree cuts avoid gapping. Lay the pre-cut rigid foam into place between the top and bottom plates, atop the studs. Don't worry about a small bow in the rigid foam—the OSB will be stiff enough to overcome that, once it is nailed on.

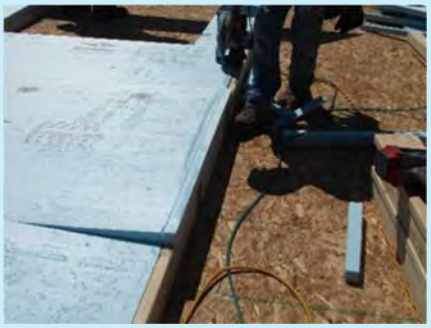
Behind headers and cripples, take advantage of scrap foam pieces, and tack them into place with a few cap nails. All rigid foam joints should land on studs.

In the EP&B configuration, the foam sheathing installed on the interior side of the OSB provides a distinct, centrally-located vapor control plane with effective drying to the direction where the source moisture came from – exterior to the exterior and interior to the interior. To ensure this layer is uninterrupted, use manufacturer-approved tape (such as DOW Weathermate™) to seal all seams between rigid foam panels and where they meet framing at the top and bottom plates. Check the spec sheet to make sure the tape is approved for use on wood. A single line of 2-7/8-in. tape at the top of the wall can seal both the foam/plate connection and the plate/plate connection. Taping the seams adds a level of protection where interior vapor drive is higher, such as winter conditions in CZs 6, 7, and 8. Fully detailed taping also allows the rigid foam layer to serve as the air barrier.

Precutting lengths of rigid foam is preferred, but if you do have to trim foam in place next to an extended plate, be sure to adjust the guide plate of the circular saw to ensure you do not cut into the lumber below.

ALTERNATE: If you do not have a table saw on site, you can use a circular saw to cut the rigid foam sheathing in place atop the walls. Lay the foam onto the wall, snugged to the bottom plate and overlapping the top plates. Use a few cap nails to hold the FPIS in place, then snap a chalk line along the top edge coincident with the bottom of the first top plate. Use a circular saw to cut away the excess foam. Take care to set the guide plate for 2-in. depth and seat the guide of the saw flat against the foam's surface for a square cut to ensure a snug fit when the foam is pressed into place between the plates and against the studs.





A table saw trims 2-in. rigid foam cleanly, with little waste or debris.

Measure and cut rigid foam for a snug fit between the EP&B wall's top and bottom plates.

Cap nails can keep the rigid foam in place until the OSB is fastened over the top.

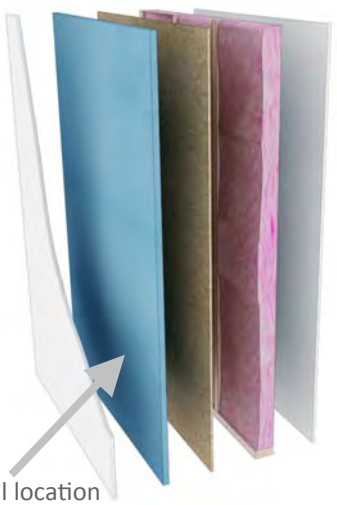
Adjust the height of the circular saw blade to protect the framing.

Wood Sheathing over the Rigid Foam Layer Allows for Standard Installation Approaches

The EP&B system locates the structural sheathing exterior to the foam sheathing. Windows, doors, the drainage plane, and the water-resistive barrier (WRB) are all located as in standard frame wall systems with well-known installation methods.

The EP&B wall system achieves more than 95% c.i. without adding complexity or risk, to yield the following advantages:

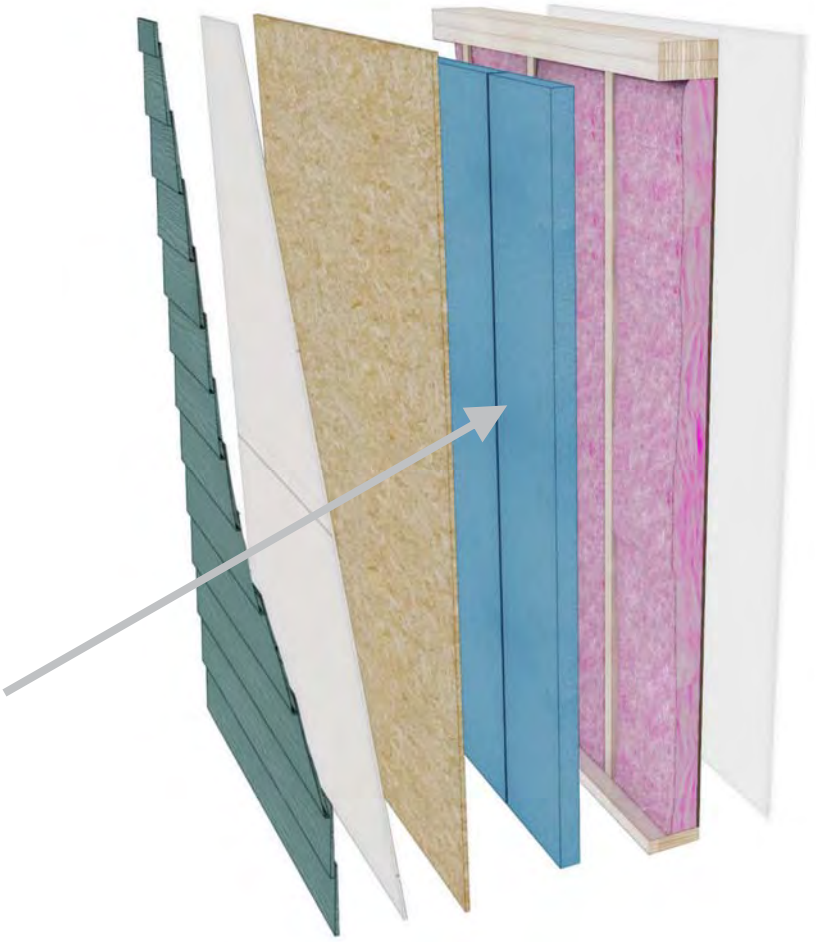
- Has a clearly identified location for the drainage plane and uses standard WRB installation;
- Allows windows and doors to be installed as in typical framing;
- Keeps the cavity warmer because of the foam's relative thickness and its location in the assembly;
- Slows interior moisture movement to the OSB or other structural sheathing;
- Promotes cavity drying to the interior and wood sheathing drying to the exterior; and
- Lab tests confirm good structural performance.



Typical location of rigid foam: exterior to WSP

Problem Solver

Typically, rigid foam c.i. located in the traditional location exterior to the structural sheathing requires special attachment of windows, doors, and siding. Thickness in excess of 1-in. may require additional furring and support for windows and doors, as well. Depending on the type of cladding, the IRC may require continuous backing, which would necessitate a 1/2 in. foam fill layer between furring strips. This ordering also complicates decisions about the location of the drainage plane and WRB—complications that are avoided with the EP&B system.



EP&B location of rigid foam: interior to WSP to simplify installation of windows and siding

Agenda Item 2d

EP&B THERMAL PERFORMANCE

Light-Frame Wall Performance—Walls with a 2 in. layer of exterior c.i. provide improved performance.

Light Frame Wall System[a]	Wall Thickness[b]	R-Value Nominal[c]	U-Value Calculated[d]	Wall Area % by Thermal Path			
				Cavity only	Cavity/c.i.	Lumber/c.i.	Lumber (bridge)
2x4 Standard 16 in. o.c. R13	4 in.	13	0.0840	75%	n/a	n/a	25%
2x6 Standard 16 in. o.c. R20	6 in.	20	0.0595	75%	n/a	n/a	25%
2x6 Advanced 24 in. o.c. R20	6 in.	20	0.0535	85%	n/a	n/a	15%
2x4 Std 16 in o.c. R13 + R10[e]	6 in.	23	0.0459	0%	75%	25%	0%
2x4 Std 16 in o.c. R13 + R10[f]	6 in.	23	0.0441	0%	75%	25%	0%
2x4/2x6 EP&B R13 + R10	**6 in.**	**23**	**0.0461**	**0%**	**75%**	**20%**	**5%[h]**
2x6/2x7.5* EP&B R21 + R10[g]	**8 in.**	**31**	**0.0344**	**0%**	**85%**	**10%**	**5%[h]**

[a] Vinyl siding, house wrap, #2 SPF lumber, 1/2 in. OSB, 1/2 in. gypsum drywall

[b] Wall framing, sheathing, and furring

[c] R-value in hr·°F·ft^2/Btu; includes cavity and c.i. values

[d] U-value in Btu/(hr·°F·ft^2/); includes all layers, interior/exterior finishes and film factors; calculated using ASHRAE Parallel Path method

[e] One layer of 1.5-in. rigid foam, with 1/2 in. foam layer alternating with let-in furring strips at 16-in. intervals

[f] One layer of 2-in. rigid foam, with 1x4 surface-mounted furring strips at 16-in. intervals

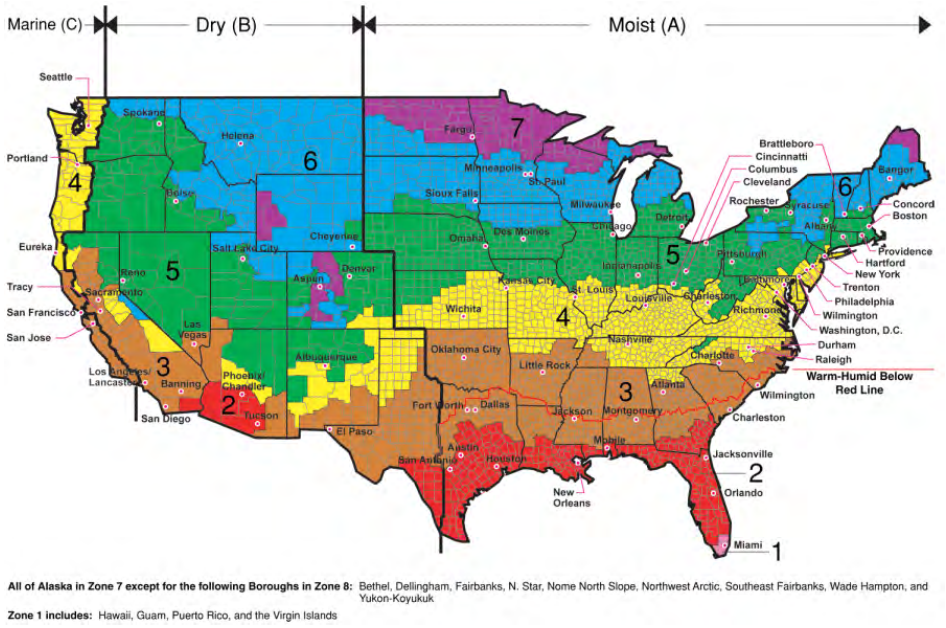
[g] 24-in. o.c. advanced framing

[h] Using an inset rim beam with a layer of c.i.

Note: All exterior c.i. examples use extruded polystyrene (XPS)

EP&B Walls Meet or Exceed Energy Code Requirements in All Climate Zones

The basic EP&B wall system using 2x4 studs and 2x6 plates meets or exceeds the most stringent IECC prescriptive insulation requirements for above-grade walls in all U.S. CZs.



DOE CZ map

Compared to an IECC code-minimum prescriptive wall, the typical 2x4/2x6 EP&B wall offers an 82% improvement in CZ 1 and 2, and a 25% improvement in CZ 3, 4, and 5, when compared using the calculated whole-wall thermal performance. EP&B provides nearly the same whole-wall performance as the prescriptive wall in CZs 6 through 8, with less cost and complexity.

The extended plates constitute only a 4.4% thermal bridge. This reduces performance by about R-1 compared to 100% exterior c.i., but with practical benefits that many builders find compelling.

For next-level performance, the EP&B configuration can be adapted to 2x6 stud framing, using a true 7.5 in. plate by ripping 2x10's to allow for the 2 in. layer of c.i. This configuration achieves nearly a 30% assembly R-value increase over the calculated performance of IECC prescriptive minimum walls in the coldest climates.

EP&B walls can contribute to whole-building thermal performance to help qualify for voluntary energy certification programs such as National Green Building Standard (NGBS), Leadership in Energy Efficient Design (LEED), and ENERGY STAR® for Homes.

Agenda Item 2d

EP&B MARKET OPPORTUNITIES

Flexibility

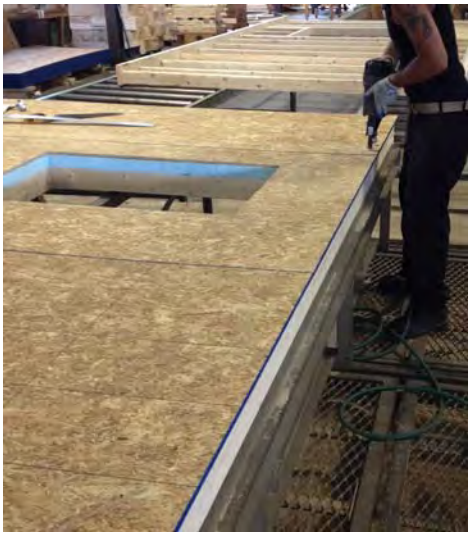
The EP&B method launches directly from the starting point most comfortable for residential builders today: 2x4 light framing. The technique is innovative; however, the system is non-proprietary—builders can choose from a broad variety of sheathing, rigid foam, WRB, and cavity insulation options, and the system is readily adaptable to field modifications.

Maintenance & Comfort

The EP&B wall's nearly continuous 2-in. layer of rigid foam ensures a warm cavity and reduces the potential for condensation and resultant mold growth. Dryer wall assemblies also contribute to greater durability and longevity of materials, which reduces maintenance cost and effort. Additionally, higher R-value means a warmer interior surface in the occupied space, which improves occupant comfort.

Can Be Panelized & Shipped

Often builders choose to have wall components factory-fabricated to streamline the construction process. Many high-performing walls do not lend themselves to factory panelization, either due to their complexity or to the risk of damage in shipping. The EP&B system design requires modest changes to the panelization process, but once employed, panels can be easily constructed and shipped from the factory to the worksite. The structural sheathing effectively protects the foam sheathing from damage during transport.



Factory Panelization—EP&B Walls can be factory fabricated.

Factory Panelization—Bundling and strapping panels.

Factory Panelization—Loading and shipping panelized wall sections from the factory.

Factory Panelization—EP&B wall system allows the contractor to realize scalar and waste reduction savings.

EP&B Wall Panel Erection—Note top plate end gap and sheathing overlap to tie into the neighboring panel.

EP&B COMPARED TO TYPICAL LIGHT-FRAME CONSTRUCTION

Competitive Cost

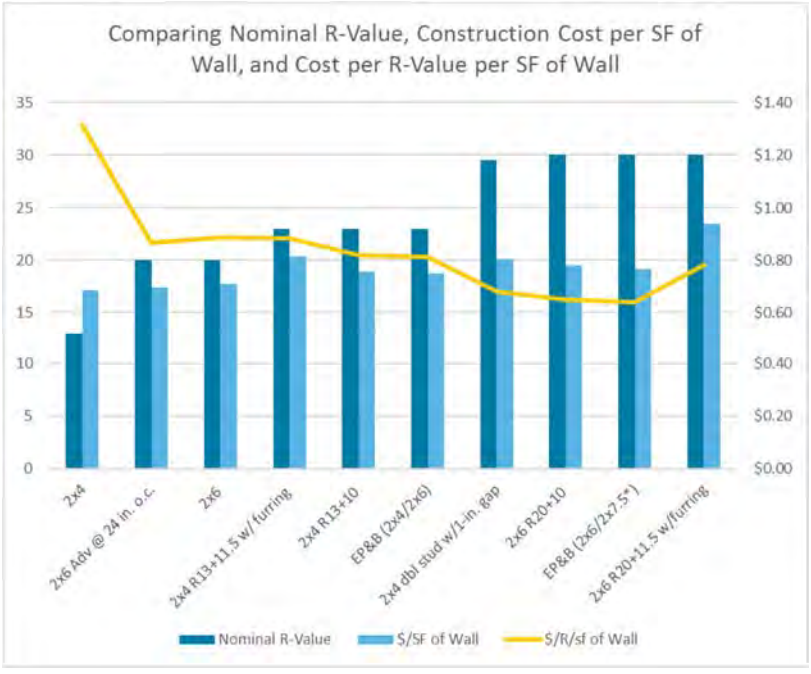
The EP&B system offers good value and reduced risk in the transition to high-R, high-performing walls. In the following graph , R-value (dark blue bar) and cost per sf of wall (light blue bar) are measured on the left axis. On a unit-area basis EP&B costs the same or less than an IECC prescriptive 2x4 wall with 2 in. of c.i., with arguably less complexity. For a typical 1,800-ft^2 single-story home, that difference can translate to several hundred dollars. When measured by the cost of the R-value provided per square foot of wall (right axis and yellow trendline), the 2x6/2x7.5* EP&B configuration meets or beats all competitors.

Advantages of Continuous Exterior Insulation

For decades, high-performance builders have used rigid insulation installed to the exterior of the wall sheathing (and sometimes replacing the sheathing) to increase thermal performance. This method effectively eliminates thermal bypass (or short circuits) caused by the framing—essentially covering nearly 100% of the framing geometry with a continuous layer of insulation.

In addition to improving thermal performance, the rigid foam c.i. can potentially reduce air infiltration and improve moisture performance. But rigid foam as the exterior layer of a wall also impacts installation details, including window load transfer and flashing, drainage plane and vapor barrier considerations, and siding attachment methods.

Although there is a long history of exterior insulation use, material selection and detailing requirements can still be challenging for many builders. The EP&B system provides an alternate, straightforward approach to incorporating c.i., especially compared with wall systems that require additional furring for siding installation.



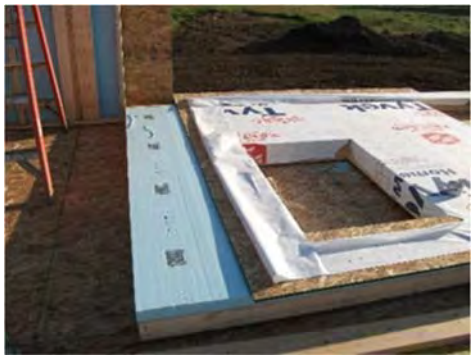
Interior view of EP&B wall system.

Exterior view of EP&B wall system.

Left, Cost Comparison: EP&B walls provide excellent incremental thermal and construction cost value. (16-in. o.c. framing unless otherwise noted.)

Note: Home Innovation Research Labs performed cost comparisons in 2015 for a typical 200-ft^2 residential wall with all components including windows and siding and rim beam. The comparison cost estimates for 2x4 and 2x6 walls with 2 in. of c.i. exterior foam include taped foam panel joints to perform as the WRB. The EP&B wall cost estimate includes a separate WRB.

OSB sheathing must always be oriented vertically, for structural bracing.



Two adjacent sections of wall must be planned to stagger the vertical joints of the rigid foam and OSB.

Two adjacent sections of wall must be planned to stagger the vertical joints of the rigid foam and OSB.

Planning: Wood Structural Panel

For required structural bracing to match the performance of an IRC prescriptive wall*, use plywood or oriented strand board (OSB) between 3/8-in. and 15/32-in. The wood structural panel (WSP) in an EP&B wall must always be oriented vertically—no horizontal joints are allowed. All WSP and rigid foam joints must occur at studs, but not at the same stud – plan your sheet placement to avoid the occurrence of a WSP seam at the same stud where two sheets of rigid foam meet. Butt rigid foam joints tightly together, but provide the typical 1/8-in. gap when installing WSP (a 10d box nail works great) or as required by code or manufacturer's installation instructions.

When building a single long wall in two sections that will be attached once the walls are tipped up, plan for the overlap of the rigid foam and WSP, to maintain the staggered vertical joints (two photos, bottom left).

For the first two walls, generally the long walls at opposite sides of the building, you can fully complete all wall layers (including rigid foam and OSB) while the wall is laying flat on the floor deck. When building the perpendicular short walls, plan your outside corners to maintain the thermal break, which probably means leaving some gaps in both the rigid foam and the OSB, to be filled in after the wall is erected.

Plan your cheat: if the pre-cut studs are at 92-5/8 in., the raw wall height with three 2x plates will be 97-1/8 in. A 4x8 sheet of OSB or plywood is 95-7/8 in. x 47-7/8 in., which makes it 1-1/4 in. short. You can apply that entire gap at the top and fasten to the first top plate (rather than the second top plate) for structural bracing, or you can split the difference by leaving a 5/8-in. gap at both top and bottom.

*See bottom of page 1 for usage recommendations. Structural lab testing based on AC 269.1 indicates the EP&B wall performs as well or better than a prescriptive WSP braced wall.

ALTERNATE: A third option for OSB installation is to do what the Grand Rapids framing crew did. The first-floor rim was 10 in. engineered lumber inset from the outside plane to accommodate 1 in. of c.i. To simplify air-sealing at the rim band, our crew designed the walls so that the OSB would lap the sole plate and extend down across the rim; this required using 9 ft. OSB and some care during tip-up.

See page 13 for rim band options. In this case, the bracing connection was still made by nailing with 3-in. o.c. spacing to the sole plate, and the bottom edge of the OSB was nailed through the foam to the rim at 6-in. o.c. spacing. A ripper was added at the bottom for a seamless exterior sheathing surface to accept cladding. If the wall height allows the sheathing to extend all the way to the sill plate, that location can become the bracing connection with 3-in. o.c. nailing.

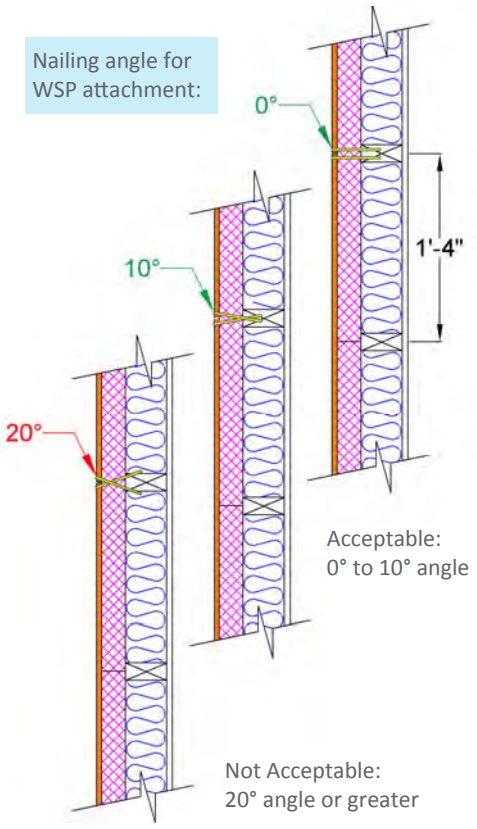
Nailing EP&B Walls

Due to the added thickness of the rigid foam, an EP&B wall requires longer-than-typical nails and a modified nailing schedule. Most standard nail guns marketed for residential framing can accommodate the 3-1/2-in. nails. You will probably be familiar with the perimeter/field pattern from typical stapling schedules, but for EP&B it is doubled: 3-in./6-in. instead of 6-in./12-in. Please note that staples are not an approved substitute for nails in the EP&B wall configuration.

Where two sheets of OSB meet in typical light-framed walls with wood structural panels (WSPs), nails are shot at a slight angle to maintain the necessary setback from the panel edge.

The typical angle for attaching structural sheathing directly to a light-framed wall is too steep for EP&B because of the 2-in. layer of rigid foam. It is necessary to straighten the angle so the nail does not over-reach and "blow past" the opposite side of the stud. Full fastener engagement at the specified frequency is required for the wall to meet the IRC bracing requirements. The nail gun does not give any indication of whether the nail has sunk entirely into the framing or has driven through and past the lumber. You'll have to examine this after the wall is standing. From inside the wall, you can use your hand to push the foam near the stud to test the connection.

This level of quality assurance is necessary with any WSP-braced wall that is built on the floor deck and subsequently tipped into place.



ABOVE, plan view: Correct nail gun angle achieves full fastener engagement at wood sheathing joints. If vertically staggered, nails can be angled up to 10 degrees. Angles of 20 degrees and more will cause the nail to blow past the stud on the opposite side, weakening the wall and requiring re-nailing from the exterior once the wall has been tipped into place.

LEFT, EP&B wall panel: 3-1/2-in. nails at 3-in. spacing at panel edges, 6-in. spacing for the field (3/6 perimeter/field pattern). See page 13 for rim insulation strategies.

EP&B Connection Schedule*

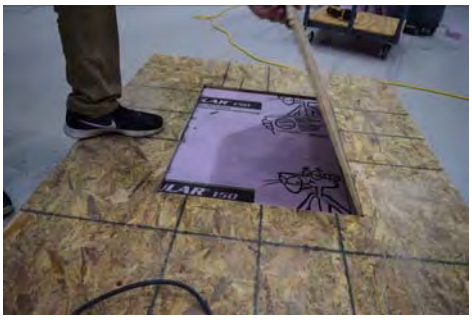
Connection	Fasteners	Schedule
EP&B Perimeter of Sheathing	3.5 in. x 0.131 in. (framing nail gun for EP&B)	3 in. o.c.
EP&B Field of Sheathing	3.5 in. x 0.131 in. (framing nail gun for EP&B)	6 in. o.c.
Top Plate to Top Plate (face-nail)	10d box (nail gun: 3.5 in. x 0.131 in.)	12 in. o.c.
Top/Bottom Plate to Stud (end-nail)	16d box or 10d box (nail gun: 3.5 in. x 0.131 in.)	Three per stud
Stud-to-Stud -Braced Wall Panels (face-nail)	16d box (nail gun: 3.5 in. x 0.131 in.)	12 in. o.c.
Corner studs in direct contact with each other	16d box (nail gun: 3.5 in. x 0.131 in.)	12 in. o.c.
Corners: WSP from both intersecting walls nailed directly to a common 2x framing member	2.5 in. x 0.131 in. nails (nail gun: 3.5 in. x 0.131 in.)	6 in. o.c.
Corner studs separated by up to 2 in. of rigid foam sheathing insulation, two options	5 in. x 0.135 in. nails	6 in. o.c.
	6 in. x 0.190 in. structural insulated panel screws	12 in. o.c.

*Notes: Staples are NOT an acceptable substitute for nails in the EP&B wall system. Table identifies potential opportunities ( ) to substitute with the 3.5-in. nail required for EP&B sheathing attachment, for economy of time.

Table adapted from IRC Table R602.3(1). This table does not supersede local code requirements for general framing and fastening.

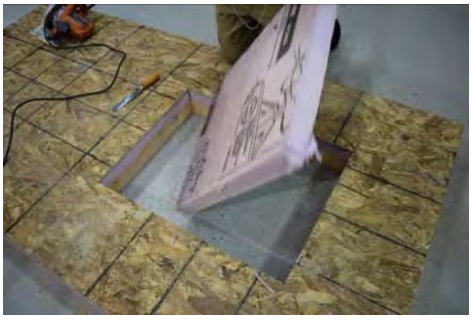
Snap chalk lines and drill holes.

Sink the circular saw to catch the first drill hole. Do not overcut at corners.



Remove OSB.

Cut corners of remaining rigid foam with a hand blade or reciprocating saw.



Remove the foam from the opening.

Window and Door Openings

Removing both the rigid foam and the OSB in a single operation is the preferred method, saving time and effort. Double check that your penciled notes for window and door openings will still be visible on the top face of the second top plate once the OSB is placed and nailed. Lay the OSB over the rigid foam and attach with 3-1/2-in. nails at the 3/6 schedule. Economize by using foam scraps at header and cripple locations. Snap chalk lines at all vertical and horizontal opening edges.

CIRCULAR SAW: The cleanest cuts with the least debris will be made with a circular saw. A 7-1/4-in. blade is required to cut the full depth of the 2-in. rigid foam and the 7/16-in. OSB. Drill all four corners and snap chalk lines. Start the saw a few inches from the drilled corner and sink the blade into the OSB. Follow the chalk line on all four sides. Cut the OSB all the way to the drilled corner, but do not overcut—the short sections of rigid foam in each corner can be removed later with the 4-in. blade or a reciprocating saw. Follow similar steps if using a track saw.

ROUTER: Use a 4-in. (or longer) pilot panel bit with a self-driving tip and a cutting depth (flute) of at least 2-3/4 in. Punch through each opening near a corner and use the 2x framing below the rigid foam as a guide. A long bit with a solid guide head is necessary to reach the full depth and seat against the 2x4 so the path will be true. A router creates more debris than a circular saw.

ALTERNATE: Two Separate Steps. Cut the rigid foam in place first with a reciprocating saw, and then lay in the OSB and make a second pass with the circular saw. This is more time-consuming, but has the advantage of providing some limited view of the framing, and is thus more forgiving. With practice, this can be done with very little time taken for measurement.

Once the rigid foam is in place and before laying in the OSB, cut the openings out of the foam with the reciprocating saw. Use the 2x4 framing to guide the saw's path—this is done both by eye and by feel. Although the cut is not crisp, it's clean enough to provide a good connection to the wood framing if you keep the blade perpendicular and don't remove too much material. Initially, you'll guide the saw along the 2x4 by feel. Once the foam rectangle is removed from the opening, you may need to tidy up some edges. Then lay in and nail on the OSB, and snap your chalk lines. Use a circular saw set to 1/2-in. depth. Having already removed the rigid foam, once the first opening is made by the circular saw, you'll be able to see the 2x4 framing below and use that as an additional visual guide.

Use the 2x4 framing to guide the reciprocating saw to cut out FPIS.

Sweep away debris and lay in OSB, careful to stagger joints vs foam.

Nail OSB at top and bottom plates and use circular saw to cut OSB at opening.

Agenda Item 2d

Water-Resistive Barrier

Attach and detail the water-resistive barrier (WRB) when all openings have been cut, both top plates are nailed on and the OSB is attached per the EP&B Fastener Schedule. Fold back the WRB from wall edges and tack it temporarily.

Attach WRB before wall erection to save time and effort. Use cap nails or wide staples per manufacturer's requirements.

Cut window openings. See window installation and detailing guidance on page 22.

Staple WRB into place. Fold back and tack long edges that need to wrap down or around when the wall is later tipped up.

Rim Band

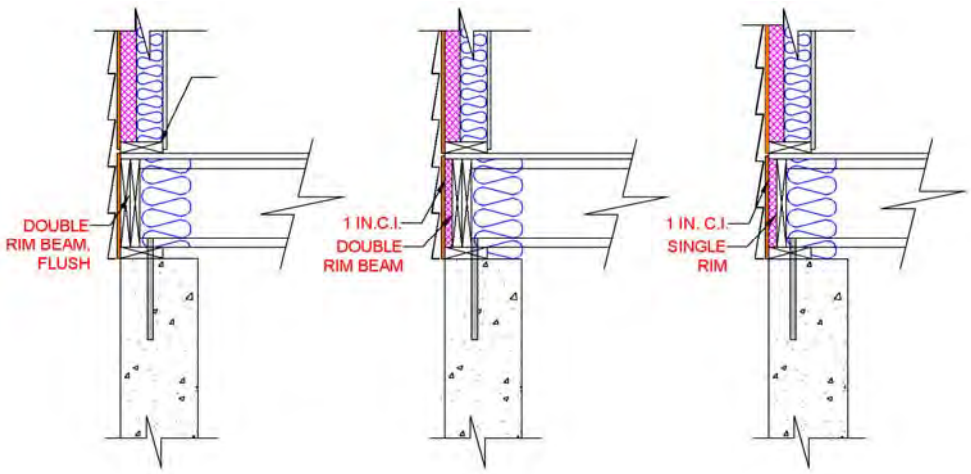
Lab tests confirm good structural performance with a double rim located at the exterior plane. Insetting a single or double rim by 1 in. also meets IRC performance targets in lab tests, and improves thermal performance by making room for a continuous layer of rigid foam. A final option allows a 2-in. inset if the WSP spans the entire wall/rim assembly, and the scheduled fasteners connect the bottom OSB edge to the sill plate. See illustrations at the bottom of this page.

If you intend to add c.i. to the rim, now is the time. The Grand Rapids demonstration crew used 1-in. rigid foam and made sure the thermal break was continuous at corners.

Cut rigid foam for rim.

Tack c.i. rigid foam to rim band.

Ensure a complete thermal break.



Rim Options – Double Rim joists may be flush to the exterior of the wall or inset by 1 in. to accommodate rigid foam layer. A single rim joist must be inset by 1 in.

NOTE: A single rim board must is not sufficiently strong to perform the duty of a header. In this case, utilize typical headers of solid or laminated lumber.

NOTE: Insetting the rim by 2 in. is allowed only if the full length of the WSP spans the entire rim height and is fastened to the sill plate per the EP&B nailing schedule.

EP&B SILLS, HEADERS, AND RIM HEADERS

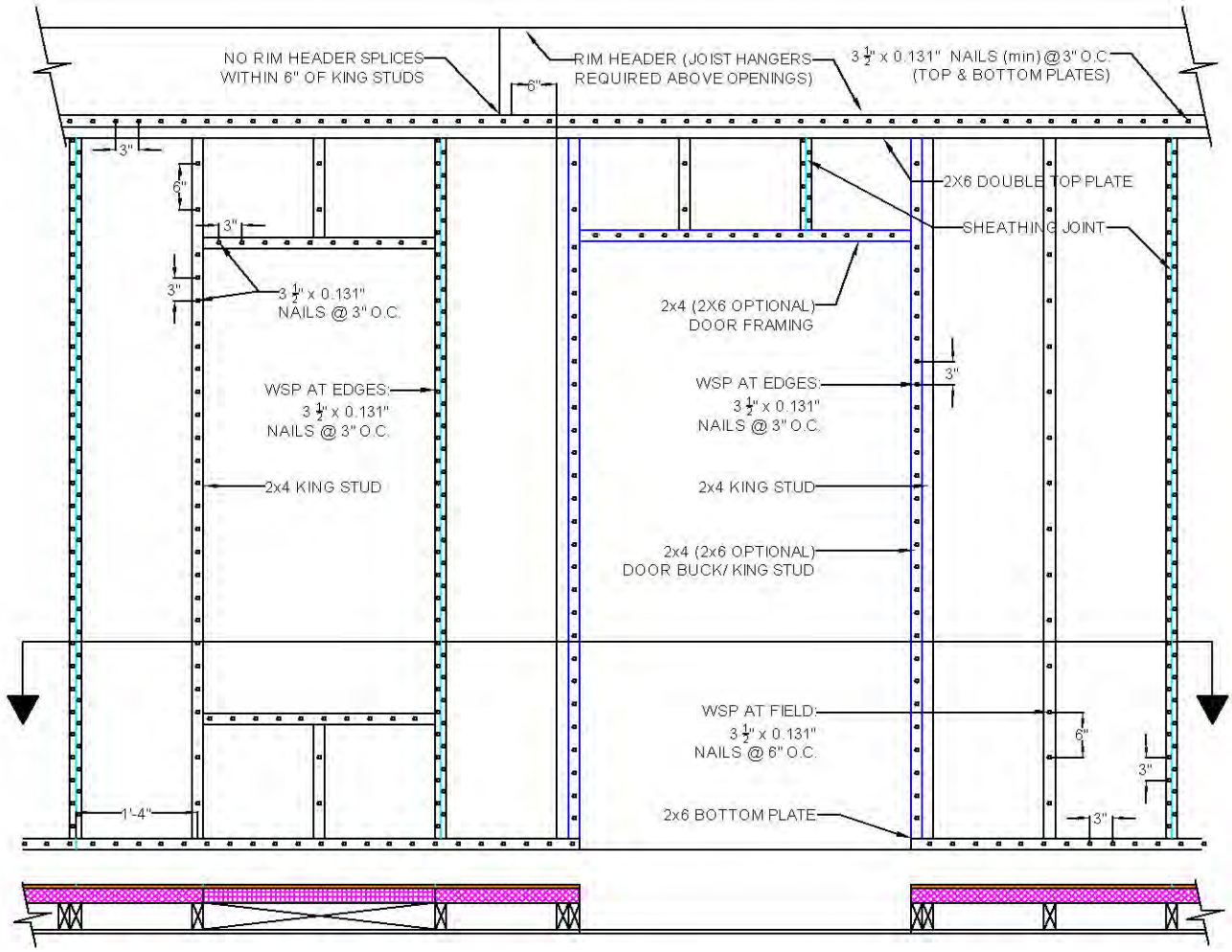
Double Rim Beam as header; note joist hangers and caulk sealing.

The EP&B wall design can use single rim joists for non-load-bearing walls with no openings, and typical headers. For two-story buildings, a double rim can act as the header for openings below and provide ample bearing for the floor joists. The joists above the opening will require joist hangers. Use of double rim headers is cost-effective and can stream-line the wall installation and allow the c.i. to span more wall area, reducing framing short-circuits. Windows can be installed in the EP&B wall with no special modifications. A 1x6 sill is sometimes added for convenience, but not required.

1x6 sill added (not required).

Double header.

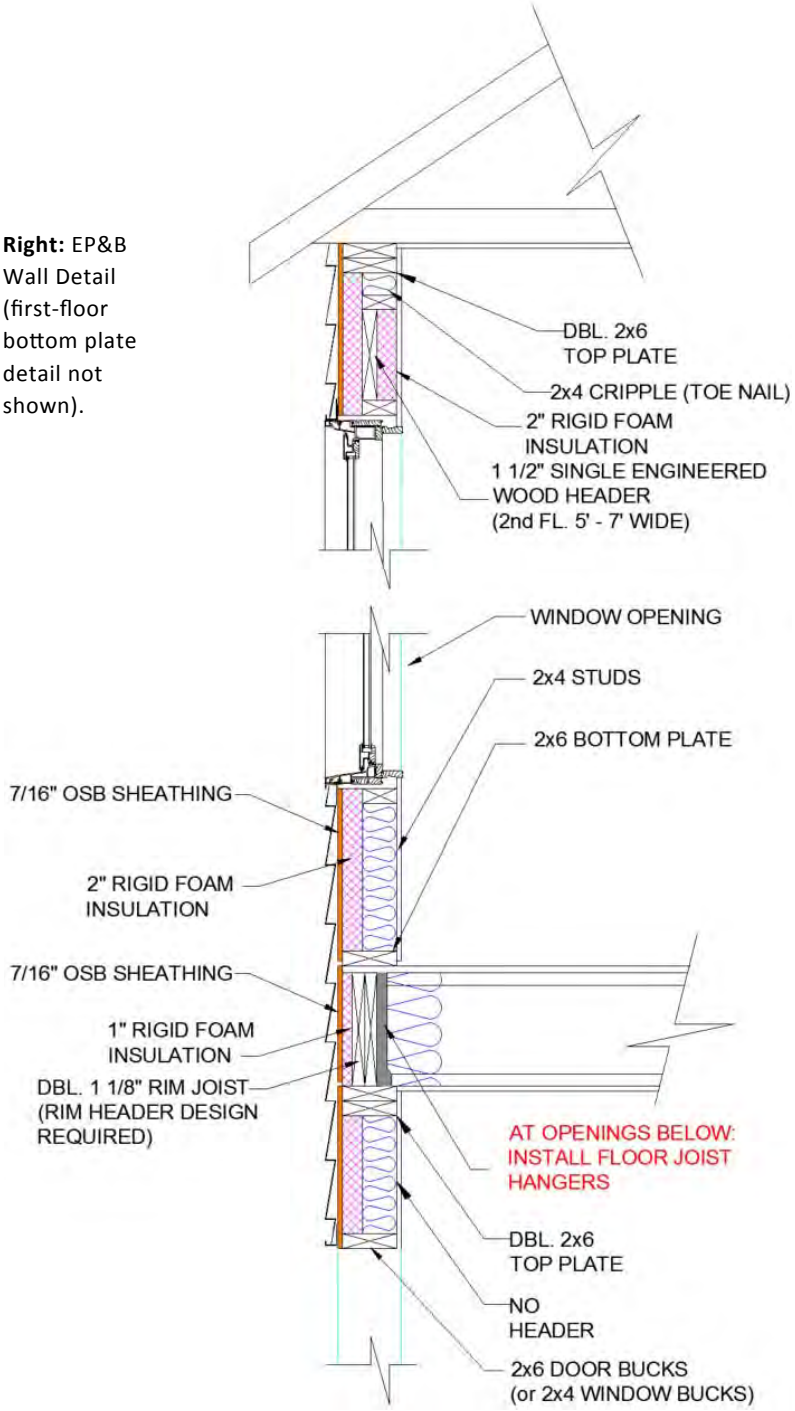
Single header, with 2x4 nailer.

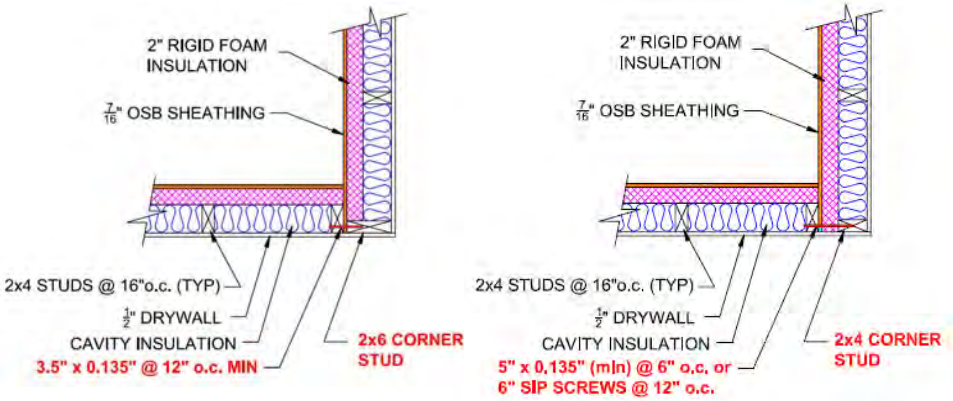


EP&B Wall Elevation – Joists attached to the double rim beam above wall openings require joist hangers. Use 3-in. nail spacing for all edges of wood sheathing panels, including at openings. No rim header splices are allowed within 6 in. of king studs.

EP&B WALL LAYER FUNCTIONS

Right: EP&B Wall Detail (first-floor bottom plate detail not shown).





The EP&B wall system detail at left is summarized for a 2-story house design (the WRB layer is not shown). EP&B unique characteristics include:

- Extended plates provide a 2-in. space for the rigid foam layer;
- Windows are framed with 2x4 framing, reducing thermal bridging;
- Doors are framed with either 2x4s (typical) or 2x6s (heavy-duty);
- Structural wood sheathing is attached directly to the extended plates, for shear resistance;
- Structural wood sheathing is detailed as the air barrier, as with typical light-framed walls;
- Double rim provides load transfer between floors;
- Double rim can act as a header for the openings below (joist hangers required);
- Double rim can be inset up to 2 in. to accommodate rigid foam c.i.; and
- A single header is used for many openings in the second floor to maximize insulation.

Lab tests confirm good structural performance with the rim located at the exterior plane, using the nailing schedule described in this guide.

Insetting a double or single rim by 1 in. also meets IRC performance targets in lab tests, and improves thermal performance by making room for a c.i. layer of rigid foam. A final option allows a 2 in. inset if the WSP spans the entire wall/rim assembly, and the scheduled fasteners connect to the sill plate.

Note that a single rim board is not sufficiently strong to perform the duty of a header. In this case, utilize typical headers of solid or manufactured lumber.

Left: Two recommendations for inside corners.

Raising Walls

Except for planning for OSB and foam joints to be offset, raising the EP&B wall is fairly typical. Prior to lifting the walls into place, apply caulk or foam to the underside of the bottom plate to air-seal the sole plate to the floor deck.

When there is a gap between adjacent studs of separate panels, apply spray foam or caulk first, then connect and fasten tightly. As with all wall panel joints, the gap should be sealed carefully, and a final bead of caulk should air-seal joints from the interior side of the wall.

Apply construction caulk at bottom plate to air-seal at floor deck.

Apply construction caulk at bottom plate to air-seal at floor deck.

Ensure air-seal at sole plate. Here, the OSB will lap the rim for improved seal.

Leave a gap at the top plate for tying adjacent panels together.

Plan the layering of foam and OSB so vertical material joints between adjacent panels occur at different studs.

When adjacent wall panels are in place, fill in the EP&B layers as necessary: rigid foam, then OSB, then WRB.

Connecting Outside Corners

Plan sheathing layers at outside wall corners so that OSB and rigid foam vertical joints do not land at the same stud, and ensure the rigid foam constitutes a continuous thermal break. If necessary, omit (or remove) foam at the ends of these walls where they will connect perpendicularly to the previously erected walls and abut the existing foam layer. The Grand Rapids crew utilized an outside corner with framing interior to the foam sheathing in both directions.

Removing a strip of FPIS to join thermal break at outside corner.

The gap provides a slot for the other wall's foam layer. Air-seal connection with caulk.

It is not possible to add foam or caulk once an exterior corner is in place, unless the OSB is added after erection.



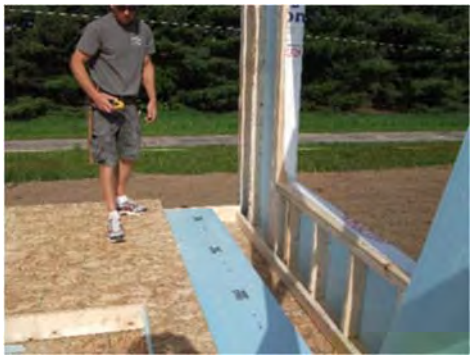
Plan outside corners carefully to anticipate the layering of rigid foam, OSB, and WRB, and a bead of caulk or spray foam for air-sealing.

Building Short Walls

Framed sections that must be tipped up to fit between two parallel walls require planning. Frame the studs and plates as usual; however, anticipate the need for connecting foam and OSB layers—leave gaps that can be filled after the final wall is upright and connected to its perpendicular neighbors. This material can be added from the exterior once the wall is up.



Plan short, connecting end walls carefully to maintain an uninterrupted layer of rigid foam across outside corners. Remember to apply a bead of caulk prior to tipping up, and follow with caulk if necessary to ensure an air-seal.


At outside corners, plan temporary gaps in the foam and OSB to leave knuckle room for erection and connection. The last sections of foam and OSB can then be added from the exterior side of the building. Ensure that foam and OSB joints do not land at the same stud.

Quality Assurance: Outside Corners and General Air-Sealing

Careful quality control at all connections is an important investment to achieve the full benefit of the EP&B wall's continuous layer of rigid foam. The WSP will be detailed as the air-control layer, so anticipate the bead of caulk or spray foam necessary to fully seal all joints and connections. The following series of photos illustrates the layers, methods, and order of operations.



Prepare the ends of the long walls for connection to the short wall. This outside corner configuration places the studs interior to the layer of rigid foam in both directions. Don't forget the continuous bead of caulk for air-sealing.



Raise the short wall and tie-in to the long walls on each side, with rigid foam and OSB gaps to allow maneuverability and connection, to be filled later from the exterior side of the wall.


Fill in the EP&B components at the outside corners of the short wall and provide a continuous rigid foam layer.


Fill in the EP&B components at the outside corners of the short wall—OSB.



Final detailing of outside corner connections.

Quality Assurance: Nailing

As with a typical frame wall, once all wall sections are up, check for missed nails at studs. Re-nail as necessary from outside (on ladder), before folding WRB into place. If any nail gun "misses" occurred where the WRB has already been stapled into place, nail through WRB and then seal the nail head with caulk or a piece of manufacturer-approved tape to maintain the WRB. For any areas where the WRB was folded back to allow tip-up, be sure to check for misses and re-nail as necessary before the WRB is unfolded and stapled to the sheathing.

If nails missed the stud, re-nail from outside.

Where possible, re-nail before fully attaching the WRB.

If it's necessary to nail through the WRB, seal each nail head with tape or caulk.

Double trusses at gable end walls are acceptable, but not required.

EP&B walls support trusses with WSP nailed to a double top plate.

Roof Trusses

Typical or raised-heel trusses can be used in the standard fashion with EP&B walls. The nailing schedule for attaching the sheathing to the double, full-width top plate provides ample bearing for the self-weight of the truss.

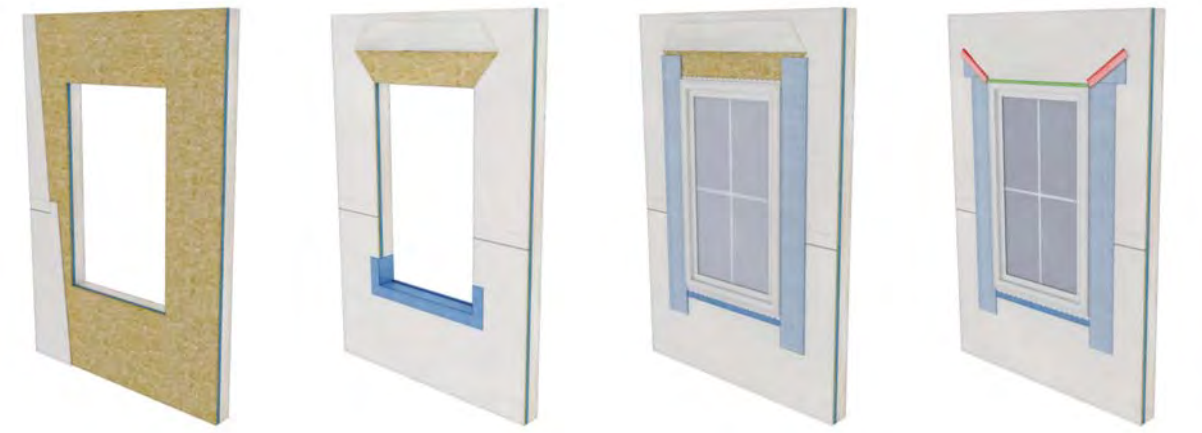
The test house photos show a double truss at the gable ends although it is not necessary for the EP&B configuration. The Grand Rapids framing crew typically uses let-in bracing instead of WSP-braced walls for shear load, and sheathes the house with 1-3/4-in. rigid foam, taping it to perform as the WRB. Two trusses sistered together for each gable end of the house ensures that the assembly bears on framing. The truss package had been ordered before the commitment was made to use EP&B walls.

WATER-RESISTIVE BARRIERS AND PAN-ADHERED FLASHING

For long-term durability, any wall system must be detailed to avoid bulk water intrusion. When properly installed over the EP&B's wood structural sheathing, a WRB provides protection against rain water entering the wall cavity from the outside. Look for a housewrap that resists tearing and always layer in shingle fashion. A WRB with texturing or vertical channels to provide a physical drainage plane behind the cladding is also worth considering.

Due to the low-permeability of the foam sheathing directly behind the OSB, drying of the wood sheathing in an EP&B wall must be outwards. A high-perm WRB is recommended (≥40 perms) and will also allow outward drying of water vapor resulting from incidental moisture that may accidentally get behind the WRB.

Installation of the WRB at windows is the same as over wood sheathing in typically-framed homes—use standard best practices for all openings and penetrations, including pan flashing installed in a shingled fashion.



See Building America Resource: https://basc.pnnl.gov/resource-guides/fully-flashed-window-and-door-openings

EP&B MOISTURE CONSIDERATIONS

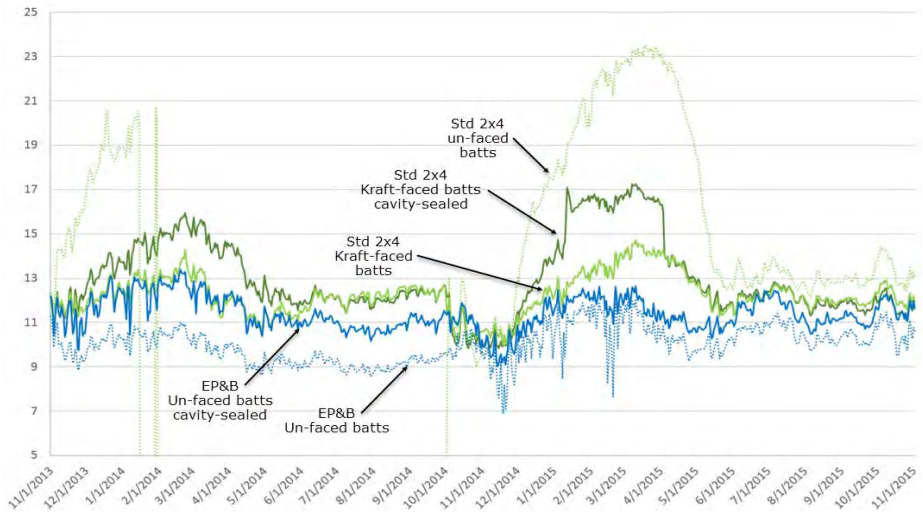
The following table lists the calculated temperatures at important locations within the wall for EP&B and other wall types when the outdoor temperature is 24° F. The foam sheathing keeps the wall cavity warmer than cavity insulation only, reducing the potential for condensation. Note that for typical light-framed walls, the OSB interior plane is coincident with the cavity's exterior plane. In the winter, the vapor drive is outward, due to warmer, moister air inside so an interior vapor retarder is especially important, because if moisture reaches this location it is very likely to condense. Note the protection offered by the c.i., and the below-freezing temperatures calculated for walls without a rigid foam layer.

Temperature Profile Calculated Temperatures(^{0}F) in the Wall when Outdoors is 24°F.

Interface/Wall Assembly	EP&B, R13/10	2x4, R13	2x6, R20
Indoor Temperature	68.0	68.0	68.0
Gypsum/Cavity Interface	66.2	64.8	65.8
Cavity/Rigid Foam Interface	**43.7**	**N/A**	**N/A**
OSB Interior Plane	26.5	28.1	26.9
OSB Exterior Plane	25.4	26.2	25.5
Outdoor Temperature	24.0	24.0	24.0

Reduced framing, c.i., and low air infiltration are characteristics common to many high-performance wall systems, including EP&B. To control airborne moisture migration, always use air-sealing best practices. Rigid foam joints should be butted firmly to each other, and to the framing members they touch, to ensure uniform coverage with no gaps. Foam joints should either be taped from the outside (before the installation of the OSB) or sealed at plates and each side of the stud on the interior side with either caulk or spray foam. The Grand Rapids house had a flash coat of closed-cell spray polyurethane foam (ccSPF) added prior to installation of cavity insulation, which provides reliable air-sealing.

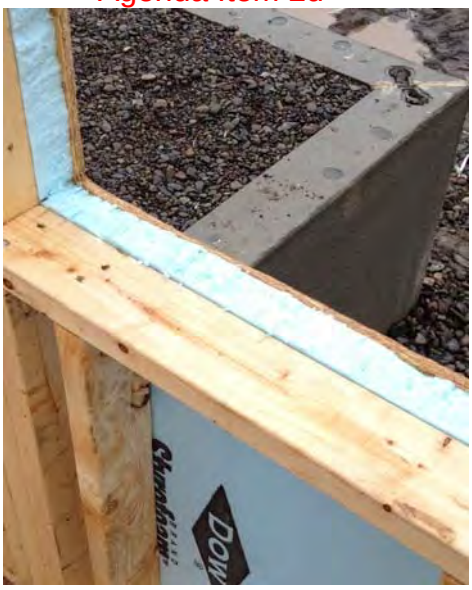
EP&B wall test data in CZ 4 shows stable wood moisture content for the system (graph below, blue lines). Compare the EP&B performance to the acceptable but cyclic performance of a standard wall without a c.i. layer (graph, green lines). Also note the large moisture variations of OSB sheathing when a vapor barrier is omitted from a typical 2x4 wall in CZ 4 (dotted pale green line). This tendency increases for CZs 5 and up, as a result of the greater vapor drive caused by colder outdoor winter temperatures.



Controlled field tests conducted by Home Innovation Research Labs from Nov. 13–15, 2014, in CZ 4 on north-facing walls show OSB moisture content (MC%). EP&B walls (blue lines) stay drier than conventional walls.

Note: Despite the gap in data for the 2x4 wall with unfaced batts from 2/1/2014 to 10/1/2014, the data collected on the remaining dates corroborates the trend.

Source: Home Innovation Research Labs: Characterization of Moisture Performance of Energy-Efficient Light-Frame Wood Wall Systems—Phase II, December, 2015.



Frame window openings with 2x4 lumber to maximize c.i.

1x6 sills may be added for convenience but are not necessary.

Window Installation

Windows in an EP&B wall do not require major changes to typical practice, unless required by the window manufacturer.

The demonstration house used flanged windows, which are installed from the outside, flush to the exterior wall plane. The factory window frame can bear on the edge of the OSB and the rigid foam, and is supported mainly by nails through the flanges and the OSB. If desired, the window sill framing (2x4) can be extended (2x6) like the top and bottom plates of the wall, but this is not required, and the added framing increases thermal bridging.

The test house crew typically builds a light-framed wall with let-in bracing and no WSP, where rigid foam acts as the sheathing—their habit is to add a 1x6 at the sill to span from the framing to the foam sheathing. They did that with the EP&B wall in the test house, as well. The added thermal bridging is minimal, and will not adversely affect performance. You are welcome to add this 1x6 member for added support, but it is not necessary. If you do add it, be sure to account for the depth of the sill material in your layout of the rough openings.

Nail the window flanges to the OSB using 2-in. galvanized, ring shanked cap nails at approximately every other hole. In our demonstration house, one window had an unusually short flange, and the nails did not engage OSB. In this case, the crew used 3-1/2-in. nails to catch the framing through the 2-in. foam layer. For added strength, 3-1/2-in. nails could be used at all window flanges to connect to framing through the foam, but this is not required.

Window Flashing

Apply flexible, self-adhered pan flashing and jamb flashing according to typical best practices. Although WRB manufacturers often suggest an inverted Y-cut at each corner to allow turning in the WRB to wrap the rough opening, other reliable methods include cutting the WRB flush to the outside sill edge (and flush with the jamb edges in areas with high probability of wind-driven rain) so the flashing can adhere directly to the framing of the rough opening and avoid any possibility that water may make its way between the framing and the WRB.

Window opening, WRB folded back, 1x6 sill plate added (not required).

Flexible, self-adhered pan flashing tape, cut to length.

Pan flashing should be as flat as possible at corners.

Agenda Item 2d

Window Flashing and Details

In an EP&B wall, the OSB sheathing provides a solid substrate for window detailing, as with typical light-framed walls. You can find an in-depth discussion of window flashing and water-sealing methods here: http://www.homeinnovation.com/~/media/Files/Reports/TechNote-Window-and-Door-Flashing.pdf.



Apply flexible, self-adhered pan flashing, extending several inches up the jamb on each side. Smooth out all wrinkles.



Apply jamb flashing in shingled layers from bottom to top.

Apply head flashing as the final layer, and then tape the WRB flap over the head flashing.

The additional c.i. layer provided by the EP&B wall system is evident at openings.

Per best practices, ensure all windows operate as expected prior to final detailing.

Sliding Door Installation

Unless extra strength is required, sliding door framing can be 2x4. Full-depth framing (2x6 if building a 2x4/2x6 EP&B configuration) can be considered for oversized sliding glass doors, to ensure the horizontal forces bear directly against framing lumber.

For the sliding glass patio door and the deck's ledger board, the crew used typical best practices for aprons, pan, head and jamb flashing, and drip caps.

Where extra stability is desired, a 3-1/2-in. spiral shanked nail may be used to connect the sliding door's flange directly to the framing.

Apron and stainless steel pan at sliding door opening, leading to elevated deck on the north side of the house.

Sliding door installed in opening.

Install windows and doors only after the opening has been properly detailed.

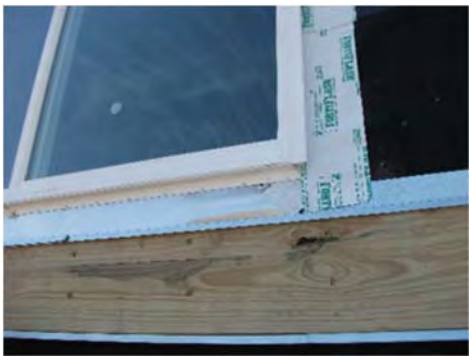
Sills of patio doors require special attention because decks may have standing water.

WRB above the door is folded up and away, and is the last waterproofing component to be folded down, as the top "shingle" to prevent bulk water intrusion by shedding water instead of trapping it.

All components of a good waterproofing detail are layered bottom-to-top.

Self-adhesive jamb flashing should be installed snug to the window frame.

Use a 3-1/2-in. spiral or ring shank nail where direct engagement to framing is desired for added security.



Bottom to top waterproof layering.

Install jamb and head flashing in shingle fashion.

Smooth wrinkles and press out air pockets to avoid imperfections that can trap water.

Caulk or seal with WRB tape all new penetrations through flashing.

Agenda Item 2d

Hinged Door Installation

All exterior hinged doors should be ordered with 6-in. jambs to fill the full width of the wall. Unless extra strength is required, the wall framing opening for the door can be 2x4 lumber; the hinge frame and jamb connection occur at the interior framing, so the 2x4 is in plane with the door's operation.

Prior to inserting the door to the garage (where there is no WRB) apply a continuous bead of silicone caulk where the brick mold meets the face of the OSB to air-seal the connection.

Door installation in an EP&B wall is similar to standard construction.

Tipping the door into place. Note that between the house and garage, the OSB was detailed as the air control layer.

Squaring the door.

Plumbing the door.

Nailing the door frame.

Exterior doors need 6-in. jambs to match the wall width of a 2x4/2x6 EP&B wall.

The factory-drilled securement jamb holes match up with the framing of an EP&B wall.

Siding Installation

One of EP&B's strongest advantages is the simplification of siding installation.

Using the alternate schedule IRC R.402.13, siding can be attached directly to the OSB sheathing of an EP&B wall, and is similar to installing siding over structural insulated panels. The IRC has included a table specifying attachment of siding weighing 3 psf or less (most fiber cement siding qualifies) to wood structural sheathing (see the following images).

The Grand Rapids test house was built over a pre-insulated, pre-cast concrete basement foundation. Furring strips were added to allow a seamless transition for horizontal vinyl siding.

Note: Alternately, siding or other types of exterior finishes may use nails or screws of sufficient length to attach through both the wood structural sheathing and 2-in. foam layer to engage the framing with penetration to the depth required by IRC Section R703.3.3, at the prescribed frequency. Be sure to coordinate with the siding crew by marking the framing geometry and stud locations, especially if WRB is installed by the framing crew.

Apply WRB and siding with standard methods.

The completed house looks clean, crisp, and traditional.

Fastening Exterior Finishes—the IRC provides an alternate schedule for fastening directly to structural sheathing.

Exterior wall covering (weighing 3 psf or less) attachment to wood structural panel sheathing, either direct or over foam sheathing a maximum of 2 in. thick.[a]

Note: Does not apply to vertical siding.

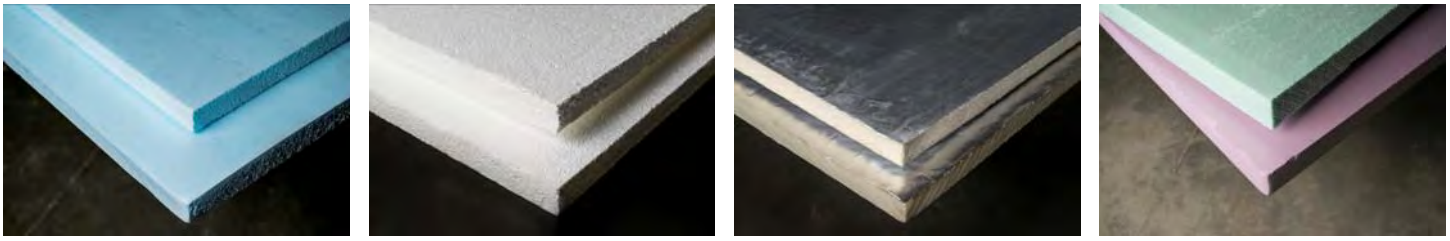
Adapted from 2015 IRC TABLE R703.3.2
OPTIONAL SIDING ATTACHMENT SCHEDULE
FOR FASTENERS WHERE NO STUD PENETRATION NECESSARY

NUMBER AND TYPE OF FASTENER	SPACING OF FASTENERS[b]
Ring shank roofing nail (0.120" min. dia.)	12 in. o.c.
Ring shank nail (0.148" min. dia.)	15 in. o.c.
#6 screw (0.138" min. dia.)	12 in. o.c.
#8 screw (0.164" min. dia.)	16 in. o.c.

[a] Fastener length shall be sufficient to penetrate back side of the wood structural panel sheathing by at least 1/4 in. The wood structural panel sheathing shall be not less than 7/16 in. in thickness.

[b] Spacing of fasteners is per 12 in. of siding width. For other siding widths, multiply "Spacing of Fasteners" above by a factor of 12/s, where "s" is the siding width in inches. Faster spacing shall never be greater that the manufacturer's minimum recommendations.

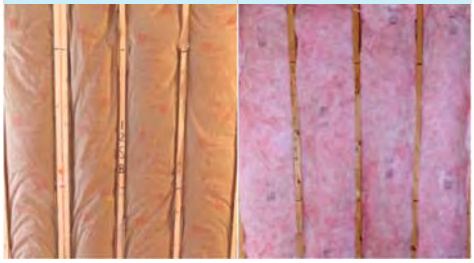
Agenda Item 2d
EP&B INSULATION



Rigid foam insulation, from left: XPS, EPS, PIC, XPS.

Mineral wool batt | Cellulose

Fiberglass batts with Kraft paper facing | Unfaced fiberglass batts



Note: The demonstration house was insulated with a 1-in. flash coat of ccSPF (a reliable air-sealer), followed by a low-moisture fibrous blown insulation.

Choose the Insulation that Meets Your Needs

Insulation choices for an EP&B wall are similar to the options for standard framed walls. Mix and match cavity fill and rigid c.i. to achieve the IECC prescriptive minimums (or greater) for your CZ (see table).

Also consider the moisture characteristics of these choices; see the following section on interior vapor retarders.

Foam plastic insulating sheathing is recommended for the EP&B c.i. layer for its compressive strength (minimum 15 psi) and low level of moisture permeance. Due to its high perm rating, EPS is recommended ONLY if it has a film facing or a low-perm film is added. For single-faced rigid insulation board, the film must be installed facing the cavity, not toward the sheathing. Because mineral wool board is not faced and not sufficiently rigid, it is not suitable for the c.i. layer of an EP&B wall. The following rigid foam sheathing products are recommended for use in an EP&B wall system:

- XPS (Extruded Polystyrene – blue, pink, yellow, or green);
- EPS (Expanded Polystyrene – typically white with a characteristic beaded appearance; use faced only); and PIC/Polyiso (Polyisocyanurate – yellow or tan with a foil facing).

Typical Insulation Thermal Performance Values[a, b, c]	
Rigid Insulation: Nominal R-Value per 2 in. layer	
EPS – Expanded Polystyrene	8
GPS – EPS with graphite	9
XPS – Extruded Polystyrene	10
XPS* – blown with low GWP blowing agent[d]	8
PIC – Polyisocyanurate	12
Cavity Insulation: Nominal R-Value per 3.5 in. layer	
Fiberglass Batt (3-1/2, 3-5/8, hi-density)	11, 13, 15
Cellulose (dense-pack wall or blown)	12.5
Blown Fiberglass (loose, dense)	12.5, 14
Mineral Wool Batt (standard, hi-density)	12.5, 14
Spray Polyurethane Foam (SPF) (open cell, closed cell)	12.5, 12 to 23

[a] Values shown are typical; check manufacturer's specifications for actual performance

[b] Thermal Resistance is measured in the unit R = (hour x ft x °F)/Btu

[c] Refer to the climate zone map and *Table R702.7.1 Class III Vapor Retarders* to ensure your chosen combination meets IECC prescriptive insulation requirements for frame walls

[d] The Global Warming Potential (GWP) of CO_2 = 1. Some low-GWP blowing agents with GWP <5 have been tested to produce R per inch performance that is 20% or more below XPS produced by standard methods. Check manufacturer's specifications.

EP&B INTERIOR VAPOR RETARDERS

Climate Zones 1–4 (except Marine 4) do not require vapor retarders according to IRC Section R702.7 and Table R702.7.1. Climate Zones 5–8 and Marine 4 require a Class I or II vapor retarder on above-grade walls unless certain conditions regarding vented cladding or c.i. are met, in which case it is permitted to use a class III vapor retarder.

Because an EP&B wall includes a 2-in. layer of c.i., in most cases a Class III vapor retarder may be used. See the following table for direction. If the configuration you've chosen does not qualify for Class III interior vapor retarder, then Home Innovation recommends a Class II vapor retarder, such as Kraft facing on batt insulation. Proprietary "smart" vapor retarder products have perm ratings that rise with increasing relative humidity from 1 perm or less at normal conditions (Class II) up to 35+ perms (vapor permeable) in high humidity, and represent a "belt and suspenders" approach, excellent for use with EP&B. In any situation expected to have a higher than normal interior vapor drive, Home Innovation strongly encourages the use of an interior vapor retarder:

- High internal moisture load due to high human and pet occupancy; and
- Very low outdoor temperatures.

CAVITY INSULATION INSTALLATION

The Grand Rapids test house received a 1-in. flash coat of closed cell spray foam, followed by blown-in fiberglass.

The ccSPF serves several functions, acting as both a reliable air barrier and a vapor retarder.

Home Innovation discourages the use of Class I interior vapor retarders (like polyethylene sheeting) as it may create a double-vapor barrier condition, trapping incidental moisture and limiting drying.

IRC Interior Vapor Retarder Requirements as They Apply to the EP&B Wall System (See IRC Table R702.7.1 Class III Vapor Retarders)

Climate Zone	EP&B Rigid Insulation, 2 in.	c.i. R-Value	2x4/2x6 EP&B	2x6/2x7.5* EP&B
1, 2, 3, Non-Marine 4	EPS, GPS, XPS*, XPS, PIC	8–12	**None required**.	
Marine 4, 5	EPS, GPS, XPS*, XPS, PIC	8–12	A minimum **Class III** vapor retarder is **required.** A **Class II** vapor retarder such as Kraft-faced batts or a "smart" film is **recommended** for the EP&B wall system.	
6	EPS, GPS, XPS*, XPS, PIC	8–9	A minimum **Class III** vapor retarder is **required.**	A minimum **Class III** vapor retarder is **required** for any c.i. choice other than PIC (R-12).
			A **Class II** vapor retarder such as Kraft-faced batts or a "smart" film is **recommended** for both configurations of the EP&B wall system.	
7, 8	EPS, GPS, XPS*	8–9	A minimum of a **Class II** vapor retarder such as Kraft-faced batts or a "smart" film is **required.**	
	XPS, PIC	10–12	A minimum **Class III** vapor retarder is **required.** A **Class II** vapor retarder such as Kraft-faced batts or a "smart" film is **recommended** for the EP&B wall system.	A minimum of a **Class II** vapor retarder such as Kraft-faced batts or a "smart" film is **required.**

INSTALLATION SPECIFICATION FOR EP&B WALL SYSTEMS

Equipment

Rigid foam sheathing can be cut with a table saw, circular saw or reciprocating saw. New toothless circular saw blades are available in 7-1/4 in. and 10 in. diameters for nearly dust-free cutting. Use eye and breathing protection per manufacturer's instructions.

Many standard framing nail guns will accommodate the 3-1/2-in. nails required to fasten the WSP to the studs through the 2-in. foam sheathing. The fastener pattern of 3 in. o.c. at the WSP perimeter and 6 in. o.c. in the field will be familiar from traditional stapling schedules. Note that staples are not an acceptable substitute for nails in the EP&B wall system.

Design Value and Other EP&B Configurations:

The EP&B wall's calculated allowable design racking shear load value is 256 plf (lbs/ft). The EP&B wall system can be adapted to 2x6 stud framing, using true 7.5 in. plates (cut from 2x10s) and 2-in. thick rigid foam. Nominal 2x8 plates with 1-3/4 in. c.i. requires two layers of rigid foam: (1) 1-in. and (1) 3/4-in. The 2x7.5* configuration is more cost effective and meets IECC code requirements in more climate zones. Modify the following specifications for either option.

King Studs at 1st-Floor Openings—with rim header[a]

Opening Width, ft	# At Window	# At Door[b]
3	1	1
4	2	1
6	3	2
8	3	2
10	4	3
12	5	4

[a] The number of 2x4 king studs at each side of the opening.

[b] Number of king studs is reduced at door opening only if the first stud (buck) is a 2x6 member.

EP&B Changes to Standard Light Frame Wall Construction.

Design	Standard 2x4 Frame Wall	Extended Plate and Beam
Wall plates	Bottom and top plates all 2x4	Bottom and top plates all 2x6
Wall studs	2x4	2x4
Wood structural panel	Exterior to the studs. Horizontal breaks in the wall plane require blocking.	Exterior to foam sheathing. Continuous vertical sheathing (plate to plate) is required—no horizontal breaks are allowed in the wall plane between the top and bottom plates. Use plywood or OSB of 3/8-in. to 15/16-in. thickness.
Insulating sheathing	Optional, exterior to (or in place of) the structural sheathing	Standard, exterior to the 2x4 studs, interior to the structural wood sheathing. Install vertically, staggering foam board joints with OSB joints.
Drainage plane	WRB over the wood structural sheathing. If FPIS is used, either exterior or interior to the FPIS	WRB over the wood structural sheathing
Window Installation	Typical, per manufacturer's instructions	Typical, per manufacturer's instructions. For convenience, a 1x6 sill may be added but is not required.
Sheathing attachment	2.5 in. nails Panel Edge: 6 in. spacing Panel Field: 12 in. spacing	3.5 in. nails Panel Edge: 3 in. spacing Panel Field: 6 in. spacing
Rim Board, foundation	Typical rim, per IRC	Double rim if flush; single or double rim where inset 1 in. for c.i. (2 in. if WSP is installed continuously from top plate to sill plate, lapping the rim, and fastened to the sill plate per the schedule.)
Rim board between floors	Typical rim, per IRC	Double rim if flush; single or double rim if inset 1 in. A double rim may act as a beam header, eliminating headers and allowing for additional insulation. Use joist hangers above openings with rim beam header. Single rims require traditional window and door headers per IRC.
Roof Trusses	Typical, per IRC	Typical, per IRC. Unlike with traditional c.i. installed as over-sheathing, single engineered roof trusses may be used with an EP&B wall no modification at gable ends.

INSTALLATION SPECIFICATION FOR EP&B WALL SYSTEMS

Example Scope of Work: 2x4 Studs with 2x6 Plates (*customize for your particular project*)

1. Introduction

1.1. This scope of work addresses the construction procedure for field-framed EP&B walls in a two-story building with a basement or a crawlspace.

1.2. This scope of work addresses the EP&B configuration constructed using 2x4 stud and 2x6 plates.

1.3. The construction procedure addresses framing and sheathing (including structural and foam sheathing).

1.4. The primary focus is on the methods and materials that are unique to the EP&B system or impacted by the EP&B system design. Where framing practices are not altered by the EP&B design, typical construction methods and material shall be used.

1.5. All headers shall be in accordance with building code or an approved, engineered design.

1.6. With the exception of the wall structural sheathing nailing schedule that is unique to the EP&B system (3-1/2-in. x 0.131-in. dia. @ 3-in./6-in. perimeter/field), all fastening requirements are consistent with building code requirements for light-frame wood walls as applicable. Approved alternatives shall be permitted.

1.7. Calculated allowable design racking shear load value for the EP&B wall as tested is 256 plf.

1.8. For additional information, refer to construction details provided with the Scope of Work.

2. Materials List

2.1. Dimension lumber: stud grade or higher.

2.2. Wall sheathing: WSP – plywood or OSB of 3/8-in. to 15/32-in. thickness.

2.3. Engineered or solid wood rim board.

2.4. Metal joist hangers (at first-floor openings only – rim header application) per engineered design.

2.5. Structural composite lumber (second-floor headers and rim joist application at first floor).

2.6. Insulating rigid foam board sheathing (EPS, XPS, or PIC; see page 28—consider the climate characteristics and the rigid foam moisture performance carefully when choosing materials combinations).

2.7. Fasteners per construction details.

2.8. WSP floor sheathing and engineered floor joists per building plans.

3. Field-Framing Guidelines

3.1. Sill Plate and First-Floor Construction

3.1.1. Verify sill plate anchor bolt size and spacing is in accordance with the house plans. The anchor bolt edge distance from exterior edge of the foundation wall should be approximately 3.5 in. to allow for the double rim joist installation, modified appropriately for other rim joist solutions.

3.1.2. Install minimum 2x6 pressure treated sill plate and secure using nuts over an appropriately-sized washer.

3.1.3. Install a double 1.25 in. engineered wood rim joist inset 1 inch from the exterior face, faced-nailed at a nominal spacing of 24 in. o.c. at top and bottom edges and toe-nailed to sill plate with 8d nails (2-1/2 in. x 0.113 in.) at 6 in. o.c.

3.1.4. Install 1-in. thick rigid foam insulation board. To the exterior of the rim joist and detail for a complete thermal break.

3.1.5. Install engineered floor joists and floor sheathing in accordance with the building plans.

3.2. Wall Construction

3.2.1. Lay out 2x6 bottom (sole) plate.

3.2.2. Lay out 2x4 studs at 16 in. o.c.

3.2.3. Lay out 2 x 6 first top plate and second top plate.

3.2.4. Attach bottom plate to studs and first top plate to studs using (2) 3-1/2 in. x 0.135 in. nails end-nailed at each connection, keeping the interior face of the studs and plates flush.

3.2.5. Attach 2 x 6 second top plate to the first top plate using 10d nails (3 in. x 0.128 in.) at 24 in. on center. End joints in double top plates shall be offset at least 24 in. and a minimum of eight (8) 10d nails (3 in. x 0.128 in.) shall be installed in the lapped area. In lieu of the offset, double top plates may be fastened to each other with an approved metal plate connector.

3.2.6. Mark the plates with the location of studs (needed for attaching WSP sheathing after foam sheathing is installed).

3.2.7. Install 2-in.-thick rigid foam sheathing over 2x4 studs between 2x6 top and bottom plates. The foam sheathing shall be oriented vertically and all vertical edges shall occur over studs. The foam sheathing can consist of two layers of 1-in.-thick panels or a single 2-in.-thick layer. If two layers are used, stagger the joints. Rigid foam sheathing shall fill the entire space between the 2x6 top and bottom plates except at openings (see Sections 3.3 and 3.5 for framing at openings). The edge/end joints of foam sheathing panels shall be tight against each other and against 2x6 plate framing members.

3.2.8. If the rigid foam layer is to be detailed as the air barrier, the foam board seams shall be taped to each other and to framing using manufacturer-approved adhesive tape. Alternatively, once the wall is tipped into place a bead of chemically-compatible caulk or spray foam may be applied from the cavity side at all material connections.

3.2.9. Install 7/8-in. WSP sheathing over the insulating rigid foam sheathing. Avoid coincident vertical joints of rigid foam and WSP by staggering the sheathing course to align on different studs. The WSP sheathing shall be

oriented vertically and shall be continuous between top and bottom 2x6 plates. Horizontal WSP orientation or horizontal joints in WSP sheathing shall not be permitted (blocked or unblocked). WSP sheathing shall overlap top and bottom plates by a minimum of 1 in. to allow installation of sheathing nails. All vertical edges shall occur over studs. Use of elongated WSP panels that extend over the rim joists below and/or above the wall is permitted, and is required if the rim joist is inset by 2 in. instead of 1-in., in which case the 3-in. o.c. nails shall attach the bottom edge of the OSB to the sill plate directly.

3.2.10. Allow 1/8-in. gap at all WSP edges (or in accordance with WSP manufacturer's recommendations).

3.2.11. Attach WSP sheathing to 2x6 top and bottom plates and to 2x4 studs using nails in accordance with the following schedule:

- At perimeter of WSP sheathing: a minimum 3.5 in. x 0.131 in. at maximum spacing of 3 in. o.c.
- At 2x4 studs in field of WSP sheathing: a minimum 3.5 in. x 0.131 in. at maximum spacing of 6 in. o.c. to allow 1-in. penetration into the framing.

3.3. First-Floor Openings

3.3.1. Window bucks are framed using 2x4 studs.

3.3.2. Door bucks are framed using 2x4 studs if exterior door jambs are the full thickness of the wall; otherwise 2x6 bucks are required for framing engagement.

3.3.3. The space above all openings is framed as for a non-bearing wall (use rim header design – see Section 3.4).

3.3.4. Horizontal door/window buck at the top of the opening shall be a continuous member and shall be attached to the exterior WSP sheathing using sheathing nails at 3 in. o.c. (to provide support for the horizontal buck member).

3.3.5. The number of king studs shall be determined based on the size of the opening in accordance with the table on page 30 or approved engineered design. (Note: a window or door buck continuous from bottom to top plate is a king stud.)

3.3.6. WSP sheathing is connected to window or door bucks using 3.5 in. x 0.131 in. nails at 3 in. o.c.

3.4. Rim Headers and Second-Floor Construction

3.4.1. Install double 1.25 in. engineered wood rim joist along the entire perimeter of the wall, inset 1 in. per 3.1.3.

3.4.2. Rim joists shall not have splice joints over an opening and the first splice joint to each side of the opening shall occur a minimum of 6 in. away from the opening edge and past the outermost king studs (rim header application).

3.4.3. Double rim joist shall be face-nailed at top and bottom edges at a nominal spacing of 24 in. o.c. and at 16 in. o.c. over openings with minimum 2.5-in. x 0.131-in. nails. The exterior rim shall be toe-nailed to top plate with 8d nails (2.5-in. x 0.113-in.) at 6 in. o.c.

3.4.4. The maximum rim joist span shall be verified by a licensed professional. (Note: A double 1.25 x 11.875 structural composite lumber member is sufficient for most openings up to 8 ft wide).

3.4.5. Install engineered wood floor joists in accordance with the floor plans.

3.4.6. If using Rim Beam design, floor joists located above an opening shall be supported by a metal joist hanger selected by a licensed professional based on design loads.

3.4.7. Install WSP floor sheathing in accordance with the building plans.

3.5. Top-Floor Openings

3.5.1. Top floor openings are conventionally framed using single 1.25-in. to 1.5-in.-thick engineered or solid wood headers (up to 5 ft–7 ft) or double engineered or solid wood headers (for larger openings).

3.5.2. Where single header is used, it is insulated with 2-in. rigid foam sheathing on the interior face of the header.

3.5.3. Headers are supported by jack studs. The number of jack studs and king studs is determined based on standard practice in accordance with building code or engineered design.

3.6. Corner Details (Exterior Walls)

3.6.1. Construct wall corners at intersecting exterior walls using one of the details provided in this Construction Guide. (pgs. 3 and 13).

3.6.2. Framing members at the corners shall be arranged in a manner to minimize thermal bridging and allow for increased quality of insulation installation. Rigid foam sheathing insulation is installed at the corners as provided in the details.

3.6.3. The intersecting walls shall be connected to each other at the corner using one of the following options:

- Adjacent framing members are nailed directly to each other using 3.5 in. x 0.135 in. nails at 12 in. o.c.
- Exterior WSP sheathing from both intersecting walls is nailed directly to a common 2x framing member using minimum 2.5 in. x 0.131 in. nails spaced a maximum of 6 in. o.c. (for each wall).
- Other approved fastening methods.

3.6.4. Double top plates are overlapped at corners and intersections, and two (2) 3 in. x 0.128 in. nails are installed at each lap (face-nailed). Alternatively, the intersecting walls are fastened to each other with an approved metal plate connector, per IRC Section R602.3.2.

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

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DOE/EE-1730 · March 2018

IDAHO BUILDING CODE BOARD

Agenda Item No. 03 Additional Building Code Board Meetings

PRESENTER: Andrew Bick, Chairman

OBJECTIVE: Schedule additional board meetings during the months of October through February to vet amendments, code cycles, and/or updated codes at the board level.

ACTION: Vote

BACKGROUND: **April 2018** – Chairman Bick has contemplated adding an action item to the agenda for regularly scheduled meetings to discuss what the Collaborative needs to concentrate on between meetings. In addition, the Board needs to determine a quality way to conduct the collaboration so no one feels bias opinions are pulled into the situation without due course. Board Member Allen Jensen suggested creating three subgroups (commercial, residential, and energy) to address to the Collaborative proposed code changes.

June 2018 – Addressed together were the topics *Create Subcommittees--Residential/ Commercial/Energy* and *Additional Building Code Board Meetings*. Although both are methods to review the residential, commercial and energy codes for possible adoption at the 2020 legislature, it was determined, the Board would arrange for three additional "working" meetings in November, December, and January. For clarity, and to abide by the open meeting laws, there will be no quorum of the Board, and each code (residential, commercial, energy) will be reviewed separately.

Recommended board meeting dates: 2018--October 16 (regular meeting/already scheduled), November 13, December 11. 2019--January 15, January 29, February 19.

ATTACHMENTS: 2018 and 2019 Board Calendars

DBS BOARD MEETINGS - 2018

DAMAGE PREVENTION BOARD	JAN 25, FEB 12 (SPE), MAR 22, MAY 24, JUL 26, SEP 27, NOV 29
FACTORY BUILT STRUCTURES ADVISORY BOARD	FEB 13, MAY 8, JUL 10
IDAHO BUILDING CODE BOARD	FEB 20, APR 17, JUN 19, AUG 21, OCT 16, NOV 13, DEC 11
IDAHO ELECTRICAL BOARD	JAN 24, APR 25, JUL 25, OCT 24
IDAHO HEATING VENTILATION & AIR COND. BOARD	FEB 1, MAR 14, MAY 9, NOV 14
IDAHO PLUMBING BOARD	JAN 18, MAR 15 (CAN), MAR 29, MAY 17 (CAN), JUN 7, SEP 20
PUBLIC WORKS CONTRACTORS LICENSE BOARD	JAN 8, JAN 18 (SPE), FEB 8 (SPE), APR 9, JUL 9, OCT 9
SCHOOL SAFETY & SECURITY ADVISORY BOARD	JAN 11, SEP 13

Board Meetings will be held at each Division of Building Safety regional office either in person or through video

1090 E WATERTOWER ST
SUITE 150
MERIDIAN, ID 83642

1250 IRONWOOD DR
SUITE 220
COEUR D'ALENE, ID 83814

2055 GARRETT WAY
BLD 1, SUITE 4
POCATELLO, ID 83201

JANUARY

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

FEBRUARY

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MARCH

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APRIL

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MAY

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JUNE

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Holidays outlined & highlighted in gray -- Management meetings outlined in blue -- Industrial Safety meetings outlined in red

DBS BOARD MEETINGS - 2019

DAMAGE PREVENTION BOARD	JAN 24, MAR 28, MAY 23, JUL 25, SEP 26, NOV 21
FACTORY BUILT STRUCTURES ADVISORY BOARD	FEB 12, MAY 14, JUL 9
IDAHO BUILDING CODE BOARD	JAN 15, JAN 29, FEB 19, APR 16, JUN 18, AUG 20 (TENT), OCT 15
IDAHO ELECTRICAL BOARD	JAN 23, APR 24, JUL 24, OCT 23
IDAHO HEATING VENTILATION & AIR COND. BOARD	JAN 8, MAR 12, MAY 21, NOV 12
IDAHO PLUMBING BOARD	JAN 17, MAR 21, MAY 16, SEPT 19
PUBLIC WORKS CONTRACTORS LICENSE BOARD	JAN 14, APR 15, JUL 15, OCT 7
SCHOOL SAFETY & SECURITY ADVISORY BOARD	JAN 10, SEP 12

Board Meetings will be held at each Division of Building Safety regional office either in person or through video

1090 E WATERTOWER ST
SUITE 150
MERIDIAN, ID 83642

1250 IRONWOOD DR
SUITE 220
COEUR D'ALENE, ID 83814

2055 GARRETT WAY
BLD 1, SUITE 4
POCATELLO, ID 83201

JANUARY

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NOVEMBER

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DECEMBER

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Holidays outlined & highlighted in **gray** -- Management meetings outlined in **blue** -- Industrial Safety meetings outlined in **red**

IDAHO BUILDING CODE BOARD

Agenda Item No. 04 **Code Review Cycles**

PRESENTER: Andrew Bick, Chairman

OBJECTIVE: Recommend a code cycle longer than every three years.

ACTION: Informational

BACKGROUND: **April 2018** – The Chairman expressed concern the information in statute is vague, and the Board should consider recommending longer code cycles; i.e., four, five or six years, to the legislature. This would provide a timeline on when to begin evaluating codes for possible amendments. In addition, Chairman Bick would like to see the Collaborative have a code cycle conversation to determine how everyone feels as far as a comfortable cycle.

June 2018 – The Chairman asked everyone to talk to their constituents, and the topic *Code Review Cycles* be placed on the August meeting agenda. In the future, the Chairman would like to either send a letter of recommendation or a vote from the Board to the legislature for their decision making process.

PROCEDURAL HISTORY:

ATTACHMENTS: No Documentation

IDAHO BUILDING CODE BOARD

Agenda Item No. 05 **Program Manager Report**

PRESENTER: Jeff Egan, Building Program Manager

OBJECTIVE: Provide the Board with an overview of the Program's current activities.

ACTION: Informational

BACKGROUND: This topic is addressed at all regularly scheduled Idaho Building Code Board meetings.

PROCEDURAL HISTORY:

ATTACHMENTS: No Documentation

IDAHO BUILDING CODE BOARD

Agenda Item No. 06 **Administrator Report**

PRESENTER: Chris L. Jensen, Administrator

OBJECTIVE: Provide the Board with an overview of the Division's current activities.

ACTION: Informational

BACKGROUND: This topic is addressed at all regularly scheduled Idaho Building Code Board meetings.

PROCEDURAL HISTORY:

ATTACHMENTS: No Documentation

IDAHO BUILDING CODE BOARD

Agenda Item No. 06a **Financial Report**

PRESENTER: Chris Jensen, Administrator

OBJECTIVE: Review the Idaho Building Code Board's financial report.

ACTION: Informational

BACKGROUND: This topic is addressed at all regularly scheduled Idaho Building Code Board meetings.

PROCEDURAL HISTORY:

ATTACHMENTS: Financial Report

Division of Building Safety

IDAHO BUILDING CODE FUND 0229-02
Fiscal Year 2018 Financial Statements
As of 06/30/2018

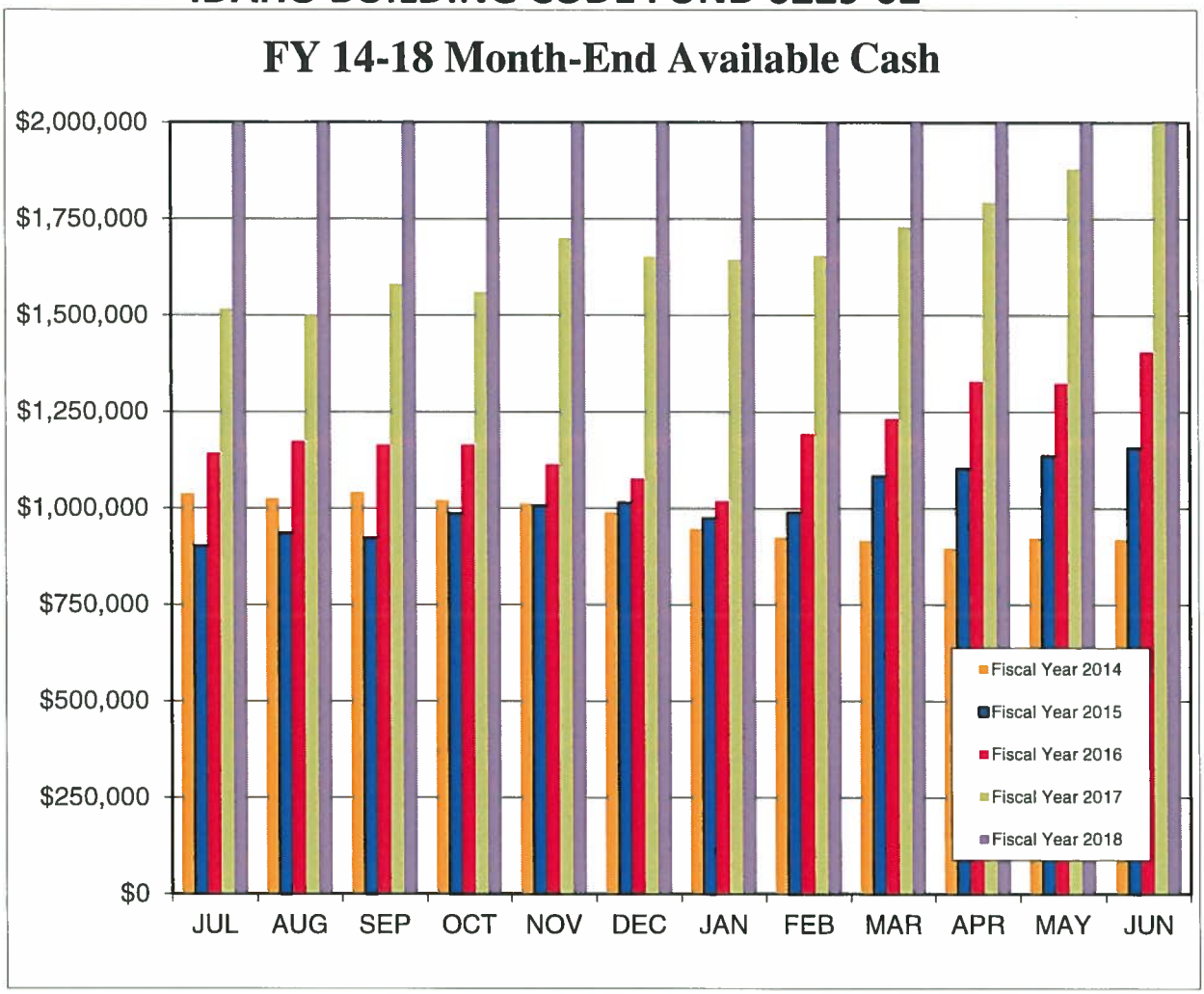
Statement of Revenues and Expenditures

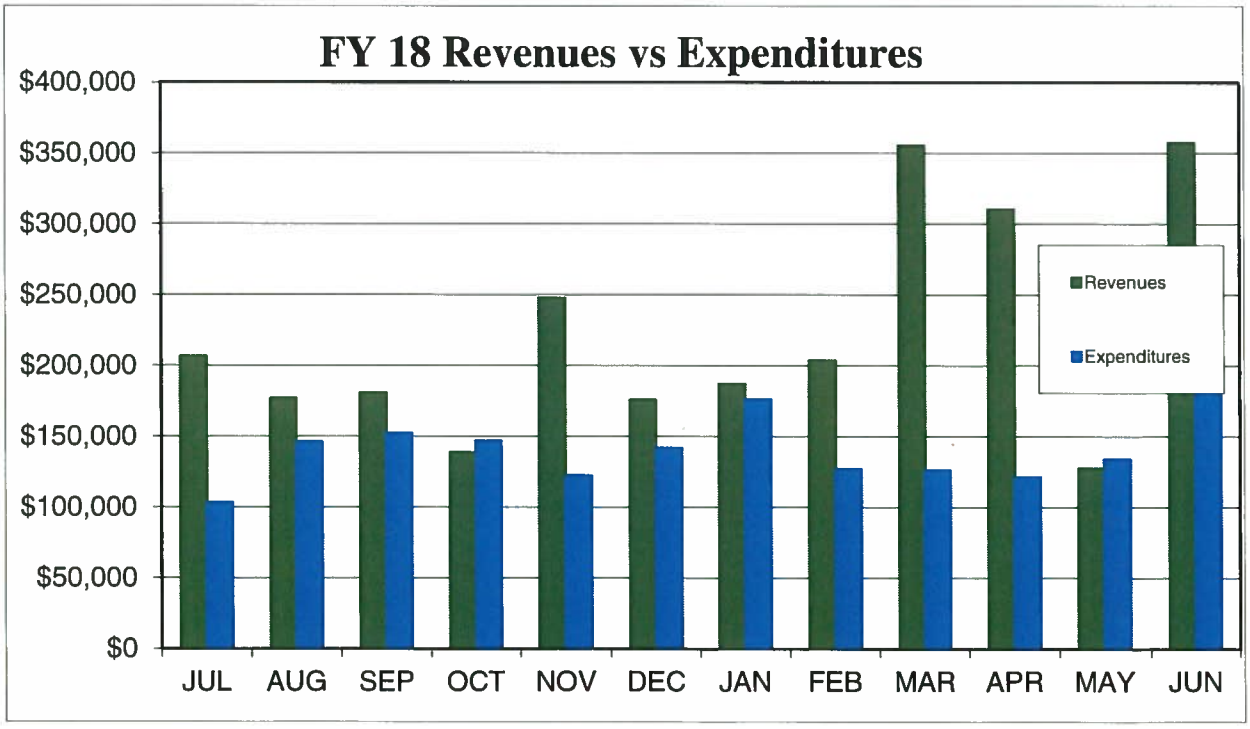
Class	Budget	Fiscal Year To Date	YTD as a % of Budget	Remaining Budget	Projected for Remainder of Year	Projected Year End Totals	Projected Total as a % of Budget
Revenues:	1,654,400	2,665,910	161.1%	(1,011,510)	-	2,665,910	161.1%
Expenditures							
Personnel:	1,400,400	1,323,701	94.5%	76,699	-	1,323,701	94.5%
Operating:	176,800	262,976	148.7%	(86,176)	-	262,976	148.7%
Capital:	77,200	115,450	149.5%	(38,250)	-	115,450	149.5%
Total Expenditures	1,654,400	1,702,127	102.9%	(47,727)	-	1,702,127	102.9%
Net for FY 2018	-	963,783			-	963,783	

Statement of Cash Balance

July 1, 2017 Beginning Cash Available	Fiscal Year to Date Revenues	Fiscal Year to Date Expenditures and Encumbrances	Other Changes in Cash	Available Cash as of June 30, 2018	Projected Change in Cash for Remainder of Year	Projected Year End Available Cash
2,040,316	2,665,910	(1,702,127)	(46,100)	2,957,999	-	2,957,999

IDAHO BUILDING CODE FUND 0229-02





IDAHO BUILDING CODE FUND 0229-02