# EB1-07/08
**101.5, 506**

*Proposed Change as Submitted:*

**Proponent:** Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

**1. Revise as follows:**

**101.5 (Supp) Compliance methods.** The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 101.5.1 through 101.5.3 as selected by the applicant. Application of a method shall be the sole basis for assessing the compliance of work performed under a single permit unless otherwise approved by the code official. Sections 101.5.1 through 101.5.3 shall not be applied in combination with each other. Where this code requires consideration of the seismic-force-resisting system of an existing building subject to repair, alteration, change of occupancy, addition or relocation of existing buildings, the seismic evaluation and design shall be based on Section 101.5.4 regardless of which compliance method is used.

> **Exception:** Subject to the approval of the code official, alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building is undergoing more than a limited structural alteration as defined in Section 807.5.3. New structural members added as part of the alteration shall comply with the *International Building Code*. Alterations of existing buildings in flood hazard areas shall comply with Section 601.3.

**101.5.1 Prescriptive compliance method.** Repairs, alterations, additions and changes of occupancy complying with Chapter 3 of this code in buildings complying with the *International Fire Code* shall be considered in compliance with the provisions of this code.

**101.5.2 Work area compliance method.** Repairs, alterations, additions, changes in occupancy and relocated buildings complying with the applicable requirements of Chapters 4 through 12 of this code shall be considered in compliance with the provisions of this code.

**101.5.3 Performance compliance method.** Repairs, alterations, additions, changes in occupancy and relocated buildings complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

**2. Add new text as follows:**

**101.5.4 Seismic evaluation and design procedures.** Where this code requires compliance with IBC or reduced IBC level seismic forces, the seismic evaluation and design of an existing building and its components shall comply with this section.

**101.5.4.1 Compliance with IBC level seismic forces.** Where compliance with the seismic design provisions of the *International Building Code* is required, the procedures used shall be in accordance with one of the following.

1. The *International Building Code* using one-hundred percent of the prescribed forces. The *R* factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R* factor specified for structural systems classified as “Ordinary” in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as “Intermediate” or “Special”.
2. Compliance with ASCE 41 using both the BSE-1 and BSE-2 Earthquake Hazard Levels and the corresponding performance levels shown in Table 101.5.4.1.

**TABLE 101.5.4.1**
**PERFORMANCE CRITERIA FOR IBC LEVEL SEISMIC FORCES**

| OCCUPANCY CATEGORY (Based on IBC Table 1604.5) | PERFORMANCE LEVEL FOR USE WITH ASCE 31 AND WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL | PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-2 EARTHQUAKE HAZARD LEVEL |
|---|---|---|
| I | Life Safety (LS) | Collapse Prevention (CP) |
| II | Life Safety (LS) | Collapse Prevention (CP) |
| III | Note a | Note a |
| IV | Immediate Occupancy (IO) | Life Safety (LS) |

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

**101.5.4.2 Compliance with reduced IBC level seismic forces**. Where seismic evaluation and design is permitted to meet reduced *International Building Code* seismic force levels, the procedures used shall be in accordance with one of the following:

1. The *International Building Code* using seventy-five percent of the prescribed forces. The *R* factor used for analysis shall be as specified in Section 101.5.4.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.5 shall be deemed to comply with this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak, or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.
   - 2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all Occupancy Categories are permitted to be based on the procedures specified in Appendix Chapter A5.
3. Compliance with ASCE 31 based on the applicable performance level as shown in Table 101.5.4.2.
4. Compliance with ASCE 41 using the BSE-1 Earthquake Hazard Level and the performance level shown in Table 101.5.4.2. The design spectral response acceleration parameters $S_{XS}$ and $S_{X1}$ specified in ASCE 41 shall not be taken less than seventy-five percent of the respective design spectral response acceleration parameters $S_{DS}$ and $S_{D1}$ defined by the *International Building Code*.

**TABLE 101.5.4.2**
**PERFORMANCE CRITERIA FOR REDUCED IBC LEVEL SEISMIC FORCES**

| OCCUPANCY CATEGORY (Based on IBC Table 1604.5) | PERFORMANCE LEVEL FOR USE WITH ASCE 31 | PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL |
|---|---|---|
| I | Life Safety (LS) | Life Safety (LS) |
| II | Life Safety (LS) | Life Safety (LS) |
| III | Note a | Note a |
| IV | Immediate Occupancy (IO) | Immediate Occupancy (IO) |

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

**3. Revise Section 506.1 and delete the following text and relocate to Sections 101.5.4, 101.5.4.1, Table 101.5.4.1, 101.5.4.2, Table 101.5.4.2 as shown above):**

## SECTION 506
## STRUCTURAL

**506.1 General.** ~~Repairs of structural elements shall comply with this section~~ Structural repairs shall be in compliance with this section and Section 501.3. Regardless of the extent of structural or nonstructural damage, the code official shall have the authority to require the elimination of conditions deemed dangerous. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

~~**506.1.1 Seismic evaluation and design.** Seismic evaluation and design of an existing building and its components shall be based on the following criteria.~~

~~**506.1.1.1 Evaluation and design procedures.** The seismic evaluation and design shall be based on the procedures specified in the *International Building Code*, ASCE 31 or FEMA 356. The procedures contained in Appendix A of this code shall be permitted to be used as specified in Section 506.1.1.3.~~

~~**506.1.1.2 IBC level seismic forces.** When seismic forces are required to meet the *International Building Code* level, they shall be one of the following:~~

1. ~~One-hundred percent of the values in the *International Building Code*. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special."~~
2. ~~Those associated with the BSE-1 and BSE-2 Earthquake Hazard Levels defined in FEMA 356. Where FEMA 356 is used, the corresponding performance leve~~

~~**TABLE 506.1.1.2**~~
~~**FEMA 356 AND ASCE 31 PERFORMANCE LEVELS**~~

(Delete table in its entirety)

~~**506.1.1.3 Reduced IBC level seismic forces.** When seismic forces are permitted to meet reduced *International Building Code* levels, they shall be one of the following:~~

1. ~~Seventy-five percent of the forces prescribed in the *International Building Code*. The *R*-factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R*-factor as specified in Section 506.1.1.2 of this code.~~
2. ~~In accordance with the applicable chapters in Appendix A of this code as specified in Items 2.1 through 2.5 below. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A shall be deemed to comply with the requirements for reduced *International Building Code* force levels.~~
   - ~~2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.~~
   - ~~2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.~~
   - ~~2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.~~
   - ~~2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.~~
   - ~~2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all occupancy categories are permitted to be based on the procedures specified in Appendix Chapter A5.~~
3. ~~In accordance with ASCE 31 based on the applicable performance level as shown in Table 506.1.1.2.~~
4. ~~Those associated with the BSE-1 Earthquake Hazard Level defined in FEMA 356 and the performance level as shown in Table 506.1.1.2. Where FEMA 356 is used, the design spectral response acceleration parameters *SXS* and *SX1* shall not be taken less than 75 percent of the respective design spectral response acceleration parameters *SDS* and *SD1* defined by the *International Building Code* and its reference standards.~~

~~**506.1.2 Wind design.** Wind design of existing buildings shall be based on the procedures specified in the *International Building Code* or *International Residential Code* as applicable.~~

**4. Revise and reorganize remaining Section 506 as follows:**

**506.2 Repairs to damaged buildings.** Repairs to damaged buildings shall comply with this section.

~~**506.2.1 Dangerous conditions.** Regardless of the extent of structural damage, dangerous conditions shall be eliminated.~~

**506.2.1 Repairs for less than substantial structural damage.** For damage less than substantial structural damage, the damaged elements shall be permitted to be restored to their pre-damage condition.

**506.2.2 Repairs for substantial structural damage to vertical elements of the lateral-force-resisting system.** A building that has sustained substantial structural damage to the vertical elements of its lateral-force-resisting system shall be evaluated ~~and repaired~~ in accordance with ~~the applicable provisions of Sections~~ Section 506.2.2.1, and either repaired in accordance with Section 506.2.2.2 or repaired and rehabilitated in accordance with Section 506.2.2.3 depending on the results of the evaluation ~~through 506.2.2.3~~.

**506.2.2.1 Evaluation.** The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamaged state, would comply with the provisions of the *International Building Code*. ~~Wind forces for this evaluation shall be those prescribed in the *International Building Code*. Seismic forces for this evaluation are~~, except that the seismic design criteria shall be permitted to be the reduced level seismic forces specified in Section ~~506.1.1.3~~ 101.5.4.2.

**506.2.2.2 Extent of repair for compliant buildings.** If the evaluation establishes ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then the damaged elements shall be permitted to be restored to their pre-damage condition ~~repairs shall be permitted that restore the building to its predamaged state using materials and strengths that existed prior to the damage~~.

**506.2.2.3 Extent of repair for noncompliant buildings.** If the evaluation does not establish ~~compliance of the predamaged building in accordance with~~ that the building in its pre-damage condition complies with the provisions of Section 506.2.2.1, then the building shall be rehabilitated to comply with ~~applicable provisions of the *International Building Code* for load combinations, including wind or seismic forces~~ the provisions of this section. The wind ~~design level~~ loads for the repair and rehabilitation shall be ~~as~~ those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the ~~design level shall be as required by the code in effect at the time of original construction or as required by~~ wind loads shall be in accordance with the *International Building Code*~~, whichever is greater~~. The seismic ~~forces~~ loads for this rehabilitation design shall be those required ~~for the design of the predamaged building~~ by the building code in effect at the tiem of original construction, but not less than the reduced level seismic forces specified in Section ~~506.1.1.3~~ 101.5.4.2. ~~Newstructural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

**506.2.3 Substantial structural damage to ~~vertical~~ gravity load-carrying components.** ~~Vertical~~ gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead and live loads in the *International Building Code*. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects Undamaged ~~vertical~~ gravity load-carrying components that receive dead, ~~or~~ live or snow loads from rehabilitated components shall also be rehabilitated ~~to carry~~ if required to comply with the design loads of the rehabilitation design. ~~New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

**506.2.3.1 Lateral-force-resisting elements.** Regardless of the level of damage to ~~vertical~~ gravity elements of the lateral force-resisting system, if substantial structural damage to vertical load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 506.2.2.1 and, if noncompliant, rehabilitated in accordance with Section 506.2.2.3.

~~**506.2.4 Less than substantial structural damage.** For damage less than substantial structural damage, repairs shall be allowed that restore the building to its predamaged state using materials and strengths that existed prior to the damage. New structural members and connections used for this repair shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.~~

**~~506.2.5~~ 506.2.4 Flood hazard areas.** In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the *International Building Code*.

**Reason:** The proposed revisions serve the following three primary purposes.

1. Allows the alternate seismic evaluation and design procedures (ASCE 31, ASCE 41, and Appendix A) to be used for the Prescriptive and Performance methods as well as the Work Area method. Without the ability to use these alternates to the IBC, the Prescriptive and Performance methods are not well suited for structural work in many existing buildings.
2. Makes editorial clarifications to Section 506.1 and 506.2 to improve clarity, flow, and delete redundant and unnecessary text. These editorial revisions are summarized as follows:
    a. Makes editorial clarifications to the seismic evaluation and design provisions in Sections 506.1.1.2 and 506.1.1.3. Intent is to focus on design criteria, compliance, and loads, rather than on forces.
    b. Splits Table 506.1.1.2 into two tables, one for full IBC forces and one for reduced IBC forces for added clarity.
    c. Clarifies difference between repair (fixing damage) and rehabilitation (additional upgrades triggered by the extent of repair and conformance of the existing building) for added clarity.
    d. Moves the text of current Section 506.2.1 to Section 506.1 for improved scoping and to ensure that requirement applies to all repairs.
    e. In Section 506.2 the requirements for less than substantial damage are moved before those for substantial damage for improved usability.
    f. Deletes section 506.1.2, which is redundant. Wind design criteria is adequately referenced in various subsections of Section 506.2 for repairs. Other Work Area method chapters provide adequate reference to the IBC for wind loads that this section is not necessary.
3. Makes two substantive revisions to 506.2:
    a. 506.2.2.3: requires rehabilitation to IBC wind loads, instead of the greater of the IBC and the code under which the original design was done.
    b. 506.2.3: includes evaluation of snow load criteria if the damage was caused by snow.

Based on the current seismic requirements in the Prescriptive and Performance Compliance methods, it is possible that these methods cannot be used for many older existing buildings. IEBC Section 302.2.3 requires that where additions or alterations result in more than a 10 percent increase in seismic demand or 10 percent decrease in seismic capacity, the entire seismic-force-resisting system be shown or rehabilitated to conform to the seismic requirements for new buildings in accordance with ASCE 7. IEBC Section 1301.4.1 requires that the existing building be capable of supporting the minimum load of IBC Chapter 16. For seismic design, the strength, stiffness, and detailing cannot be separated since the seismic loads are based on an R-factor, which depends on system detailing. These detailing requirements are often not satisfied in older buildings and it is usually impractical to revise the detailing in order to comply with the current seismic codes. Therefore, the IBC is often not well suited for seismic evaluation and rehabilitation of existing buildings. If it is not practical or possible to demonstrate IBC compliance in an existing building, then the Prescriptive and Performance Compliance methods may not be able to be used, since IEBC Section 101.5 prohibits mixing and matching of compliance methods.

It seems contrary to the stated intent of the IEBC (Section 101.3) that seismic requirements would not allow two of the three compliance methods in the code to be used for some buildings. Therefore, this proposal revises the IEBC to allow the alternative seismic evaluation and design standards and guidelines current referenced in Chapter 5 for the Work Area method (ASCE 31, ASCE 41, and Appendix A) to be used for all three compliance methods. Based on the scoping language and limitations in Section 506.2, any of the three sets of provisions can be used for buildings where the Work Area Method is being proposed, and there is no good reason why these provisions should not be permitted for the Prescriptive and Performance Compliance methods.

All three sets of provisions were specifically developed for existing buildings and provide seismic evaluation and design criteria results in seismic performance that is fairly uniform. The proposed scoping is such that where either Chapter 3 or Chapter 13 requires compliance with the IBC, the provisions for “full IBC level forces” (new Section 101.5.4.1 is used). Where reduced IBC forces are permitted, then new Section 101.5.4.2 will apply, which based on the current text of Chapters 3 and 13, will not apply to either methods, so this proposal will not reduce the required seismic performance criteria for Chapters 3 and 13 from what is currently in the IEBC.

The scoping and referencing of the seismic evaluation and design provisions is proposed to be moved out of Chapter 5 and into Chapter 1 to avoid cross referencing between the 3 compliance methods. In addition, placing the seismic provisions in Section 101.5 highlights the fact that there are several different compliance methods for seismic performance.

There editorial revisions to the remaining text of Sections 506.1 and 506.2 as well as the text that is being moved from Section 506.1.1 to new Section 101.5.4. The editorial revisions to current Section 506.1.1 where also submitted under a separate change proposal that did not include the proposed relocation of the text to Chapter 1. Refer to that change proposal for an underline-strikethrough of the proposed revisions to the current Section 506.1.1.

The proposed substantive change to Section 506.2.2.3 simplifies the evaluation and design process by eliminating the need to check wind loads for two codes. There doesn’t seem to be any reason to rehabilitate a building to wind loads in excess of the current code even if for some reason the loads were higher in the code under which the original building was designed. There is no need to exceed the requirements of the current code.

The proposed substantive change to Section 506.2.3 is a reasonable addition to the repair scope for buildings in which substantial structural damage was caused by snow. In this case, the repair and rehabilitation should strengthen the damaged building to meet current snow load requirements to minimize potential future damage. A similar proposal is being submitted on behalf of NCSEA for repairs under IBC Chapter 34.

**Cost Impact:** The code change proposal will not increase the cost of construction.

## Committee Action: Approved as Modified

**Modify the proposal as follows:**

**506.1 General.** Structural repairs shall be in compliance with this section and Section 501.3. Regardless of the extent of structural or nonstructural damage, ~~the code official shall have the authority to require the elimination of conditions deemed~~ dangerous conditions shall be eliminated. Regardless of the scope of repair, new structural members and connections used for repair or rehabilitation shall comply with the detailing provisions of the *International Building Code* for new buildings of similar structure, purpose and location.

(Portions of proposal not shown remain unchanged)

**Committee Reason:** The language proposed to be moved to Section 101.5 is more appropriately located there as it deals with scope and extent of work and method of compliance. The amendment restores more succinct and definitive language that is still necessary in Section 506.1.

**Assembly Action:** **None**

## *Individual Consideration Agenda*

### This item is on the agenda for individual consideration because public comments were submitted.

*Public Comment 1:*

### Gary J. Ehrlich, National Association of Home Builders, requests Approval as Modified by this public comment.

**Modify proposal as follows:**

**101.5.4.1 Compliance with IBC level seismic forces.** Where compliance with the seismic design provisions of the *International Building Code* is required, the procedures used shall be in accordance with one of the following.

1. The *International Building Code* using one-hundred percent of the prescribed forces. The *R* factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R* factor specified in accordance with Table 12.2-1 of ASCE 7. Where structural systems are classified as "Ordinary," "Intermediate" and "Special," the R factor used for analysis shall be the R factor specified for structural systems classified as "Ordinary" ~~in accordance with Table 12.2-1 of ASCE 7~~, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special".
2. Compliance with ASCE 41 using both the BSE-1 and BSE-2 Earthquake Hazard Levels and the corresponding performance levels shown in Table 101.5.4.1.

(Portions of proposal not shown remain unchanged)

**Commenter's Reason:** The existing language in the IEBC regarding selection of the R-factor is flawed. There are many systems which are not separated into "Ordinary", "Intermediate" and "Special" classifications, for example light-frame shear walls and buckling-restrained braces. The language as it currently stands could be taken to imply that only those systems which have "Ordinary", "Intermediate" or "Special" classifications are permitted for use under the IEBC. This proposal clarifies that those systems are acceptable, and that the R-factor as specified for those systems in ASCE 7 is the factor to use. NAHB asks for your support in approving this proposal as modified.

*Public Comment 2:*

### Peter Somers, Magnusson Klemencic Associates, representing National Council of Structural Engineers Associations, Existing Buildings Subcommittee, requests Approval as Modified by this public comment.

### Modify the proposal as follows:

**101.5 Compliance methods.** The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 101.5.1 through 101.5.3 as selected by the applicant. Application of a method shall be the sole basis for assessing the compliance of work performed under a single permit unless otherwise approved by the code official. Sections 101.5.1 through 101.5.3 shall not be applied in combination with each other. ~~Where this code requires consideration of the seismic force-resisting system of an existing building subject to repair, alteration, change of occupancy, addition or relocation of existing buildings, the seismic evaluation and design shall be based on Section 101.5.4 regardless of which compliance method is used.~~

**Exception:** Subject to the approval of the code official, alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building is undergoing more than a limited structural alteration as defined in Section 807.5.3. New structural members added as part of the alteration shall comply with the *International Building Code*. Repairs and alterations of existing buildings in flood hazard areas shall comply with Sections 501.4 and Section 601.3, respectively.

**101.5.1 Prescriptive compliance method.** Repairs, alterations, additions and changes of occupancy complying with Chapter 3 of this code in buildings complying with the *International Fire Code* shall be considered in compliance with the provisions of this code.

**101.5.2 Work area compliance method.** Repairs, alterations, additions, changes in occupancy and relocated buildings complying with the applicable requirements of Chapters 4 through 12 of this code shall be considered in compliance with the provisions of this code.

**101.5.3 Performance compliance method.** Repairs, alterations, additions, changes in occupancy and relocated buildings complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

## CHAPTER 3
## SEISMIC EVALUATION AND DESIGN

### SECTION 301
### GENERAL

**301.1 Scope.** Where this code requires consideration of the seismic-force-resisting system of an existing building subject to repair, alteration, change of occupancy, addition or relocation of existing buildings, the seismic evaluation and design shall be based on this chapter regardless of which compliance method is used.

### SECTION 302
### SEISMIC EVALUATION AND DESIGN PROCEDURES

**302.1 General.** ~~**101.5.4 Seismic evaluation and design procedures.**~~ Where this code requires compliance with IBC or reduced IBC level seismic forces, the seismic evaluation and design of an existing building and its components shall comply with this section.

**302.2** ~~**101.5.4.1**~~ **Compliance with IBC level seismic forces.** Where compliance with the seismic design provisions of the *International Building Code* is required, either of the following procedures shall be permitted.

1. The *International Building Code* using one-hundred percent of the prescribed forces. The *R* factor used for analysis in accordance with Chapter 16 of the *International Building Code* shall be the *R* factor specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that the structural system satisfies the proportioning and detailing requirements for systems classified as "Intermediate" or "Special".
2. Compliance with ASCE 41 using both the BSE-1 and BSE-2 Earthquake Hazard Levels and the corresponding performance levels shown in Table ~~101.5.4.1~~ 302.2.

**TABLE ~~101.5.4.1~~ 302.2 SEISMIC PERFORMANCE CRITERIA**

| OCCUPANCY CATEGORY (BASED ON IBC TABLE 1604.5) | PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL | PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-2 EARTHQUAKE HAZARD LEVEL |
|---|---|---|
| I | Life Safety (LS) | Collapse Prevention (CP) |
| II | Life Safety (LS) | Collapse Prevention (CP) |
| III | Note a | Note a |
| IV | Immediate Occupancy (IO) | Life Safety (LS) |

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

**302.3** ~~**101.5.4.2**~~ **Compliance with reduced IBC level seismic forces**. Where seismic evaluation and design is permitted to meet reduced *International Building Code* seismic force levels, one of the following procedures shall be permitted:

1. The *International Building Code* using seventy-five percent of the prescribed forces. The *R* factor used for analysis shall be as specified in Section 302.3 ~~101.5.4.1~~ of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.5 shall be deemed to comply with this section.
   - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
   - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A2.
   - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A3.
   - 2.4. Seismic evaluation and design of soft, weak, or open-front wall conditions in multiunit residential buildings of wood construction in Occupancy Category I or II are permitted to be based on the procedures specified in Appendix Chapter A4.
   - 2.5. Seismic evaluation and design of concrete buildings and concrete with masonry infill buildings in all Occupancy Categories are permitted to be based on the procedures specified in Appendix Chapter A5.
3. Compliance with ASCE 31 based on the applicable performance level as shown in Table 302.3 ~~101.5.4.2~~
4. Compliance with ASCE 41 using the BSE-1 Earthquake Hazard Level and the performance level shown in Table 302.3 ~~101.5.4.2~~. The design spectral response acceleration parameters $S_{XS}$ and $S_{X1}$ specified in ASCE 41 shall not be taken less than seventy-five percent of the respective design spectral response acceleration parameters $S_{DS}$ and $S_{D1}$ defined by the *International Building Code*.

**TABLE 302.3 ~~101.5.4.2~~**
**REDUCED SEISMIC PERFORMANCE CRITERIA**

| OCCUPANCY CATEGORY (BASED ON IBC TABLE 1604.5) | PERFORMANCE LEVEL FOR USE WITH ASCE 31 | PERFORMANCE LEVEL FOR USE WITH ASCE 41 BSE-1 EARTHQUAKE HAZARD LEVEL |
|---|---|---|
| I | Life Safety (LS) | Life Safety (LS) |
| II | Life Safety (LS) | Life Safety (LS) |
| III | Note a | Note a |
| IV | Immediate Occupancy (IO) | Immediate Occupancy (IO) |

a. Performance Levels for Occupancy Category III shall be taken as halfway between the performance levels specified for Occupancy Category II and IV.

**Commenter's Reason:** I am the proponent of this proposal that was approved AM at the Palm Springs hearings (errata and a Code Committee modification are not related to the portion of the proposal that is the subject of this comment). During the testimony at the hearings there was some concern about placing technical or scoping provisions for seismic evaluation and design into the administrative chapter. As stated during my testimony, Chapter 1 is the only place within the current framework of the IEBC to put the provisions so that they could be applicable to all of the compliance methods (Prescriptive, Work Area, and Performance). A separate chapter was suggested, but a floor modification of that kind wasn't possible at the hearings. This public comment responds to the suggestion and serves as an alternate to any potential public comments submitted in opposition of this proposal based on the location of the text in Chapter 1.

As indicated in the reason statement of the original proposal and supported by the Code Committee, it is important to allow the seismic evaluation and design procedures currently applicable to just the Work Area compliance method (they are contained currently in Chapter 5) to be applicable to the Prescriptive and Performance compliance methods as well. Without the ability to use these alternates to the IBC, the Prescriptive and Performance methods are not well suited for structural work on existing buildings. Therefore, we don't want objections to technical provisions appearing in Chapter 1 to cause disapproval of this important proposal. If there aren't any public comments submitted in opposition to the approved location of these provisions, we will withdraw this comment.

In summary, this public comment takes all of the text that had been moved from the current Sections 506.1.1 through 506.1.1.3 to Section 101.5 and new Section 101.5.4 by the approved EB1-07/08 and moves it to a new Chapter 3. Chapter 1 ends up unchanged from the current 2006 IEBC version and Chapter 5 ends up unchanged from the AM version of EB1-07/08.

Final Action: AS AM AMPC____ D

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# EB3-07/08
## 104.2.1.1

*Proposed Change as Submitted:*

**Proponent:** David Bonowitz, SE, representing National Council of Structural Engineers Associations Existing Buildings Committee

**Revise as follows:**

**104.2.1.1 Building evaluation.** The code official is authorized to require an existing building to be investigated and evaluated by a registered design professional based on the circumstances agreed upon at the preliminary meeting ~~to determine the existence of~~. The design professional shall notify the code official if any potential nonconformance with the provisions of this code is identified.

**Reason:** To clarify the role of the design professional with respect to inspections required by the code official.

As written, the provision requires the designated design professional to find *any and all* potential problems with a given building. This places an undue burden (and possibly undue liability) on the design professional, who, at the time of the preliminary meeting, rarely has either complete access to the building or structure or complete knowledge of its construction and history. Compliance with the provision as currently written could result in unnecessary and expensive destructive investigation, and reasonable effort by the design professional could be deemed non-compliance.

The preferred approach, which is probably what was intended by the provision, is for the design professional to set the scope of any inspection with the code official at the preliminary meeting, then make a reasonable effort and report to the code official whatever is found. Guidelines exist to assist both the design professional and the code official with the exercise of discretion. For example, ASCE 11, Guidelines for Structural Condition Assessments, addresses appropriate investigation measures and the application of engineering judgment.

**Cost Impact:** The code change proposal will not increase the cost of construction.

**Committee Action:** **Disapproved**

**Committee Reason:** The proposed language is unnecessary, and, in the opinion of the committee, potentially more prone to misinterpretation. In addition, this opens up the intent of the section to deal with the broader issue of scope of work.

**Assembly Action:** **None**

*Individual Consideration Agenda*

**This item is on the agenda for individual consideration because a public comment was submitted.**

*Public Comment:*

**David Bonowitz, SE, representing National Council of Structural Engineers Associations, Existing Buildings Subcommittee, requests Approval as Submitted.**

**Commenter's Reason:** The Committee's reason for Disapproval illustrates the confusion that was evident at the hearings. Deliberations by the Committee made clear that it had a mistaken context in mind and believed the proposal to be more complex than it really is. A simple reading of the existing provision and the proposal shows that the Committee's reason – "[The proposal] opens up the intent of the section to deal with the broader issue of scope of work" – does not make sense. Indeed, the scope of work is unclear in the existing provision, and proposal EB3 would clarify it.

The current 104.2.1.1 authorizes the code official to require an investigation. It has the following problems:

- Scope is unclear. First it says the investigation is to be "based on the circumstances agreed upon at the preliminary meeting." Then it says the scope is "to determine the existence of any potential nonconformance."
- Scope is unreasonable. To require the design professional "to determine the existence of any potential nonconformance" in an existing building is unreasonable and often impossible, since the design professional has neither complete access nor complete information. The provision as written makes the design professional responsible for information he can not possibly know.
- Direction is unclear. The provision does not say what the design professional is to do with the results of the investigation.

Proposal EB3 simply fixes these problems as follows:

- It clarifies the scope. The investigation should be "based on the circumstances agreed upon at the preliminary meeting," period.
- It sets a reasonable scope. The investigation should not be required to find any and all hidden conditions of "nonconformance."
- It gives direction. If nonconformance is identified, the design professional must notify the code official.

Final Action: AS AM AMPC____ D

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# EB6-07/08
**202**

*Proposed Change as Submitted:*

**Proponent:** Gary R. Searer, Wiss, Janney, Elstner Associates, Inc., representing himself

**Revise definition as follows:**

**SECTION 202**
**GENERAL DEFINITIONS**

**DANGEROUS.** Any building or structure or ~~any individual member with~~ portion thereof that meets any of the ~~structural~~ conditions ~~or defects~~ described below shall be deemed dangerous:

~~1. The stress in a member or portion thereof due to all factored dead and live loads is more than one and one third the nominal strength allowed in the *International Building Code* for new buildings of similar structure, purpose, or location.~~

~~2. Any portion, member, or appurtenance thereof likely to fail, or to become detached or dislodged, or to collapse and thereby injure persons.~~

~~3. Any portion of a building, or any member, appurtenance, or ornamentation on the exterior thereof is not of sufficient strength or stability, or is not anchored, attached, or fastened in place so as to be capable of resisting a wind pressure of two thirds of that specified in the *International Building Code* for new buildings of similar structure, purpose, or location without exceeding the nominal strength permitted in the *International Building Code* for such buildings.~~

~~4. The building, or any portion thereof, is likely to collapse partially or completely because of dilapidation, deterioration or decay; construction in violation of the *International Building Code*; the removal, movement or instability of any portion of the ground necessary for the purpose of supporting such building; the deterioration, decay or inadequacy of its foundation; damage due to fire, earthquake, wind or flood; or any other similar cause.~~

~~5. The exterior walls or other vertical structural members list, lean, or buckle to such an extent that a plumb line passing through the center of gravity does not fall inside the middle one third of the base.~~

1. The building or structure has collapsed, partially collapsed, moved off its foundation, or lacks the support of any portion of ground necessary to support it.

2. There exists a significant risk of collapse, detachment, or dislodgment of any portion, member, appurtenance, or ornamentation of the building or structure under typical day-to-day service loads.

**Reason:** The purpose of this proposed change is to clarify the language of the IEBC and make the definition of the word "dangerous" more in line with the common engineering understanding of the word and to preclude structures that are not significantly distressed or even not distressed at all (e.g. older wood structures that had much higher allowable stresses at the time they were permitted, structures with older materials that are no longer allowed by the IBC, older claddings that had much lower design wind loads at the time they were designed, etc.) from being improperly deemed dangerous.

**Cost Impact:** The code change proposal will not increase the cost of construction.

**Committee Action:** **Approved as Modified**

**Modify the proposal as follows:**

2. There exists a significant risk of collapse, detachment, or dislodgment of any portion, member, appurtenance, or ornamentation of the building or structure under ~~typical day-to-day~~ service loads.

(Portions of proposal not shown remain unchanged)

**Committee Reason:** The proposal makes the word "dangerous" more in line with current engineering practice. The modification was made to make the language more succinct by removing an ambiguous phrase.

**Assembly Action:** **None**

## *Individual Consideration Agenda*

**This item is on the agenda for individual consideration because a public comment was submitted.**

*Public Comments:*

**David Bonowitz, SE, representing National Council of Structural Engineers Associations, Existing Buildings Subcommittee requests Approval as Modified by this public comment.**

**Gary R. Searer, SE, Wiss, Janney, Elstner Associates, Inc., representing himself requests Approval as Modified by this public comment.**

**DANGEROUS.** Any building or structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, partially collapsed, moved off its foundation, or lacks the support of ~~any portion of~~ ground necessary to support it.
2. There exists a significant risk of collapse, detachment, or dislodgment of any portion, member, appurtenance, or ornamentation of the building or structure under service loads.

(Portions of proposal not shown remain unchanged)

**Commenter's Reason: (Bonowitz)** The proposed modification is editorial. It is made for consistency with a modification made by the IBC-Structural Committee to a matching definition in proposal G205-07/08. EB6 and G205 were intended to introduce identical definitions into the IBC and the IEBC. G205 was modified as shown above, but EB6 was not. This modification by public comment will restore the identical language.

**Commenter's Reason: (Searer)** This minor change is requested to be consistent with the actions of the IBC Structural Committee. The IEBC Committee eliminated the words "typical day-to-day" which were, according to comments from the IEBC committee, redundant; the IBC Structural Committee then followed suit based on the proponent's request. However, the IBC Structural Committee also eliminated the words "any portion of" which addressed the concerns expressed by the NAHB representative, but the IEBC Committee did not make a similar change. This proposed public comment change merely matches the language to that accepted for inclusion into the IBC.

As background, two similar proposals were submitted to the IEBC Committee (EB6) and to the IBC Structural Committee (G205) and were accepted with minor modifications by both Committees; the overall goal of these proposals was to redefine and clarify the definition of "dangerous" as defined in the IEBC, and add the definition of dangerous to the IBC, which lacks such a definition.

The current definition in the IEBC is awkward, contains commentary, and is often non-workable, as described below.

For example, Item 1 in the current definition bases determination of dangerous conditions on a comparison between stress in a member compared to nominal strength allowed by the IBC. Not only does this definition force illogical and ill-defined comparisons, it results in significant problems with archaic or non-conforming materials such as unreinforced masonry, hollow clay tile, or tile arch flooring -- materials for which no allowable strength is provided in the IBC. It also creates problems for materials for which allowable stresses have been significantly reduced over the years, such as wood. Thus, even structures that have not experienced any damage or distress over the course of many decades may be illogically deemed "dangerous" according to the current definition in the IEBC.

Item 2 in the current definition does not define the loads that should be considered in determining whether a portion of a structure if likely to fail. This proposal states the loads that should be considered are service loads (i.e. typical day-to-day loads as opposed to other loads such as blast and earthquake that may never occur during the life of the structure). Note that in areas of the country that have large design snow loads, the new definition of dangerous would still include consideration of these loads in determining whether a structure was dangerous.

Item 3 in the current definition requires a structure be defined as dangerous if the cladding is not able to resist at least two-thirds of the IBC wind loads, yet many structures have claddings that were designed for only 20 or 25 psf and have performed perfectly adequately over their lives, yet would be deemed dangerous because the IBC wind loads are almost double the original design pressures in some instances.

Items 4 and 5 in the current definition provide unnecessary commentary.

Based on the reasons above, I urge adoption of this proposed public comment change to match the modification by the IBC Structural Committee.

Final Action: AS AM AMPC____ D

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# EB17-07/08

## 602.1, 602.2, 602.3 (New)

*Proposed Change as Submitted:*

**Proponent:** Marcelo M. Hirschler, GBH International, representing American Fire Safety Council

**1. Revise as follows:**

**602.1 (Supp) Interior finishes.** All newly installed interior wall and ceiling finishes shall comply with the flame spread index and smoke-developed index requirements of Chapter 8 of the *International Building Code*.

**602.2 ~~Carpeting~~ Interior floor finish.** New interior floor finish, including new carpeting used as an interior floor finish material shall comply with the critical radiant flux and other requirements of Section 804 of the *International Building Code*.

**2. Add new text as follows:**

**602.3 Interior trim.** All newly installed interior trim materials shall comply with the requirements of Section 806 of the *International Building Code*.

(Renumber subsequent section)

**Reason:** This change is basically clarification.

Chapter 8 of the IBC has requirements for flame spread index and smoke-developed index (and alternative approaches based on heat release requirements from testing in a room-corner test) for interior wall and ceiling finishes. The amended wording clarifies that the smoke-developed index requirements must also be met and that the alternate requirements, based on a room-corner test (such as NFPA 286) instead of being based on testing for flame spread index and smoke-developed index by ASTM E 84, as permitted by the IBC, are also permitted for alterations of existing buildings.

Section 804 of the IBC addresses requirements for interior floor finish and not only carpeting. Also, the requirements of section 804 are slightly broader than just critical radiant flux.

Section 806 of the IBC (or section 804 of the IFC) addresses requirements for interior trim materials and those should also be complied with when alterations are made in existing buildings.

**Cost Impact:** The code change proposal will not increase the cost of construction.

**Committee Action:** **Approved as Submitted**

**Committee Reason:** The proposal provides a useful clarification that new interior trim materials meet Chapter 8 of the IBC.

**Assembly Action:** **None**

*Individual Consideration Agenda*

**This item is on the agenda for individual consideration because public comments were submitted.**

*Public Comment 1:*

**Lawrence Brown, CBO, National Association of Home Builders, requests Approval as Modified by this public comment.**

**Modify proposal as follows:**

**602.3 Interior trim.** All newly installed interior trim materials shall comply with the requirements of Section 806 of the *International Building Code*.

**Exception:** New interior trim materials used for the repair or replacement of existing interior trim materials shall be permitted to match the existing trim.

**(Portions of proposal not shown remain unchanged)**

**Commenter's Reason:** This modification provides a means for older and historic buildings to retain their original interior trim design during repair or renovation. If enforced as proposed, it is possible that repaired and replacement trim would not be able to match the existing trim in size as the provisions for trim may be different in IBC Chapter 8. This modification is especially important in those situations where only a portion of the trim within a room needed to be repaired due to causes such as water damage. Without this modification the replacement trim sections may not be permitted to match the existing trim materials that were code-compliant at the time of installation. In addition, the "Reason" to support the Proposal provided no documentation that shows replacing the existing trim with the same type size and material would pose a greater fire hazard than the existing trim. Replacing the existing trim with trim that matches the existing trim will not pose a greater risk than allowing the existing trim to remain in place.

*Public Comment 2:*

**Maureen Traxler, City of Seattle, WA, representing Washington Association of Building Officials Technical Code Development Committee, requests Approval as Modified by this public comment.**

**Modify proposal as follows:**

**602.1 (Supp) Interior finishes.** All newly installed interior wall and ceiling finishes shall comply with ~~the flame spread index and smoke developed index requirements of~~ Chapter 8 of the *International Building Code*.

**602.2 Interior floor finish.** New interior floor finish, including new carpeting used as an interior floor finish material shall comply with ~~the critical radiant flux and other requirements of~~ Section 804 of the *International Building Code*.

**602.3 Interior trim.** All newly installed interior trim materials shall comply with ~~the requirements of~~ Section 806 of the *International Building Code*.

**Commenter's Reason:** This comment removes unnecessary language from these sections. The intent is to require compliance with all the requirements of the referenced sections, so it isn't necessary to specify flame spread or radiant flux.

Final Action: AS AM AMPC____ D

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# EB22-07/08
## 606.2.2, 606.2.3 (New)

*Proposed Change as Submitted:*

**Proponent:** Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

**1. Revise as follows:**

**606.2.2 ~~Parapet~~ Bracing ~~and wall anchors for reroof permits~~ for unreinforced masonry parapets.** ~~Unreinforced masonry bearing wall buildings classified as~~ Where a permit is issued for reroofing on a building assigned to Seismic Design Category D, E, or F, that has parapets constructed of unreinforced masonry, the work shall include installation of ~~shall have~~ parapet bracing ~~and wall anchors installed at the roof line whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be designed in accordance with~~ to resist the reduced *International Building Code* ~~level~~ seismic forces ~~as~~ specified in Section 506.1.1.3, unless an evaluation demonstrates compliance of such items ~~and design procedures of Section 506.1.1.1~~.

**2. Add new text as follows:**

**606.2.3 Wall anchors for concrete and masonry buildings.** Where a permit is issued for reroofing on a building assigned to Seismic Design Category D, E, or F with a structural system consisting of concrete or reinforced masonry walls with a flexible roof diaphragm or unreinforced masonry walls with any type of roof diaphragms, the work shall include installation of wall anchors at the roof line to resist the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1, unless an evaluation demonstrates compliance of existing wall anchorage.

**Reason:** This proposal includes the following revisions:

- Adds a 25% trigger for requiring additional upgrades, consistent with other sections of the IEBC that place reasonable limitations on the amount of work done before additional items are triggered.
- Editorially revises the current language with respect to parapet bracing and wall anchorage to require evaluation of the existing anchorage, if any, prior to adding anchorage.

- Revises the scope for parapet bracing to include unreinforced masonry parapets in all buildings, not just parapets in unreinforced masonry buildings. Many old concrete frame buildings have unreinforced masonry parapets that could pose a similar hazard as those in masonry buildings.
- Revises the scope for wall anchorage to include wall-to-roof anchors at concrete and masonry buildings with flexible diaphragms.
- Splits the current section into 2 separate sections for clarity.

Consistent with the overall approach of the IEBC, in which upgrade triggers are reasonably calibrated to the level of work, adding a stipulation that a significant portion of the roof needs to be impacted before requiring rehabilitation of the wall anchorage and parapet bracing.

Make this section consistent with the standard approach for existing buildings – first determine whether seismic deficiencies existing, then fix them if required.

Unbraced unreinforced masonry parapets can pose a significant falling hazard in any type of building, and reroofing is the appropriate time to address this potential deficiency.

Lack of wall anchorage at concrete and masonry buildings can pose as significant a risk as in unreinforced masonry buildings. To wit, the IEBC contains an appendix chapter (A2) focused on mitigating the seismic hazard associated with these buildings. Reroofing provides a good opportunity to address this potential deficiency.

**Cost Impact:** The code change proposal will not increase the cost of construction.

**Committee Action:** **Approved as Submitted**

**Committee Reason:** The proposal makes this section consistent with the standard code approach for existing buildings, to first determine if there are deficiencies, then fix them. It is important that all unreinforced masonry parapets be dealt with, not just masonry parapet in unreinforced masonry buildings.

**Assembly Action:** **None**

## *Individual Consideration Agenda*

**This item is on the agenda for individual consideration because public comments were submitted.**

*Public Comment 1:*

**Gary R. Searer, SE, Wiss, Janney, Elstner Associates, representing himself, requests Approval as Modified by this public comment.**

**Modify proposal as follows:**

**606.2.3 Wall anchors for ~~concrete and~~ masonry buildings.** Where a permit is issued for reroofing on a building assigned to Seismic Design Category D, E, or F with ~~a structural system consisting of concrete or reinforced masonry walls with a flexible roof diaphragm or~~ unreinforced masonry walls ~~with any type of roof diaphragms~~, the work shall include installation of wall anchors at the roof line to resist the reduced *International Building Code* level seismic forces as specified in Section 506.1.1.3 and design procedures of Section 506.1.1.1, unless an evaluation demonstrates compliance of existing wall anchorage.

**Commenter's Reason:** This is the first of two public comments regarding EB22; if this proposed change is not approved, I urge disapproval of EB22.

The proposed wording that was accepted by the Committee included the introduction of new mandatory seismic upgrade provisions for structures with concrete walls and flexible roof diaphragms (e.g. tilt-ups and similar rigid-wall-flexible-diaphragm structures) as a result of re-roofing. This is illogical, as wall-to-roof anchorages of most tilt-ups and similar buildings can be (and are) strengthened from underneath the roof. Since strengthening of wall-to-roof connections has no relationship with re-roofing and does not need to be performed in a manner that would affect the roofing, there is no logical reason to trigger seismic upgrade of wall-to-roof connections with the act of re-roofing.

In the code change proposal submitted to ICC, it was claimed that this code change will not increase the cost of construction, but it clearly will increase the cost of re-roofing for a large number of existing buildings. **During the hearing in February, no testimony regarding the anticipated cost of this upgrade trigger was provided. Furthermore, no input from building owners or from the Building Owners and Managers Association (BOMA) was provided. Given the presumably significant cost implications of this new upgrade trigger, testimony from building owners and BOMA should be solicited at the Final Action Hearing in September.**

The new mandatory seismic upgrades that were added for concrete and reinforced masonry structures should be deleted as provided in this public comment. If a jurisdiction wants to mandate seismic strengthening of tilt-up and similar rigid-wall-flexible-diaphragm structures, it should do so via a local ordinance; the ordinance can then be debated and weighed by all interested parties, including building owners, tenants, and the public. The ordinance can then have a compliance timeline, which will give building owners time to plan for the added expense of seismically upgrading their buildings -- an expense that is unrelated to re-roofing. Linking seismic upgrading of tilt-ups with re-roofing permits unfairly penalizes building owners who may have to re-roof their structures in the near future. Inserting a seismic upgrade trigger into the code without any testimony regarding the cost of this trigger is, in my opinion, unfair and illogical -- particularly since the upgrade trigger (i.e. reroofing) has so little to do with the actual upgrade (i.e., installation of wall-to-roof anchors at the underside of the roof).

*Public Comment 2:*

**Gary R. Searer, SE, Wiss, Janney, Elstner Associates, representing himself, requests Disapproval.**

**Commenter's Reason:** This is the second of two public comments regarding EB22; if the change proposed in my first comment is not approved, I urge disapproval of EB22.

The proposed wording that was accepted by the Committee included the introduction of new mandatory seismic upgrade provisions for structures with concrete walls and flexible roof diaphragms (e.g. tilt-ups and similar rigid-wall-flexible-diaphragm structures) as a result of re-roofing. This is illogical, as wall-to-roof anchorages of most tilt-ups and similar buildings can be (and are) strengthened from underneath the roof. Since strengthening of wall-to-roof connections has no relationship with re-roofing and does not need to be performed in a manner that would affect the roofing, there is no logical reason to trigger seismic upgrade of wall-to-roof connections with the act of re-roofing.

In the code change proposal submitted to ICC, it was claimed that this code change will not increase the cost of construction, but it clearly will increase the cost of re-roofing for a large number of existing buildings. **During the code hearings in February, no testimony regarding the anticipated cost of implementing this upgrade trigger was provided. Furthermore, no input from building owners or from the Building Owners and Managers Association (BOMA) was provided. Given the presumably significant cost implications of this new upgrade trigger, testimony from building owners and BOMA should be solicited at the Final Action Hearing in September.**

If the new mandatory seismic upgrades that were added by EB 22 for concrete and reinforced masonry structures are not deleted as suggested in another public comment, then the entire code change proposal should be disapproved. If a jurisdiction wants to mandate seismic strengthening of tilt-up and similar rigid-wall-flexible-diaphragm structures, it should do so via a local ordinance; the ordinance can then be debated and weighed by all interested parties, including building owners, tenants, and the public. The ordinance can then have a compliance timeline, which will give building owners time to plan for the added expense of seismically upgrading their buildings -- an expense that is unrelated to re-roofing. Linking seismic upgrading of tilt-ups with re-roofing permits unfairly penalizes building owners who may have to re-roof their structures in the near future. Inserting a seismic upgrade trigger into the code without any testimony regarding the cost of this trigger is, in my opinion, unfair and illogical -- particularly since the upgrade trigger (i.e. reroofing) has so little to do with the actual upgrade (i.e., installation of wall-to-roof anchors at the underside of the roof).

Final Action: AS AM AMPC____ D

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# EB25-07/08
## 606.3

*Proposed Change as Submitted:*

**Proponent:** Peter Somers, SE, Magnusson Klemencic Associates, representing NCSEA Existing Building Committee

**Revise as follows:**

**606.3 Roof diaphragms in high wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building located where the basic wind speed is greater than 90 mph or in a special wind region, as defined in Section 1609 of the *International Building Code*, ~~where the roof diaphragm is a part of the main windforce-resisting system the integrity of the roof diaphragm shall be evaluated and if found deficient because of insufficient or deteriorated connections, such connections shall be provided or replaced~~ roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition do not comply with those wind provisions, they shall be replaced or strengthened..

**Reason:** This proposal includes editorial revisions to clarify scope of the section, replace vague and/or unenforceable language, and clarify the wind load criteria for the roof diaphragm evaluation. In addition there is a proposed substantive change to limit the scope of this requirement to high wind regions.

The current text of this section is not clear concerning criteria for the evaluation.

Consistent with the overall approach of the IEBC, in which upgrade triggers are reasonably calibrated to the level of work, this proposal limits the scope of roof diaphragm evaluation to locations with relatively high wind loads. This is also consistent with Section 606.2.2 in which the triggers for parapet bracing are limited to areas with high seismic hazard (Seismic Design Category D-F).

Specifying areas with basic wind speed greater than 90 mph covers all Hurricane-Prone Regions as defined in the IBC (Atlantic and Gulf coasts, Hawaii, etc) as well as the high wind areas of Alaska. Including the special wind regions defined in IBC Figure 1609 captures other areas that the IBC considers at risk of high winds. The remainder of the country is exempt from this requirement, which is consistent with the intended scope of work associated with the Level 1 alterations – trigger fixes for only significant problems. Note that the IBC wind provisions for new buildings do not contain any special criteria for the tornado prone areas in the Midwest compared to other areas with the same basic wind speed of 90 mph.

**Cost Impact:** The code change proposal will not increase the cost of construction.

**Committee Action:** **Approved as Submitted**

**Committee Reason:** This appropriately limits the need for roof diaphragms and connections to be upgraded to present day code in high wind regions only.

**Assembly Action:** **None**

*Individual Consideration Agenda*

**This item is on the agenda for individual consideration because public comments were submitted.**

*Public Comment 1:*

**Gary R. Searer, SE, Wiss, Janney, Elstner Associates, representing himself, requests Approval as Modified by this public comment.**

**Modify proposal as follows:**

**606.3 Roof diaphragms in high wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building located where the basic wind speed is greater than 90 mph or in a special wind region, as defined in Section 1609 of the *International Building Code,* roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition ~~do not comply with those wind provisions~~ are not capable of resisting at least 75% of those wind loads, they shall be replaced or strengthened.

**Commenter's Reason:** EB25 necessarily addresses unenforceable and incomprehensible language in Section 606.3 of the IEBC and tries to parlay this Section into a rational upgrade trigger. However, the proposed wording that was accepted by the Committee does not contain any language that allows any overstresses; hence any overstress -- no matter how small -- triggers upgrade of the wind-resisting system to meet current code. In the 2003 and 2006 IEBC, only when elements could not resist at least two-thirds (67%) of the current wind loads were the elements considered dangerous. In the *Uniform Code for the Abatement of Dangerous Buildings* (one of the bases of the IEBC), only when elements could not resist at least one-half (50%) of the current wind loads were the elements considered dangerous -- and therefore worthy of administrative action requiring strengthening. EB24 proposed to use a 67% cutoff, but the Committee rejected that limit as being arbitrary. The 75% cutoff proposed in this public comment is consistent with the reduced seismic forces in other portions of the IEBC, and is consistent with the fact that buildings and components that are designed for 100% wind loads are intended to remain elastic… Therefore, if a structure and its components can resist at least 75% of current wind load, one would expect that the performance would still be acceptable under the design loads due to the difference between minimum yield and expected ultimate strengths and due to the generally conservative nature of design. Stated differently, one would not expect to see global or widespread failure or even damage in the wind-force resisting system due to overstresses from wind in the range of 1% to 33%. No evidence to demonstrate that upgrading structures and components with overstresses in this range would significantly reduce or preclude damage was provided at the hearings in February.

Since the prior version of Section 606.3 was unintelligible and therefore unenforceable, and since the prior version only dealt with connections and this new wording deals with both connections and the entire diaphragm, this is essentially a new upgrade trigger. **During the hearing in February, no testimony regarding the cost of this upgrade trigger was provided. Furthermore, no input from building owners or from the Building Owners and Managers Association (BOMA) was provided. Given the presumably significant cost implications of this new upgrade trigger, testimony from building owners and BOMA should be solicited at the Final Action Hearing in September.**

*Public Comment 2:*

**Maureen Traxler, Department of Planning and Development, City of Seattle, WA requests Approval as Modified by this public comment.**

**Modify proposal as follows:**

**606.3 Roof diaphragms in high wind regions.** Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building located where the basic wind speed is greater than 90 mph or in a special wind region, as defined in Section 1609 of the *International Building Code,* roof diaphragms and connections that are part of the main wind-force resisting system shall be evaluated for the wind loads specified in the *International Building Code*, including wind uplift. If the diaphragms and connections in their current condition do not comply with those wind provisions, they shall be replaced or strengthened in accordance with the loads specified in the *International Building Code*.

**Commenter's Reason:** This proposed modification is offered to clarify that it is not enough to merely increase the strength, but the diaphragms and connections must be able to carry the loads in the current IBC.

Final Action: AS AM AMPC____ D

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# EB37-07/08
## 912.8.2

**THIS CODE CHANGE WILL BE HEARD ON THE IBC MEANS OF EGRESS PORTION OF THE HEARING ORDER.**

*Proposed Change as Submitted:*

**Proponent:** Dominic Marinelli, United Spinal Association

**Revise as follows:**

**912.8 Accessibility.** Existing buildings that undergo a change of group or occupancy classification shall comply with this section.

**912.8.1 Partial change in occupancy.** Where a portion of the building is changed to a new occupancy classification, any alterations shall comply with Sections 605 and 706 as applicable.

**912.8.2 (Supp) Complete change of occupancy.** Where an entire building undergoes a change of occupancy, it shall comply with Section 912.8.1 and shall have all of the following accessible features:

1. At least one accessible building entrance.
2. At least one accessible route from an accessible building entrance to primary function areas.
3. Signage complying with Section 1110 of the *International Building Code*.
4. Accessible parking, where parking is provided.
5. At least one accessible passenger loading zone, where loading zones are provided.
6. At least one accessible route connecting accessible parking and accessible passenger loading zones to an accessible entrance.

Where it is technically infeasible to comply with the new construction standards for any of these requirements for a change of group or occupancy, the above items shall conform to the requirements to the maximum extent technically feasible.

~~**Exception:** Type B dwelling or sleeping units required by Section 1107 of the *International Building Code* are not required to be provided in existing buildings and facilities.~~

**Reason:** The intent of this proposal is to make the Type B dwelling unit requirements required in a building that undergoes a change of occupancy. While the Fair Housing Act only addresses new construction, the building codes historically have required buildings that change from one use to another to comply with the requirements for the new use. What could be the technical justification that would prohibit a warehouse being converted into apartments from providing the minimal accessibility requirements in Type B units? The same exceptions in Section 1107.7 would apply as for new construction, therefore Type B units would not be required in changes of occupancy with fewer than 4 units, in upper floors of non-elevator buildings, etc. These types of units are in greater need as the average population of America ages.

This same change of occupancy would be expected to provide Type A units if it contained more than 20 units. Why is the justification for the codes being inconsistent in their approach dealing with providing homes that can be used for a persons lifetime?

United Spinal has similar changes in for IBC Chapter 34 and IEBC Chapter 3 where they are requesting the elimination of the Type B exception for existing buildings. This revision would also be consistent for partial changes of occupancy in 2007 Supplement Section 912.8.1. United Spinal has proposed a change to Section 706 (referenced in Section 912.8.1) to required Type B units when 4 or more units are added.

**Cost Impact:** This code change proposal will increase the cost of construction.

**Committee Action:** **Approved as Submitted**

**Committee Reason:** The committee agrees with the proponent that Type B units should be required for a change of occupancy, just as they would be required for new construction.

**Assembly Action:** **None**

## *Individual Consideration Agenda*

**This item is on the agenda for individual consideration because public comments were submitted.**

*Public Comment 1:*

**Lawrence Brown, CBO, National Association of Home Builders, requests Disapproval.**

**Commenter's Reason:** The deletion of the Exception is contrary to the U.S. Federal Law Fair Housing Act accessibility requirements. The Federal Fair Housing Act does not require existing buildings that are converted to residential use to comply with the Fair Housing Act accessibility requirements. There are many structural aspects of existing buildings, such as the inability to move walls, that are considerations as to why the Federal law only applies to multifamily buildings constructed after March 13, 1991. Reading the Committee Statement, *"The committee agrees with the proponent that Type B units should be required for a change of occupancy, just as they would be required for new construction,"* goes to the reason to support of this Public Comment. The IBC does not require existing buildings with a change of occupancy to a Residential Use to contain Type B units. In fact, and contrary to the IEBC Code Committee belief, if this change is not Disapproved, there WILL BE AN INCONSISTENCY between the IBC and the IEBC. Section 3409.1 of the IBC states:

> **3409.1 Scope.** The provisions of Sections 3409.1 through 3409.9 apply to maintenance, change of occupancy, additions and alterations to existing buildings, including those identified as historic buildings.
>
> **Exception:** Type B dwelling or sleeping units required by Section 1107 are not required to be provided in existing buildings and facilities.

Federal Law for the implementing the accessibility requirements of the Fair Housing Act only apply to new multifamily buildings as described in the HUD Fair Housing Act Design Manual as follows: *"The Fair Housing Act does not require any renovations to existing buildings. Its design requirements apply to new construction only – to covered multifamily dwellings that are built for first occupancy after March 13, 1991. First occupancy is defined as "a building that has never before been used for any purpose."*

The I-Codes should not contain requirements that are contrary to Federal public law.

*Public Comment 2:*

**Lawrence G. Perry, AIA, representing Building Owners and Managers Association (BOMA) International, requests Disapproval.**

**Commenter's Reason:** The proposed change seeks to require that Type B dwelling or sleeping units be provided upon a change of occupancy. This is inconsistent with the requirements of the Federal Fair Housing Amendments Act upon which the Type B unit scoping and technical provisions have been based. The proponent reason statement provides inadequate substantiation for such a significant departure from the long-standing approach to Type B units. When first developed, it was accepted that just providing Type B units, equivalent to the requirements of Fair Housing, was an inadequate approach. Therefore, requirements for more accessible "Type A" units (and for even more accessible "Accessible Units" in certain occupancies) were maintained in the scoping package and in the A117 reference standard. These Accessible Units and Type A units are required in alterations and upon a change of occupancy. The Federal Fair Housing requirements apply only to new construction, and the Type B scoping provisions accurately reflect this.

The proposal reason statement notes that this change is consistent with 912.8.1 (Supp) dealing with partial changes of occupancy. This is an inaccurate statement; 912.8.1, and its references to 605 and 706, would require only Accessible Units or Type A units, as applicable, in partial changes of occupancy. There is no requirement to provide Type B units upon a partial change of occupancy.

The proposal reason statement also notes: "The same exceptions in Section 1107.7 would apply as for new construction…" This, too, is inaccurate. One of the major exceptions provided for Type B unit scoping, consistent with similar provisions in the Federal Fair Housing Guidelines, allows a significant reduction in the number of Type B units required where 'site impracticality' exists (See IBC 1107.7.4). The determination of site impracticality requires that an assessment of site grades, prior to development, be analyzed. Also note that section 1107.7.1.2, which is used to determine if more than one story of units must be Type B units, requires an analysis of the 'slopes of the undisturbed site'. How can the grades that existed 'prior to development' or on 'the undisturbed site' be assessed in a building undergoing a change of occupancy? Even if they can be determined, do they have any relevance when dealing with an existing building?

This proposal is one of many being introduced on several fronts seeking to expand both the technical and the scoping requirements for Type B units beyond that intended when they were developed. Type B units were incorporated into the codes as a means of providing a more usable mechanism for achieving compliance with the Federal Fair Housing Requirements. Such major departure from an overall package of Accessible, Type A, and Type B units should not be made unless it is determined that a wholesale review of the entire approach to accessible dwelling and sleeping units is needed.

**Analysis:** Public comments have been submitted for Code Change Proposal G215-07/08 and EB37-07/08 that would affect Type B unit requirements in existing buildings undergoing a change in occupancy. Actions taken on these submittals will determine if IBC Chapter 34 and IEBC Chapters 3 and 9 will have consistent requirements.

Final Action: AS AM AMPC____ D

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# EB44-07/08

## 202 (New), 410 (New), 1301 (New), 1302 (New), 1303 (New), 1304 (New)

*Proposed Change as Submitted:*

**Proponent:** T. Eric Stafford, representing Institute for Business and Home Safety

**Add new text as follows:**

**SECTION 202**
**GENERAL DEFINITIONS**

**RETROFIT.** The voluntary process of strengthening or improving buildings or structures, or individual components of buildings or structures, with the purpose of making existing conditions better serve the purpose for which they were originally intended or the purpose that current building codes intend.

**CHAPTER 4**
**CLASSIFICATION OF WORK**

**SECTION 410**
**RETROFITTING**

**410.1 Scope.** Retrofitting of buildings, as defined in Chapter 2, includes work of a voluntary nature for the purpose of improving the ability of the building or building elements or building components serve the purpose for which they were originally intended or the purpose that current building codes intend. Retrofit work shall not include repair work as defined in Chapter 2 and described in Section 402.1.

**410.2 Application.** Retrofitting of existing buildings shall comply with the provisions of Chapter 13.

## CHAPTER 13
## RETROFITTING

### SECTION 1301
### GENERAL

**1301.1 Intent and purpose.** The provisions of this subsection provide prescriptive solutions for the retrofitting of buildings. The retrofit measures are intended to provide strengthening of buildings such that the retrofitted measures have strength equal to the structural provisions of the latest building code requirements for new buildings. Design for compliance of new buildings and additions to existing buildings shall conform to the requirements of the *International Building Code* or *International Residential Code* as applicable.

**1301.2 Scope.** Retrofit work as described in Section 410.1 shall comply with the requirements of this chapter.

### SECTION 1302
### DEFINITIONS

**ANCHOR BLOCK.** A nominal 2-inch thick by at least 4" wide piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

**COMPRESSION BLOCK.** A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain in the compression mode (force directed towards the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

**CONVENTIONALLY FRAMED GABLE END.** A conventionally framed gable end with studs whose faces are perpendicular to the gable end wall.

**HORIZONTAL BRACE.** A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

**RETROFIT STUD.** A nominal 2-inch lumber member used to structurally supplement an existing gable end wall stud.

**RIGHT ANGLE BRACKET.** A 14 gage or thicker metal right angle bracket with a minimum load capacity perpendicular to the plane of either face of 350 lbs when connected to wood or concrete with manufacturer specified connectors.

**STUD-TO-PLATE CONNECTOR.** A manufactured metal connector designed to connect studs to plates with a minimum uplift capacity of 500 lbs.

**TRUSS GABLE END.** An engineered factory made truss or site built truss that incorporates factory installed or field installed vertical studs with their faces parallel to the plane of the truss and are spaced no greater than 24-inches on center. Web or other diagonal members other than top chords may or may not be present. Gable end trusses may be of the same height as nearby trusses or may be drop chord trusses in which the top chord of the truss is lower by the depth of the top chord or outlookers.

### SECTION 1303
### MATERIALS OF CONSTRUCTION

**1303.1 Existing materials.** All existing wood materials that will be part of the retrofitting work (trusses, rafters, ceiling joists, top plates, wall studs, etc.) shall be in sound condition and free from defects or damage that substantially reduce the load-carrying capacity of the member. Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions.

**1303.2 New materials.** All materials approved by this code, including their appropriate allowable stresses, shall be permitted to meet the requirements of this chapter.

**1303.3 Dimensional lumber.** All dimensional lumber for braces, studs, and blocking shall conform to applicable standards or grading rules. Dimensional lumber shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. All new dimensional lumber to be used for retrofitting purposes shall be a minimum grade and species of #2 Spruce-Pine-Fir or shall have a specific gravity of 0.42 or greater. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this code shall be accepted.

**1303.4 Metal plate connectors, straps and anchors.** Metal plate connectors, straps and anchors shall have product approval. They shall be approved for connecting wood-to-wood or wood-to-concrete as appropriate. Straps and tie plates shall be manufactured from galvanized steel with a minimum thickness provided by 20 gauge. Tie plates shall have holes sized for 8d nails.

**1303.5 Twists in straps.** Straps shall be permitted to be twisted 90 degrees in addition to a 90 degree bend where they transition between framing members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length.

**1303.6 Fasteners.** Fasteners meeting the requirements of Sections 1303.6.1 and 1303.6.2 shall be used and shall be permitted to be screws or nails meeting the minimum length requirement shown in figures and specified in tables.

**1303.6.1 Screws.** Screws shall be a minimum #8 size with head diameters no less than 0.3 inch. Screw lengths shall be no less than indicated in the Figures and in Tables. Permissible screws include deck screws, wood screws, or sheet metal screws (without drill bit type tip, but can be sharp pointed). Screws shall have at least 1 inch of thread. Fine threaded screws or drywall screws shall not be permitted. Note that many straps will not accommodate screws larger than #8.

**1303.6.2 Nails.** Unless otherwise indicated in the provisions or drawings, where fastener lengths are indicated in Figures and Tables as 1-¼ inch, 8d common nails with shank diameter 0.131 inch and head diameters no less than 0.3 inch shall be permitted. Unless otherwise indicated in the provisions or drawings, where fasteners lengths are indicated in Figures and Tables as 3 inch, 10d common nails with shank diameter of 0.148 inch and head diameters no less than 0.3 inch shall be permitted.

**1303.7 Fastener spacing.** Fastener spacing shall be as follows:

1. distance between fasteners and the edge of lumber shall be a minimum of ½ inch except where the holes in straps place fasteners closer to the edge. In that case, the minimum shall be1/4 inch unless otherwise indicated,
2. distance between fasteners and the end of lumber shall be a minimum of 2-½ inch,
3. distance between fasteners parallel to grain (center-to-center) when straps are not used shall be a minimum of 2-1/2 inches unless a ½-inch stagger (perpendicular to the grain) is applied for adjacent fasteners, then the distance between fasteners parallel to the grain shall be a minimum of 1-1/4 inches.
4. distance between fasteners across grain (row spacing) when straps are not used shall be a minimum of 1 inch, and the
5. distance between fasteners inserted in metal plate connectors, straps and anchors as defined in Section 1303.4 shall be those provided by holes manufactured into the straps.

## SECTION 1304
## RETROFITTING GABLE END WALLS

**1304.1 Scope and intent.** Gable ends to be strengthened shall be permitted to be retrofitted using methods prescribed by provisions of this section. The provisions of this section are limited to buildings with wood framed roof structures and mean roof height of 45 feet or less. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end wall construction for out-of-plane wind loads resulting from high wind events. The retrofit method addresses four issues. These include strengthening the framing members of the walls if necessary (retrofit studs), bracing the top and bottom of the gable wall so that lateral loads are transmitted into the roof and ceiling diaphragms (horizontal braces, straps to retrofit studs and compression blocks) and connecting the bottom of the gable end wall to the wall below to help brace the top of that wall (specialty metal brackets).

The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss or a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to or perpendicular to the gable wall surface. An overview perspective drawing of the retrofit is shown in Figure 1304.1.

**1304.2 Horizontal braces.** Horizontal braces shall be installed approximately perpendicular to the roof and ceiling framimg members at the location of each existing gable end wall stud greater than 3-feet in length.

The horizontal braces shall consist of the minimum size member indicated in Table 1304.2. The horizontal braces shall be oriented with their wide faces across the roof or ceiling framing members, be fastened to a minimum of three framing members, and extend at least 6-feet measured perpendicularly from the gable end wall plus 2-1/2 inch beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end wall as shown in Figure 1304.2.1 (and 1304.2.6). The horizontal brace shall be located no farther than $^1/_2$ inch from the inside face of the gable end wall truss. Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch long fasteners (#8 wood screws or 10d nails) as indicated in Figures 1304.2.2 through 1304.2.5 for trusses (and Figures 1304.2.7 through 1304.2.10 for conventionally framed).

If the spacing of existing gable end studs is greater than 24 inches or no vertical gable end stud is present, a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be 24–inches. Additional gable end wall studs shall not be required at locations where their length would be 3-feet or less. Each end of each required new stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using a minimum of two 3-inch toenail fasteners (#8 wood screws or 10d nails) and a metal connector or mending plate with a minimum of four 1-1/4 inch long fasteners (#8 wood screws or 8d nails).

**Exceptions:**

1. Where impediments, other permanently attached obstacles or conditions exist that will not permit installation of horizontal braces at the indicated locations, refer to Section 1304.5 for permitted modification of these prescriptive retrofit methods.
2. Where impediments, other permanently attached obstacles or conditions exist that will not permit extension of the horizontal braces across the existing framing members such that they can be fastened to a minimum of three framing members and extend at least 6-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member, the horizontal braces may be shortened provided that all of the following conditions are met.
   - 2.1. The horizontal brace shall be installed across a minimum of two framing spaces, fastened to each existing framing member with three 3-inch long fasteners (#8 wood screws or 10d nails), and extend a minimum of 4-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member.
   - 2.2. An anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure 1304.2.11. The minimum edge and face sizes of the anchor block shall be equivalent to the existing roof or ceiling framing members as appropriate for that particular installation. Six 3-inch long fasteners (#8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
   - 2.3. The anchor block shall extend into the space between the roof or ceiling framing members a minimum of one-half the depth of the existing framing members at the location where the anchor block is installed. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed $^1/_8$ inch.

**1304.3 Retrofit studs.** The retrofit studs shall consist of the minimum size members for the height ranges of the existing vertical gable end wall studs indicated in Table 1304.2. Retrofit studs shall be installed adjacent to the existing or added (Section 1304.2) vertical gable end wall studs and extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace. A maximum gap of 1/8-inch shall be permitted between the retrofit stud and the bottom horizontal brace. A maximum gap of 1/2-inch shall be permitted between the top edge of the retrofit stud closest to the upper horizontal brace and the horizontal brace surface.

**Exception:** Where impediments, other permanently attached obstacles or conditions exist that will not permit the installation of a new retrofit stud adjacent to an existing gable end wall stud, refer to Section 1304.5 for permitted modification of these prescriptive retrofit methods.

**1304.3.1 Retrofit stud fastening.** Each retrofit stud shall be fastened to the top and bottom horizontal brace members with a minimum of a 20 gauge, 1-1/4 inch wide flat or coil metal strap with pre-punched fastener holes. The flat metal straps shall be the minimum length as indicated in Table 1304.2. Each top and bottom strap shall extend sufficient distance onto the vertical face of the retrofit stud and be fastened with the number of 1-1/4 inch long fasteners (#8 wood screws or 8d nails) indicated in Table 1304.2. Each strap shall be fastened to the top and bottom horizontal brace members with the minimum number of 1-1/4 inch long fasteners (#8 wood screws or 8d nails) as indicated in Table 1304.2. The retrofit stud members shall also be fastened to the side of the existing vertical gable end wall studs with 3-inch long fasteners (#8 wood screws or 10d nails) spaced at 6-inches on center as shown in Figure 1304.2.1.

**1304.3.2 Retrofit stud splices.** Retrofit studs greater than 8-feet in height may be field spliced as shown in Figure 1304.3.

**1304.4 Compression blocks.** Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. For clarity, Figures 1304.2.2 through 1304.2.5 (trusses) and Figures 1304.2.7 through 1304.2.10 (conventionally framed) show the installation of the compression block against the existing vertical gable end wall stud with the strap from the retrofit stud running beside the compression block. When the compression block is installed against the retrofit stud, the block shall be allowed to be placed on top of the strap. A maximum gap between the compression block and the existing vertical gable end wall stud member or retrofit stud of $^1/_8$ inch shall be permitted. Compression blocks shall be fastened to the horizontal braces with the minimum number of 3-inch long fasteners (#8 wood screws or 10d nails) specified in Table 1304.2. End and edge distances for fastener installation shall be as listed in Section 1303.7 and shown in Figures 1304.2.2 through 1304.2.5 (trusses) and Figures 1304.2.7 through 1304.2.10 (conventionally framed).

**1304.5 Impediments– permissible modifications to prescriptive gable end retrofits.** Where impediments, other permanently attached obstacles or conditions exist in attics that preclude the installation of a retrofit stud or horizontal braces in accordance with Sections 1304.2 or 1304.3, the gable end retrofit shall be deemed to meet the requirements of this section if the requirements of Section 1304.5.1 are met. Impediments to the installation of retrofit studs or horizontal braces include gable end vents, attic accesses, recessed lights, skylight shafts, chimneys, air conditioning ducts, or equipment. Where the installation of a horizontal brace for the top of a center stud is obstructed by truss plates near the roof peak, methods prescribed in 1304.5.1 are permitted to be used, or retrofit ridge ties as prescribed in Section 1304.5.2 are permitted to be used to support the horizontal brace.

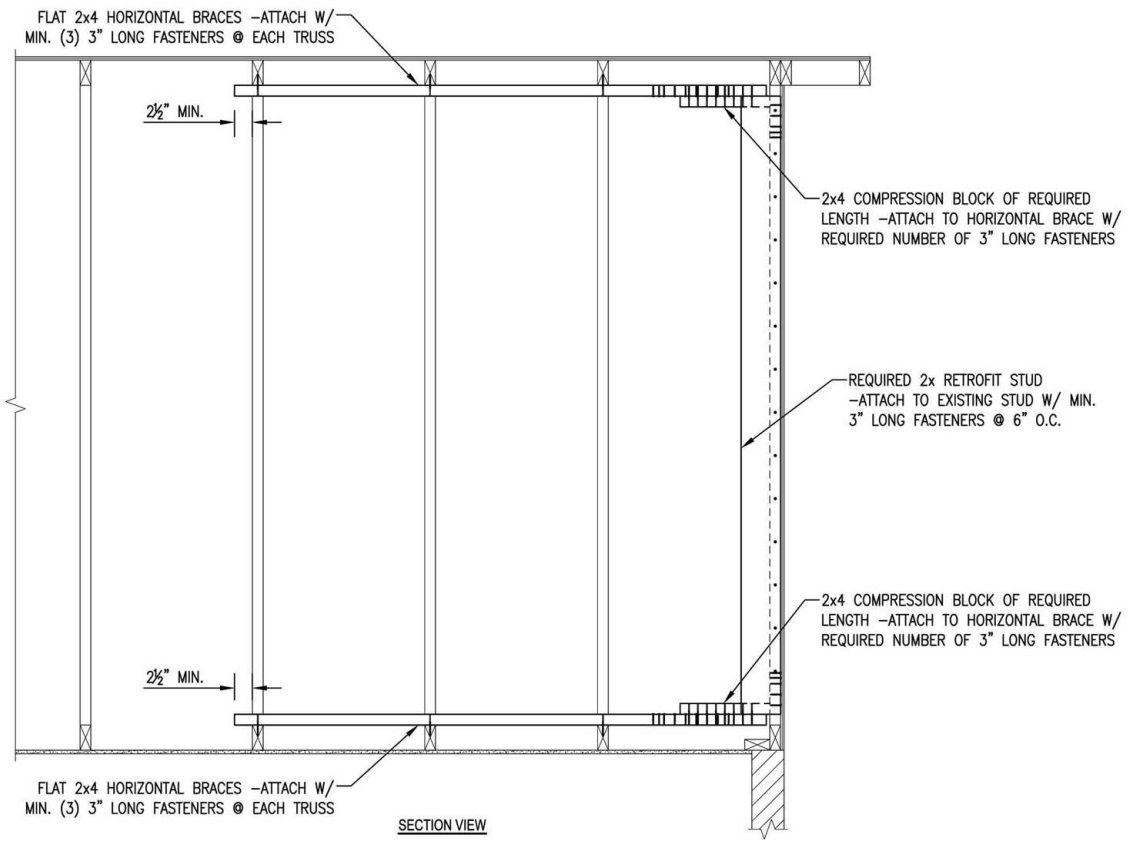



FIGURE 1304.2.1 SECTION VIEW OF GABLE END RETROFIT (TRUSS WALL)

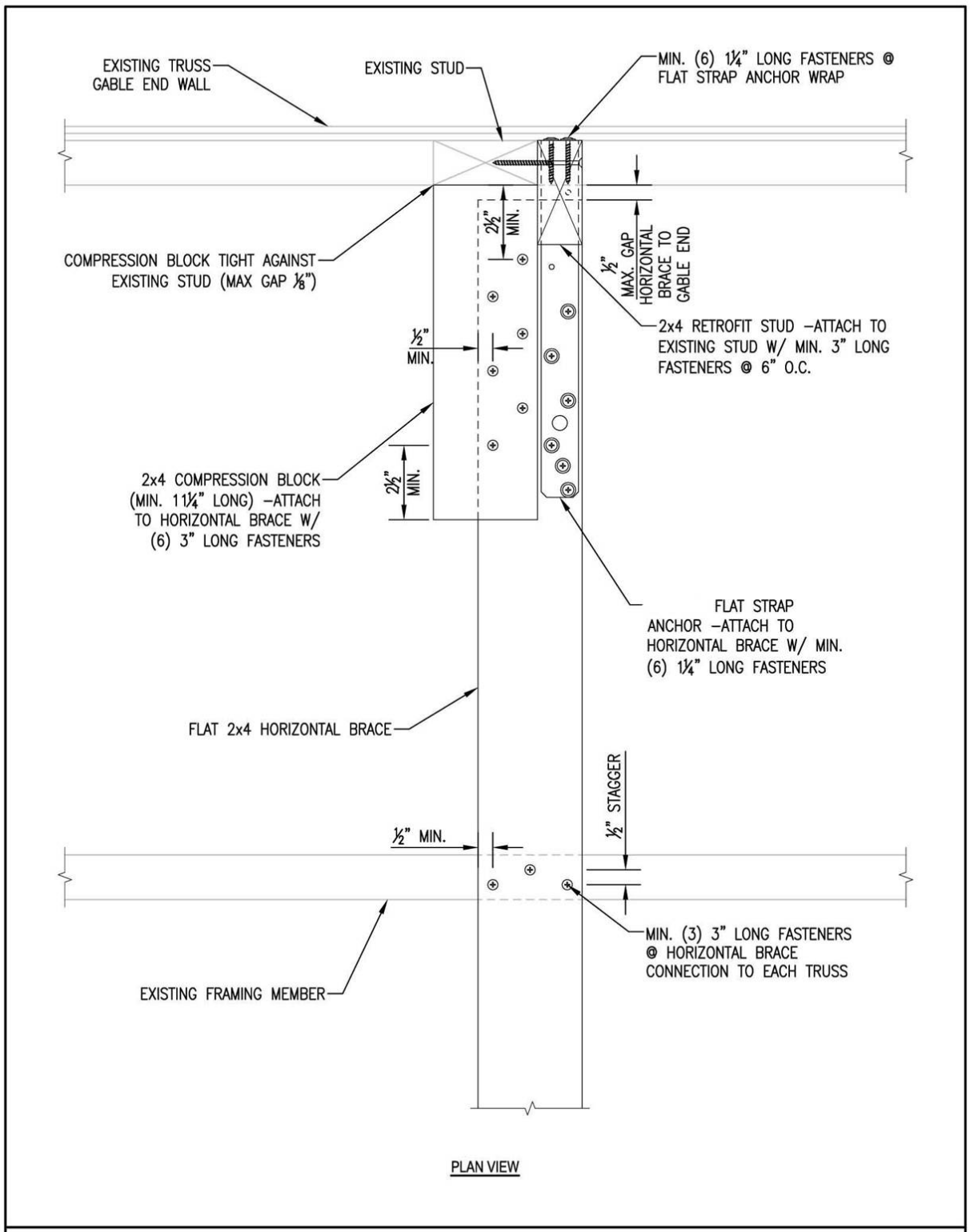



FIGURE 1304.2.2 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x4 RETROFIT STUD

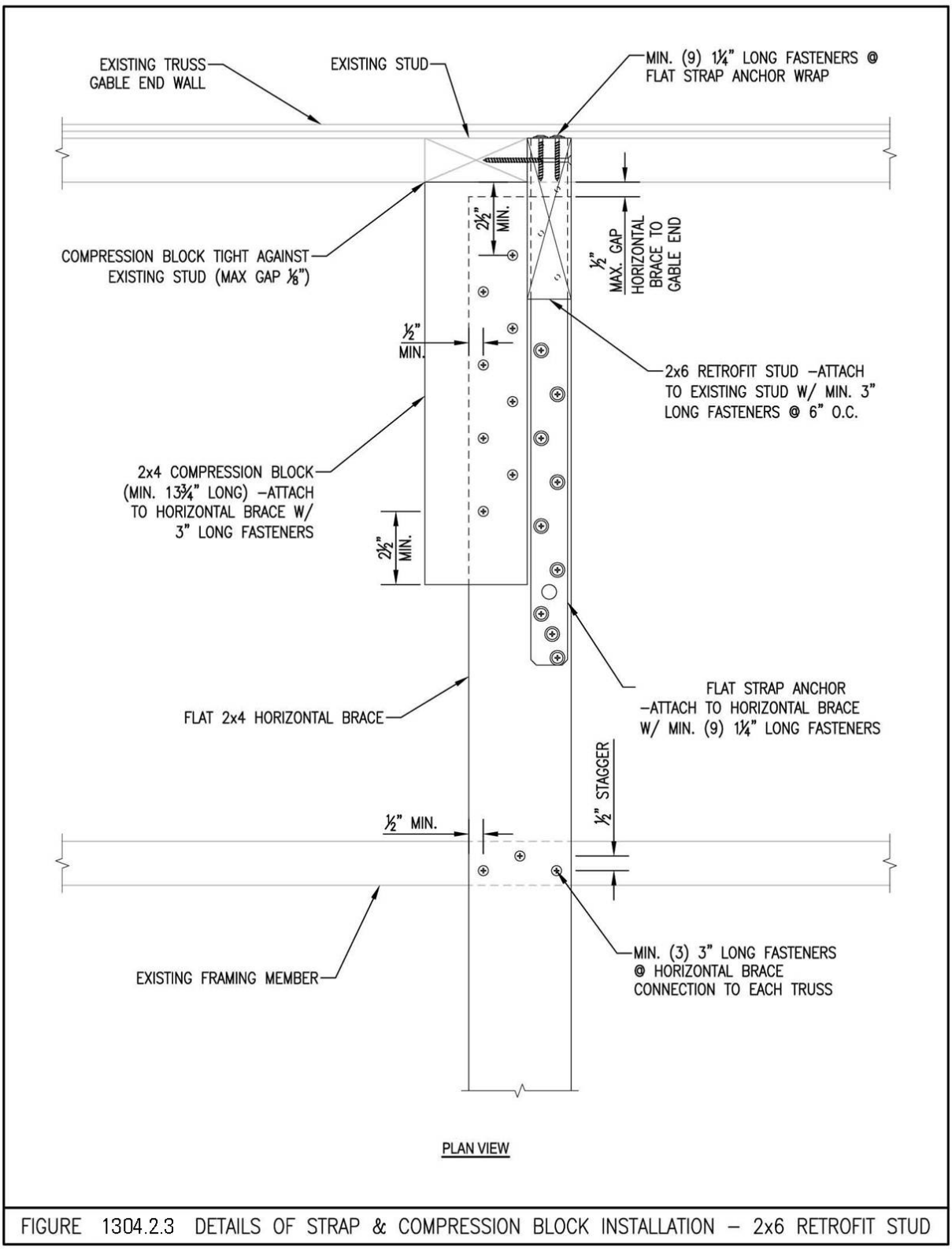



FIGURE 1304.2.3 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x6 RETROFIT STUD

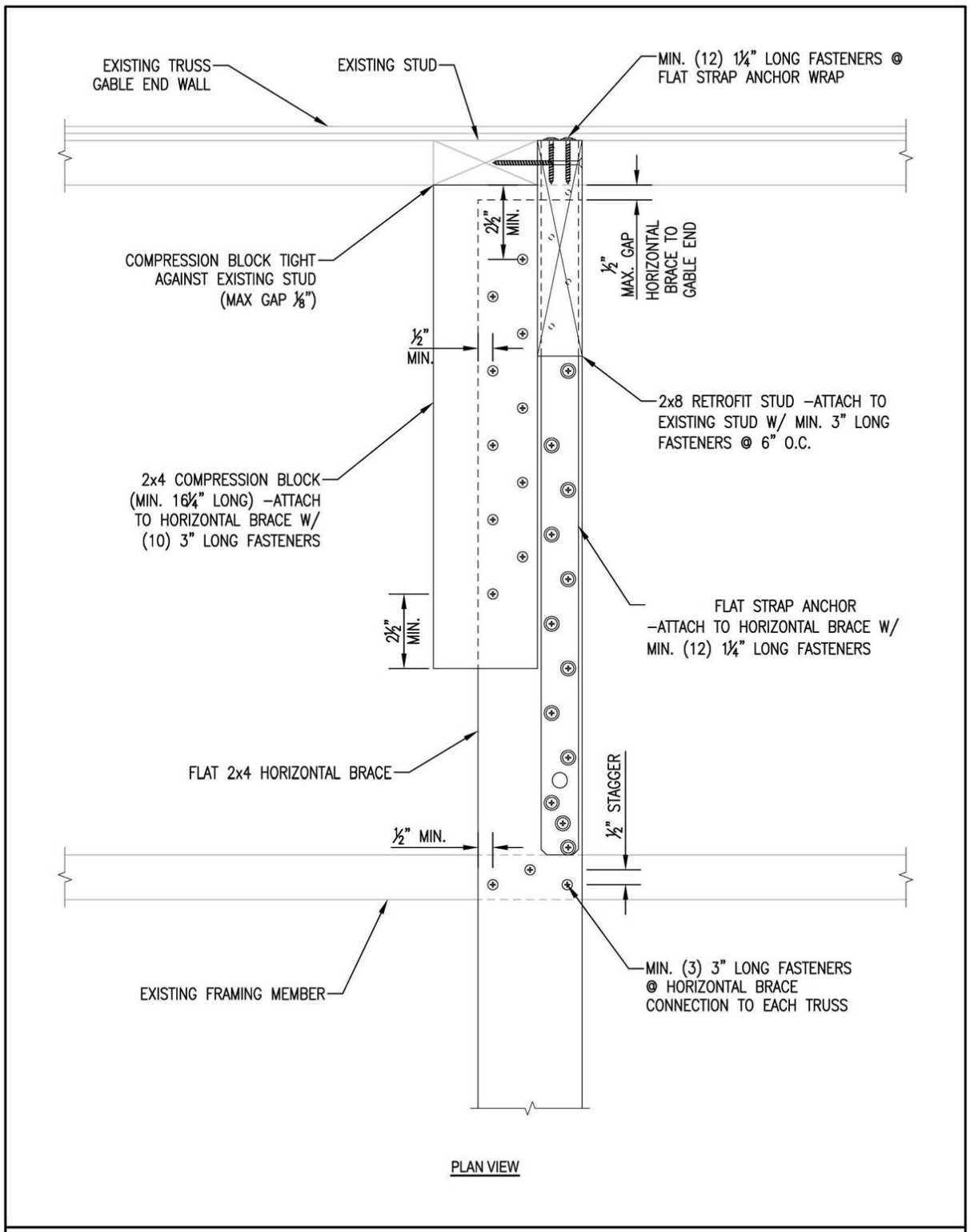



FIGURE 1304.2.4 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x8 RETROFIT STUD

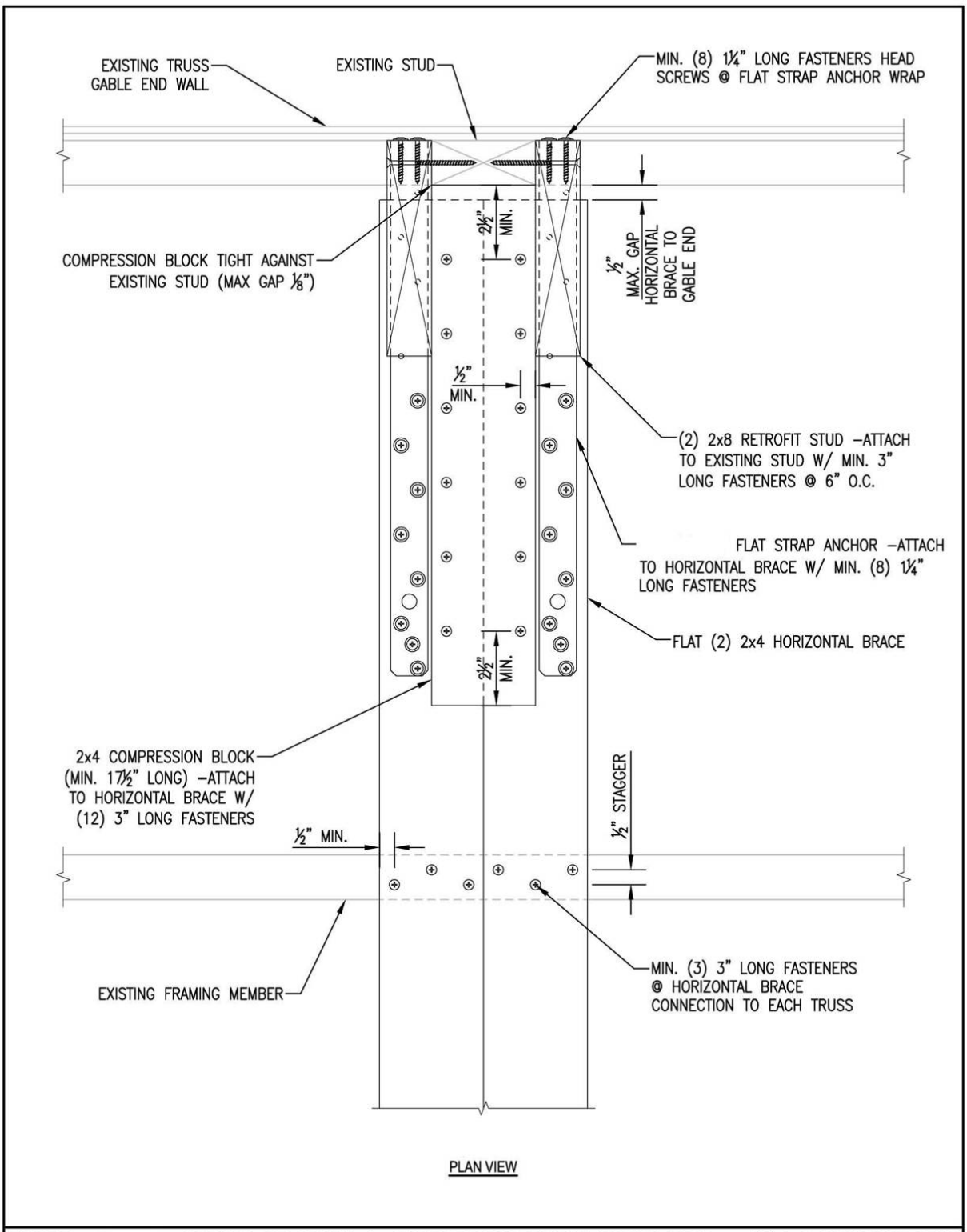



FIGURE 1304.2.5 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – (2)2x8 RETROFIT STUD

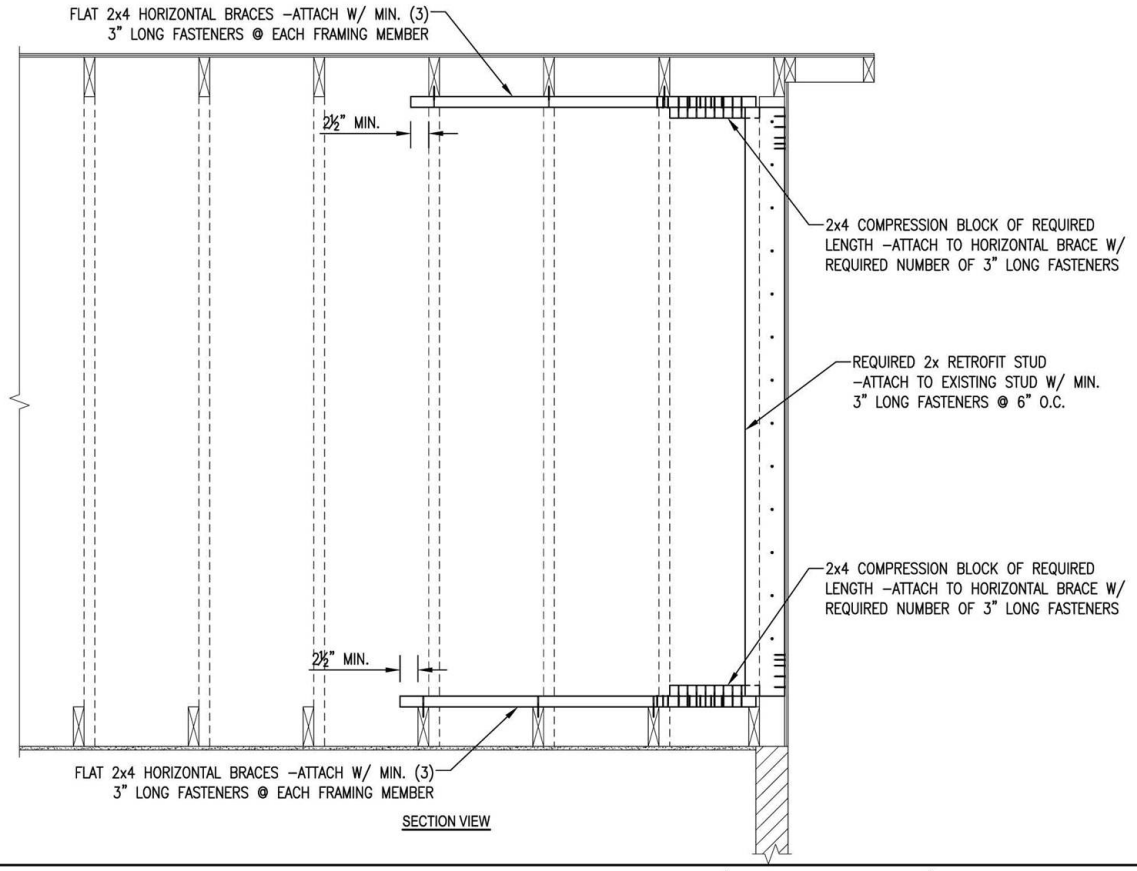



FIGURE 1304.2.6 SECTION VIEW OF GABLE END RETROFIT (CONVENTIONAL FRAMED)

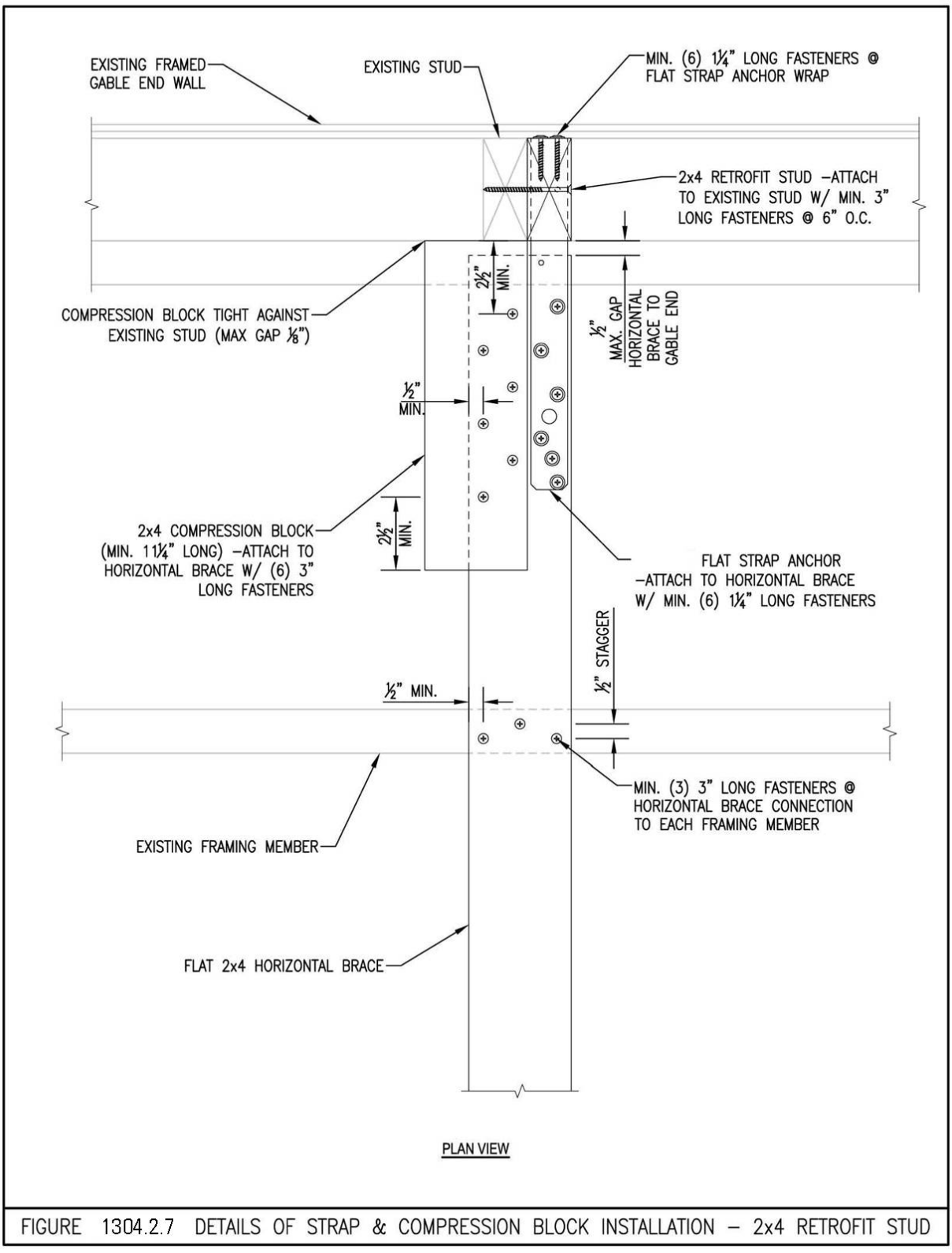



FIGURE 1304.2.7 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x4 RETROFIT STUD

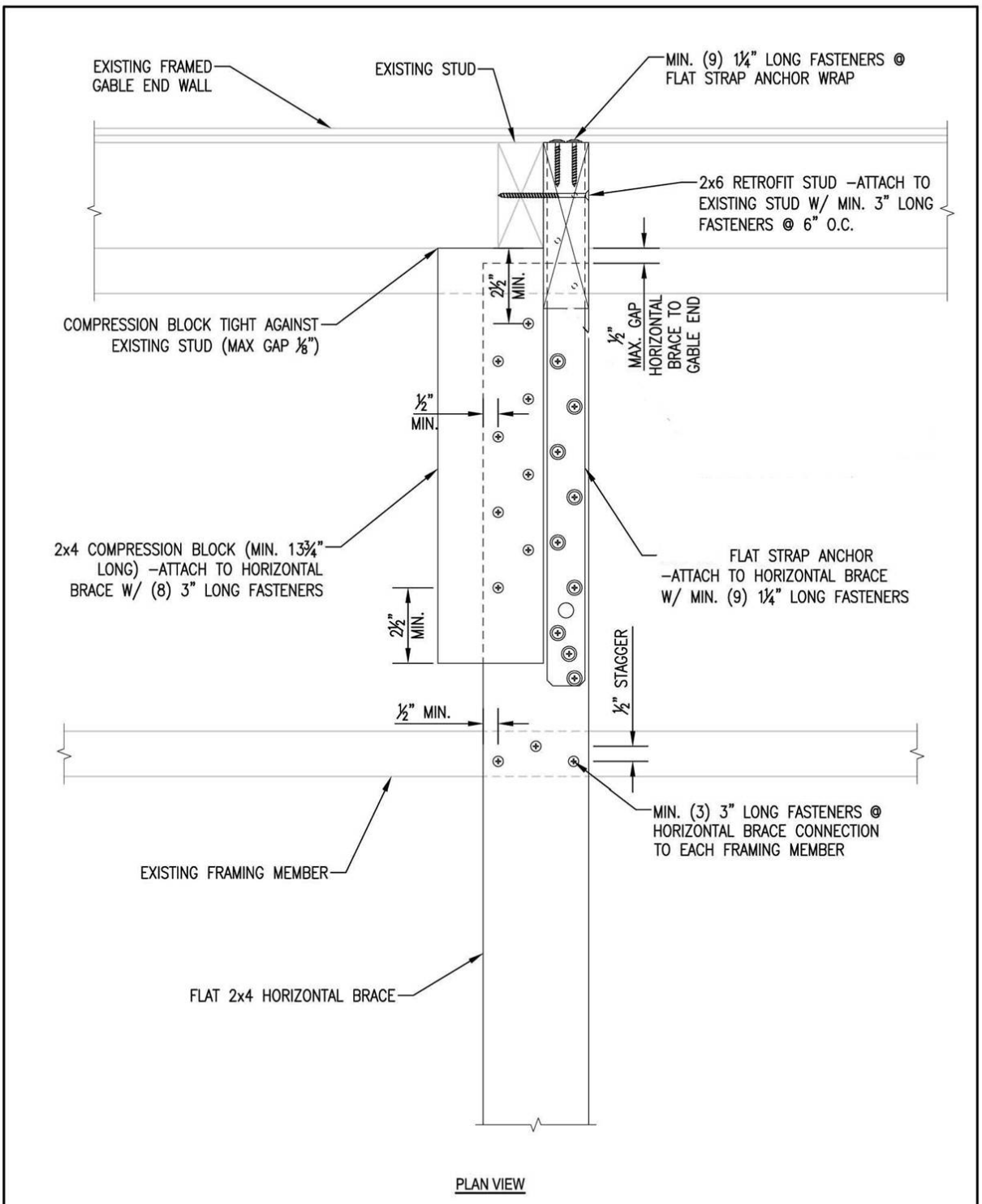



FIGURE 1304.2.8 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x6 RETROFIT STUD

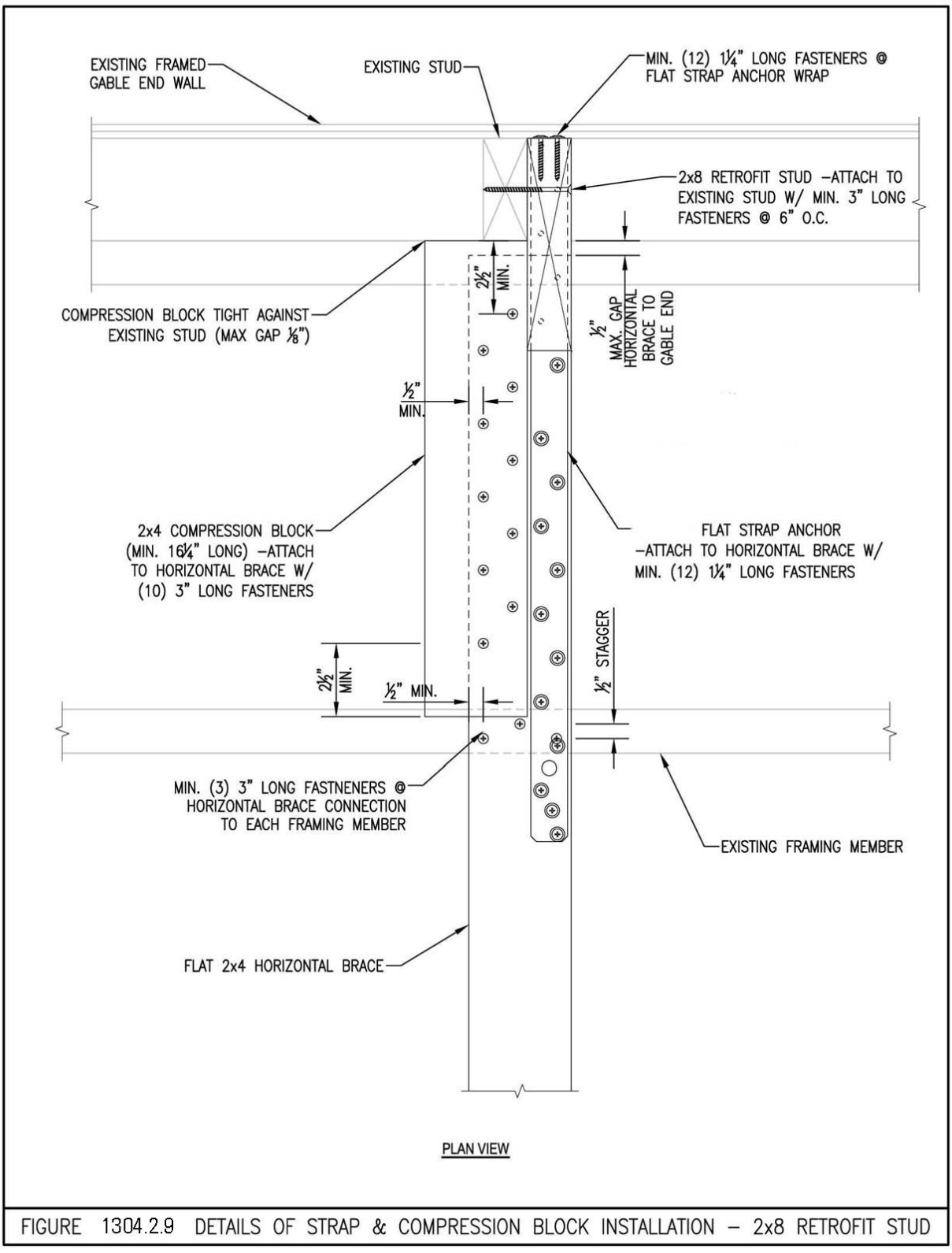



FIGURE 1304.2.9 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – 2x8 RETROFIT STUD

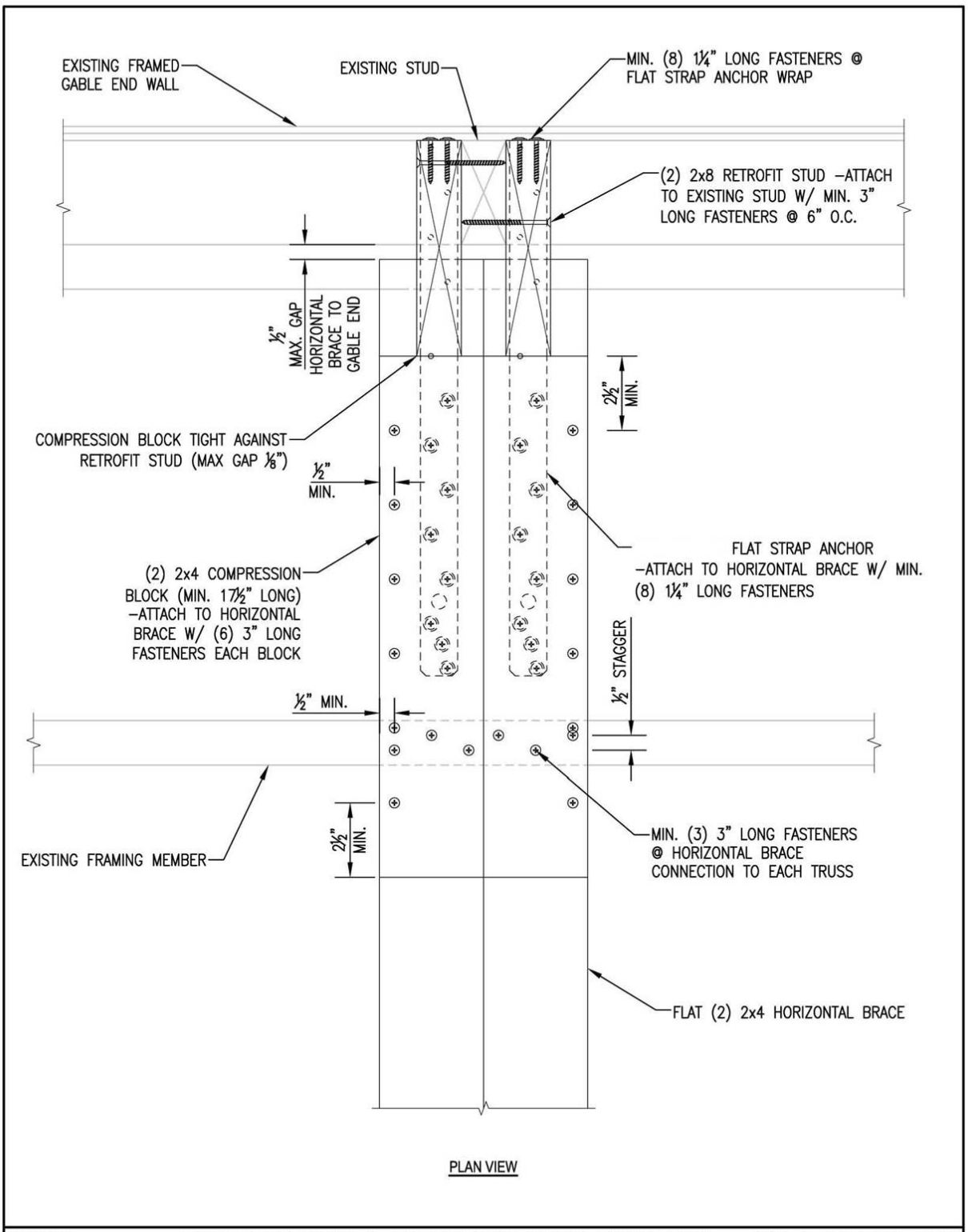
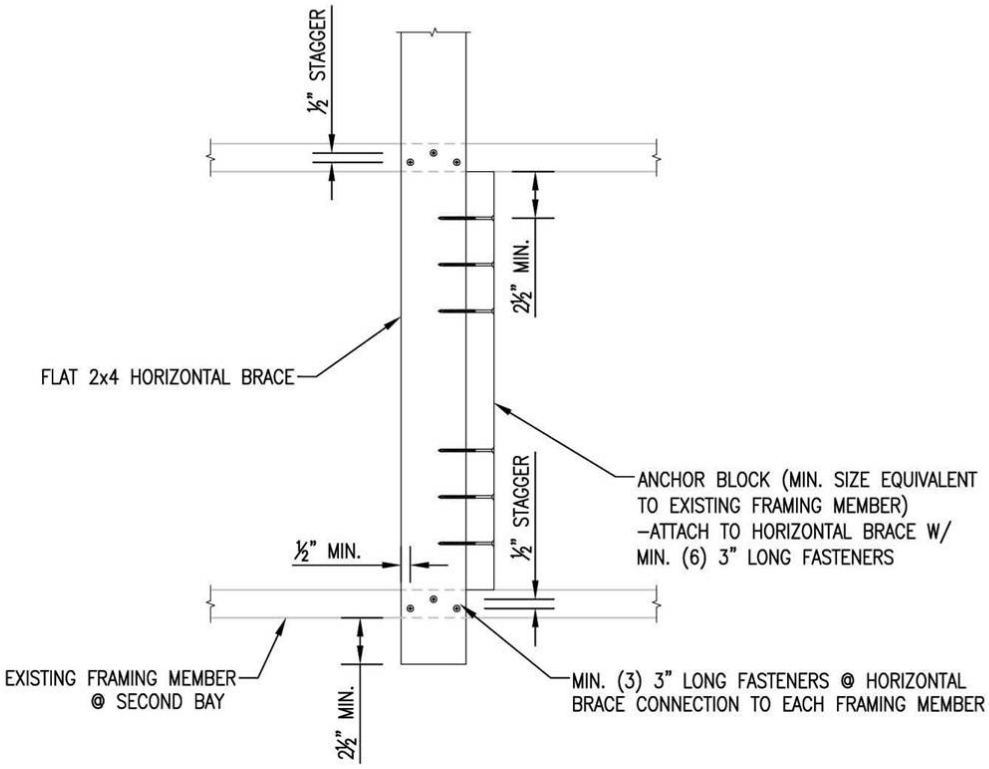



FIGURE 1304.2.10 DETAILS OF STRAP & COMPRESSION BLOCK INSTALLATION – (2)2x8 RETROFIT STUD



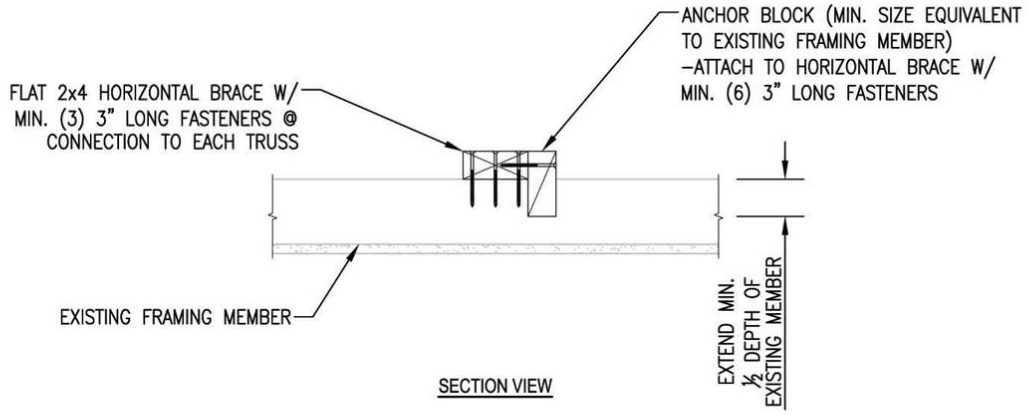




FIGURE 1304.2.11 DETAIL OF ANCHOR BLOCK INSTALLATION

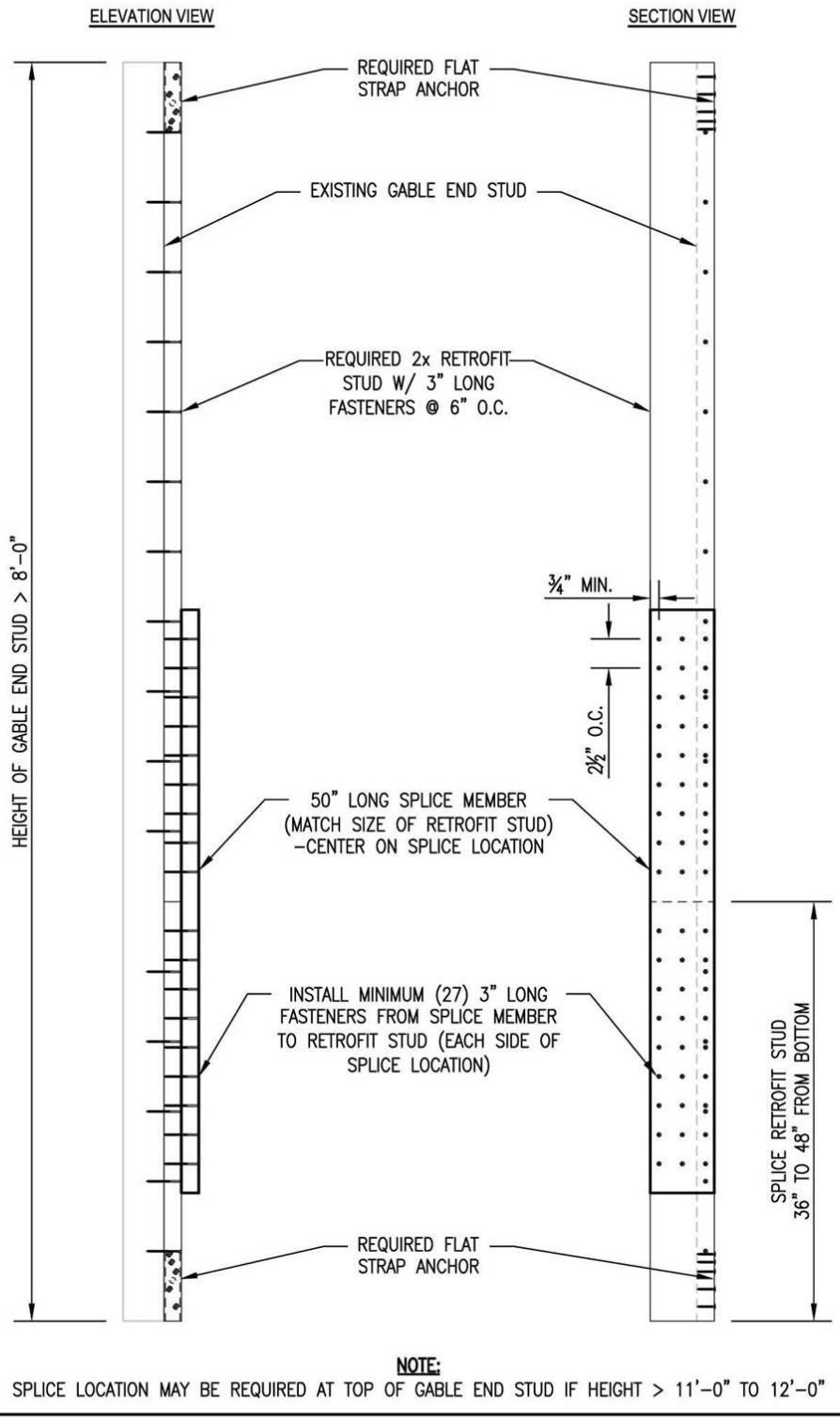



FIGURE 1304.3 DETAIL OF RETROFIT STUD SPLICE

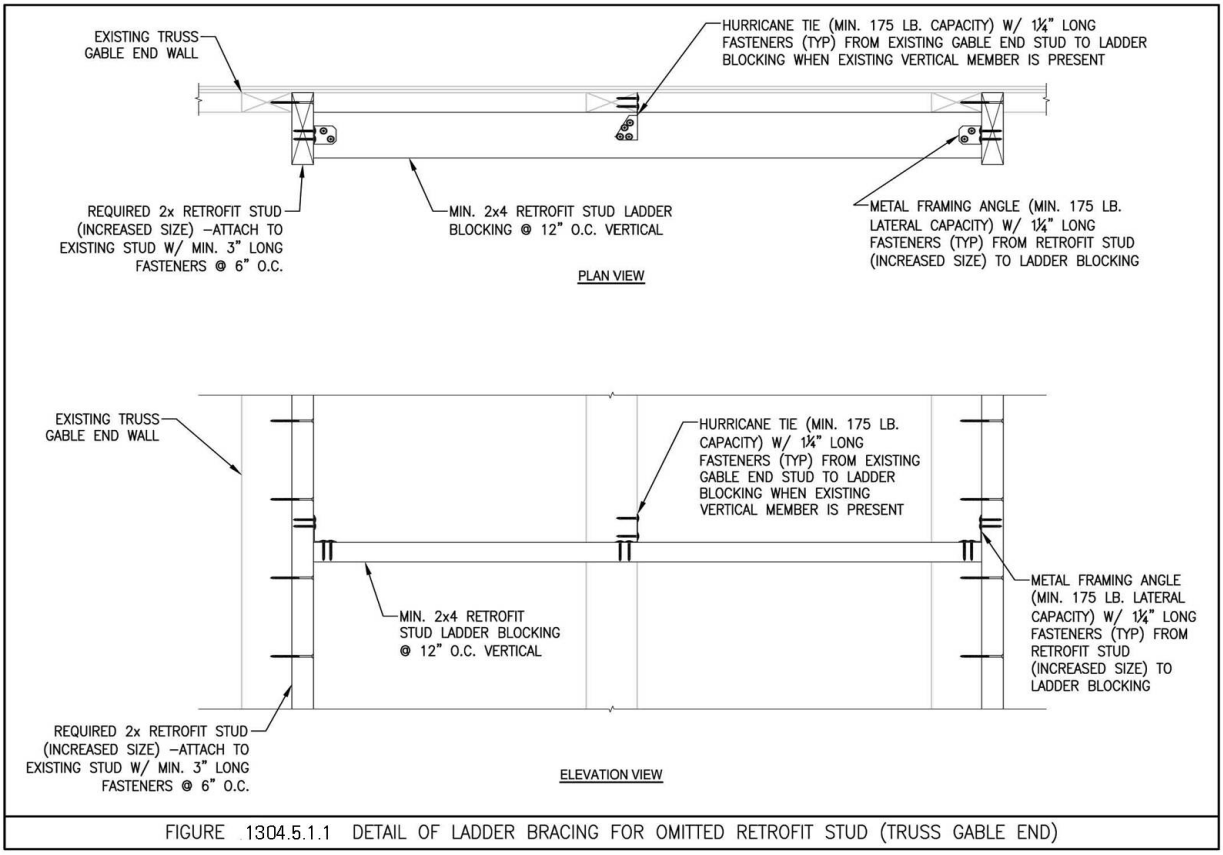



FIGURE 1304.5.1.1 DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (TRUSS GABLE END)

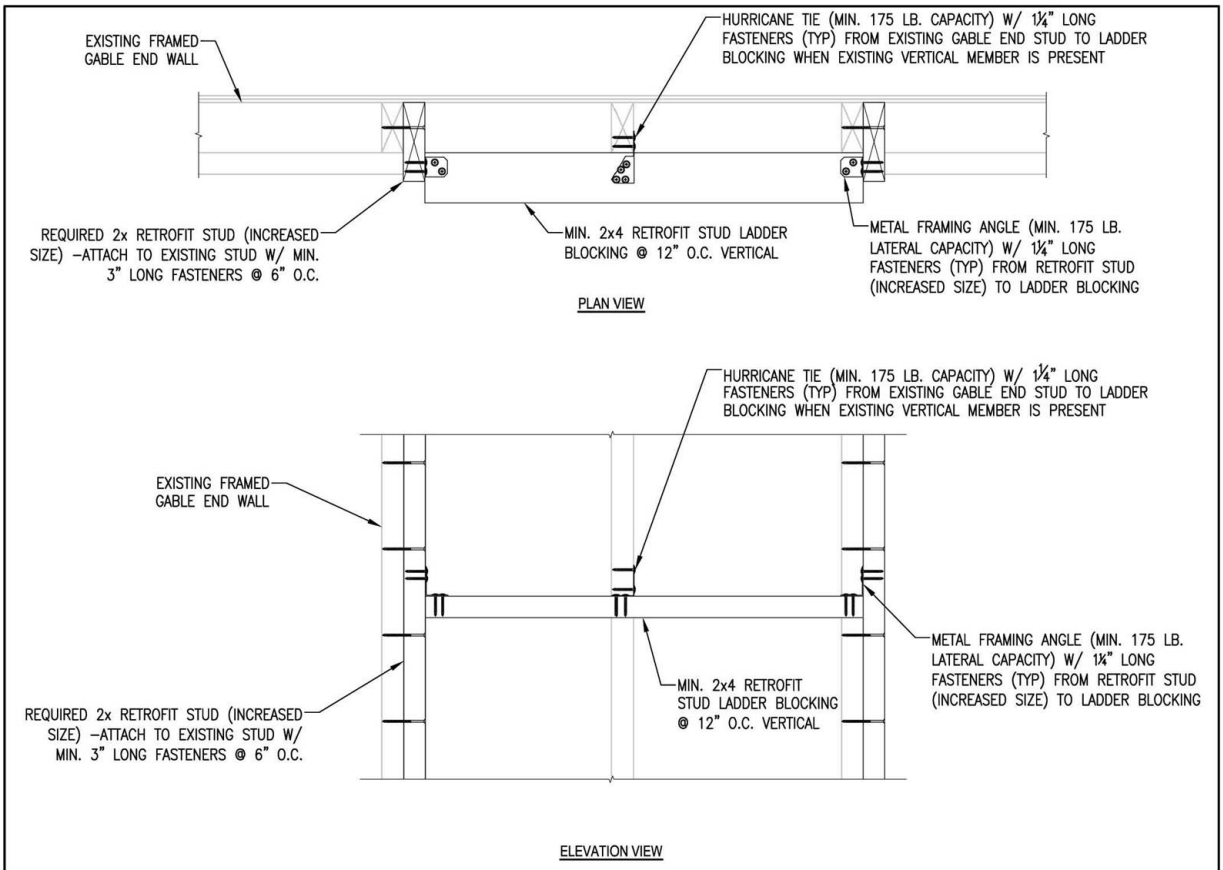



FIGURE 1304.5.1.2 DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (CONVENTIONAL FRAMING)

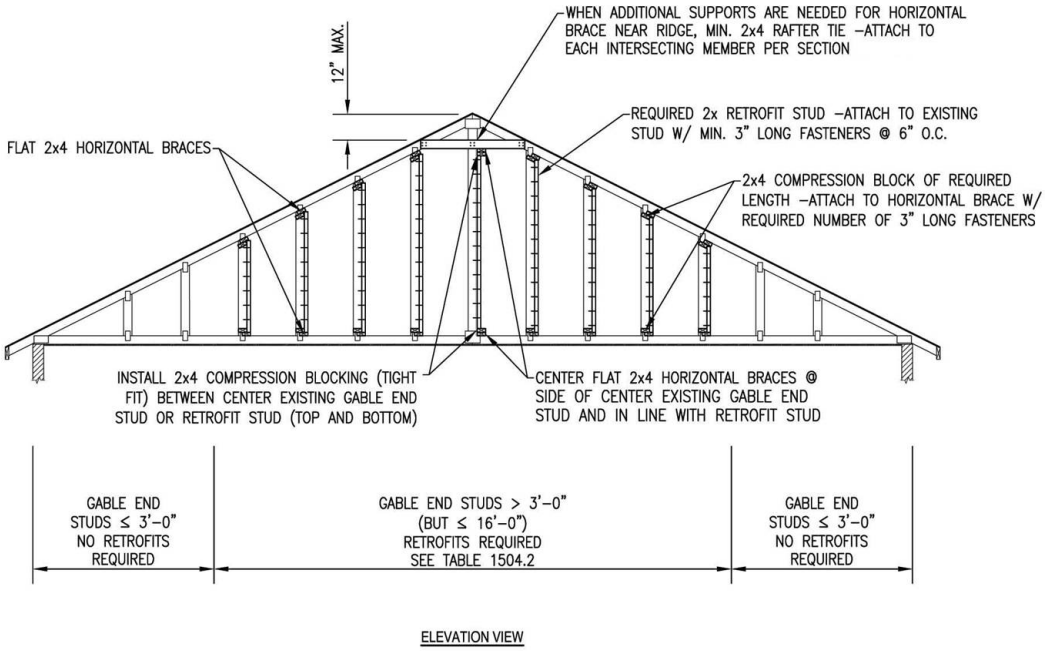
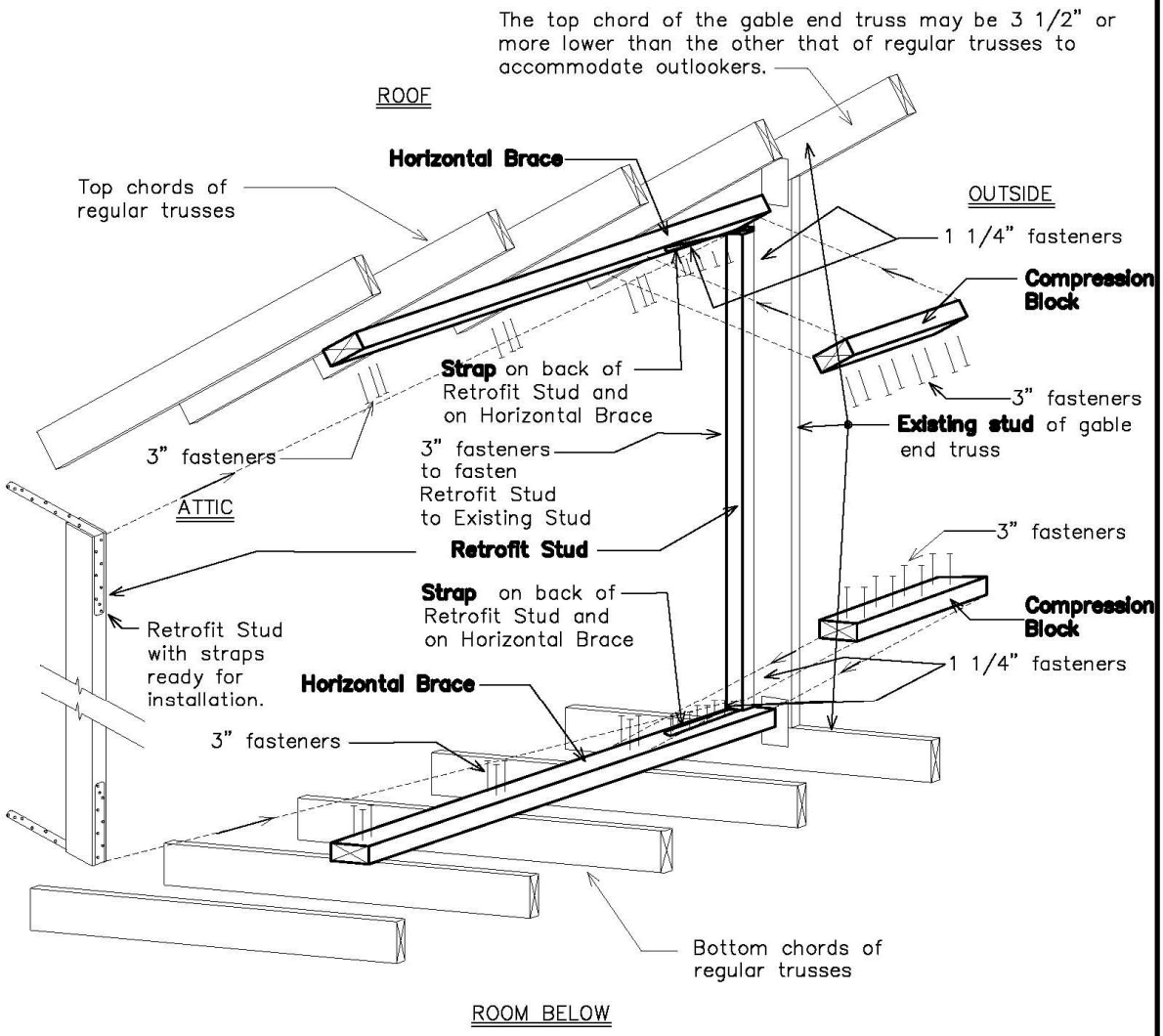



FIGURE 1304.5.2 DETAIL OF RETROFIT RIDGE TIE INSTALLATION




The gable end shown is a truss gable end. Similar retrofit measures apply to conventionally framed gable ends.

Regular trusses may have diagonal members that connect the bottom and top chords.

Fasteners shown illustrate locations and not the number of fasteners.

**FIGURE 1304.1**
**RETROFIT DETAILS FOR TRUSS GABLE ENDS**

**1304.5.1 Remedial measures where obstacles prevent installation of retrofit studs or horizontal braces.** If a retrofit stud or horizontal brace cannot be installed because of an impediment, the entire assembly can be omitted from that location provided all of the following conditions are met.

1. No more than two assemblies of retrofit studs and horizontal braces are omitted on a single gable end.
2. There shall be at least two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (no two ladder braces bearing on a single retrofit stud).

3. The retrofit studs on each side of the omitted retrofit stud are increased to the next indicated member size in Table 1304.2 and fastened as indicated in Section 1304.3.1.
4. The horizontal bracing members on each side of the omitted brace shall be sized in accordance with Table 1304.2 for the required retrofit studs at these locations.
5. The horizontal bracing members on each side of the omitted brace shall meet the requirements of Section 1304.2.
6. Ladder bracing is provided across the location of the omitted retrofit studs as indicated in Figures 1304.5.1.1 (trusses) and 1304.5.1.2 (conventionally framed).
7. Ladder bracing shall consist of a minimum 2x4 members oriented horizontally and spaced a maximum of 12-inches on center vertically. Ladder bracing shall be attached to each adjacent retrofit stud with a metal framing angle with a minimum lateral capacity of 175 lbs. Ladder bracing shall be attached to the existing stud at the location of the omitted retrofit stud with a metal hurricane tie with a minimum capacity of 175 lbs.
8. Where ladder bracing spans across a gable end vent, the gable end vent framing shall be attached to the ladder bracing using metal straps or clips.
9. Notching of the ladder bracing shall not be permitted unless the net depth of the framing member is a minimum of 3-1/2 inches.

**1304.5.2 Retrofit ridge ties.** When impediments along the ridge of the roof impede the installation of a horizontal brace for one or more studs near the middle of the gable wall, retrofit ridge ties may be used to provide support for the required horizontal brace. The top of retrofit ridge tie members shall be installed a maximum of 12-inches below the existing ridge line or 4-inches below the impediment(s). The retrofit ridge tie members shall be installed across a minimum of three bays, but no less than 6-feet to permit fastening of the horizontal brace. A minimum of a 2x4 member shall be used for each ridge tie and fastening shall consist of two 3-inch long wood screws, four 3-inch long 10d nails or two 3-1/2 inch long 16d nails driven through and clinched at each top chord or web member intersected by the ridge tie as illustrated in Figure 1304.5.2.

**1304.5.3 Notching of retrofit studs.** Retrofit studs may be notched in one location along the height of the stud member provided that all of the following conditions are met.

1. The retrofit stud to be notched shall be sized such that the remaining depth of the member at the location of the notch (including cut lines) shall not be less than that required by Table 1304.2.
2. The notched retrofit stud shall not be spliced within 12 inches of the location of the notch. The splicing member shall not be notched and shall be installed as indicated in Figure 1304.3.
3. The length of the flat metal straps indicated in Table 1304.2 shall be increased by the increased depth of the notched retrofit stud member to be installed.
4. The height of the notch shall not exceed 12 inches vertically as measured at the depth of the notch.
5. The notched retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section 1304.3.1. Two additional 3-inch fasteners (#8 wood screws or 10d nails) shall be installed on each side of the notch in addition to those required by Section 1304.3.1.

**1304.6 Connection of gable end wall to wall below.** The bottom chords or bottom members of wood framed gable end walls shall be attached to the wall below using one of the methods prescribed in Sections 1304.6.1 or 1304.6.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered.

**1304.6.1 Truss gable end wall.** The bottom chords of the gable end wall shall be attached to the wall below using right angle brackets consisting of 14 gage or thicker material with a minimum specified load capacity of 350 lbs perpendicular to the plane of either face of the connector. The right angle brackets shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet at the spacing specified in Table 1304.6. A minimum of two of the fasteners specified by the manufacturer shall engage the body of the bottom chord. Connection to the wall below shall be by one of the methods listed below:

1. For a wood frame wall below, two fasteners of the same diameter and style specified by the bracket manufacturer shall engage the body of the bottom top plate of the wall below.
2. For a concrete or masonry wall below without a sill plate, the fasteners into the wall shall be consistent with the bracket manufacturer's specifications for fasteners installed in concrete or masonry.
3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the bracket manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the bracket can be anchored to the sill plate using fasteners consistent with the bracket manufacturer's specifications for wood connections, provided that the sill plate is

anchored to the wall on each side of the bracket by a 1/4-inch diameter masonry screw with a 2-1/2 inch embedment into the concrete or masonry wall. ¼-inch washers shall be placed under the heads of the masonry screws.

**1304.6.2 Conventionally framed gable end wall.** Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3-feet, shall be attached to the bottom or sill plate using a stud to plate connector. The bottom or sill plate shall then be connected to the wall below using one of the methods listed below:

1. For a wood frame wall below, two fasteners of the same diameter and style specified by the bracket manufacturer shall engage the body of the bottom top plate of the wall below. The fasteners shall be installed at the spacing indicated in Table 1304.6.
2. For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼-inch diameter concrete or masonry screws of sufficient length to provide a 2-1/2 inch embedment into the top of the concrete or masonry wall. The fasteners shall be installed at the spacing indicated in Table 1304.6.

(Renumber subsequent chapters)

**Reason:** The purpose of the proposed addition is to provide prescriptive means for retrofitting gable ends to resist high winds. This code addition will facilitate the retrofitting of gable ends without requiring site specific engineering for common applications, thus removing some of the obstacles that might impede this important retrofit in hurricane prone regions.

**Reason for adding provisions for retrofitting gable ends**

Gable end failures are one of the most common types of structural failures observed in hurricanes. They have been documented in most major hurricanes and in many weaker hurricanes. Analysis of damage in Hurricane Charley which struck Port Charlotte in 2004 demonstrated that homes built to meet the high wind requirements such as those specified in the ICC Building and Residential codes suffered very little structural damage while older homes built to weaker codes or using conventional construction suffered significant damage.

The proposed code addition is intended to be a prescriptive approach to reduce retrofitting costs, facilitate retrofitting, minimize the need for engineering, and facilitate code review and inspection. The addition will provide standardized off the shelf methods that can be readily approved and easily inspected by building department personnel. Building departments can thus become creditable third party resources for authenticating retrofitting just as they do for other structural issues of buildings.

It should be recognized that almost no attempt to retrofit will actually weaken or compromise a building or subject surrounding buildings to risk, on the contrary all will benefit. The retrofitting is voluntary.

**Reason for adding retrofit measures to the code**

Because most America's buildings located in hurricane prone regions were not built to today's building codes standards, there is significant value added to the code if the retrofitting of buildings could be facilitated by the provision of prescriptive means. This would inherently reduce the cost of retrofitting. The need for structural retrofitting has been highlighted in the recent spate of hurricanes and the insurance crises that has developed in the coastal high wind areas of a number of states because of older buildings that do not meet current building code structural requirements. Clearly, it is in the public's health, welfare, and safety to facilitate retrofitting. Given the importance of retrofitting to the public, retrofitting of buildings should be encouraged and facilitated by removing as many impediments as possible. The code can actually facilitate and encourage retrofitting by providing prescriptive means. Such methods should encourage, facilitate, and reduce the cost of improving America's building stock.

**Reason for location in code**

Clearly, prescriptive retrofit methods should be located in the *International Existing Building Code.* At first blush a reasonable point to insert such methods would be in chapter 4, Repairs; however, existing conditions are not necessarily broken, thus not needing repair. The distinction between repair and retrofit needs to be maintained to avoid confusion with those that require conformance to building codes (repairs) and retrofit measures are that are voluntary and not mandatory.

Consequently, the preferred approach is to add a chapter that deals specifically with retrofitting of a voluntary nature. The advantage of this approach is that it easily allows for additional retrofit measures to be added without confusing code users by gable end retrofit being in the repair section and then changing its location to a separate chapter in a subsequent edition when more retrofit measures are added. Further by grouping retrofit measures into a separate chapter users will find them and perhaps even use the chapter as a catalog of potential retrofit measures. Additionally, grouping voluntary measures into a separate chapter, a chapter separate from mandatory measures, will make code administration less prone to confusion. Logically the new chapter would be inserted after chapter 12 so that it would fall in the sequence of classifications of work defined in chapter 4 thus making it chapter 13.

A separate chapter for a single method? Yes, because it is anticipated to be but the first retrofit issue to be inserted into the code. And yes because of the somewhat peculiar nature of the voluntary nature of retrofitting. Although retrofit language reads with shall language the whole notion of retrofitting is not `shall', but voluntary.

**Cost Impact:** The code change proposal will not increase the cost of construction.

## Committee Action: Disapproved

**Committee Reason:** There were several problems with the language that were identified. In addition, there were references to figures not provided. Finally, the committee felt that this type of prescriptive provision is more appropriately located in an appendix, a guide, or a standard.

## Assembly Action: None

*Individual Consideration Agenda*

**This item is on the agenda for individual consideration because a public comment was submitted.**

*Public Comment:*

**T. Eric Stafford, representing Institute for Business and Home Safety, requests Approval as Modified by this public comment.**

**Replace proposal as follows:**

(Underlining omitted for clarity)

**APPENDIX C**
**RETROFITTING**

**SECTION C101**
**GENERAL**

**C101.1 Intent and purpose.** The provisions of this Appendix provide prescriptive solutions for selected structural retrofitting of existing buildings.

**C101.2 Scope.** The provisions of this Appendix are intended to provide prescriptive methods for retrofitting buildings to make them stronger or more durable. Retrofitting of buildings, as defined in Section C102, includes work of a voluntary nature for the purposes of improving the ability of the building or building elements or building components to better serve the purpose for which they were originally intended or the purpose that current building codes intend. Retrofit work shall not include repair work as defined in Chapter 4 and described in Section 402.1

**SECTION C102**
**DEFINITIONS**

**ANCHOR BLOCK.** A nominal 2-inch thick by at least 4" wide piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

**COMPRESSION BLOCK.** A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain in the compression mode (force directed towards the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

**CONVENTIONALLY FRAMED GABLE END.** A conventionally framed gable end with studs whose faces are perpendicular to the gable end wall.

**HORIZONTAL BRACE.** A nominal 2-inch thick by at least 4" wide piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

**HURRICANE TIES.** Manufactured metal connectors designed to provide uplift and lateral restraint for roof framing members.

**NAIL PLATE.** A manufactured metal plate made of minimum of 20 gauge galvanized steel with factory punched holes sized for 8d common nails. A nail plate may have the geometry of a strap.

**RETROFIT.** The voluntary process of strengthening or improving buildings or structures, or individual components of buildings or structures for the purpose of making existing conditions better serve the purpose for which they were originally intended or the purpose that current building codes intend.

**RETROFIT STUD.** A nominal 2-inch lumber member used to structurally supplement an existing gable end wall stud.

**RIGHT ANGLE BRACKET.** A 14 gage or thicker galvanized metal right angle bracket listed by the manufacturer for the material into which they will be attached, masonry (concrete or CMU) or wood, to have a minimum specified load capacity of 350 lbs for uplift and lateral conditions, when the maximum number of fasteners specified by the manufacturer are used.

**STUD-TO-PLATE CONNECTOR.** A manufactured metal connector designed to connect studs to plates with a minimum uplift capacity of 500 lbs.

**TRUSS GABLE END.** An engineered factory made truss or site built truss that incorporates factory installed or field installed vertical studs with their faces parallel to the plane of the truss and are spaced no greater than 24-inches on center. Web or other diagonal members other than top chords may or may not be present. Gable end trusses may be of the same height as nearby trusses or may be drop chord trusses in which the top chord of the truss is lower by the depth of the top chord or outlookers.

**SECTION C103**
**MATERIALS OF CONSTRUCTION**

**C103.1 Existing materials.** All existing wood materials that will be part of the retrofitting work (trusses, rafters, ceiling joists, top plates, wall studs, etc.) shall be in sound condition and free from defects or damage that substantially reduces the load-carrying capacity of the member.

Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions.

**C103.2 New materials.** All materials approved by this code, including their appropriate allowable stresses, shall be permitted to meet the requirements of this chapter.

**C103.3 Dimensional lumber.** All dimensional lumber for braces, studs, and blocking shall conform to applicable standards or grading rules. Dimensional lumber shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. All new dimensional lumber to be used for retrofitting purposes shall be a minimum grade and species of #2 Spruce-Pine-Fir or shall have a specific gravity of 0.42 or greater. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this code shall be accepted.

**C103.4 Metal plate connectors, straps and anchors.** Metal plate connectors, plates, straps and anchors shall have product approval. They shall be approved for connecting wood-to-wood or wood-to-concrete as appropriate. Straps and nail plates shall be manufactured from galvanized steel with a minimum thickness of 20 gauge. Nail plates shall have holes sized for a minimum of 8d nails.

**C103.5 Twists in straps.** Straps shall be permitted to be twisted 90 degrees in addition to a 90 degree bend where they transition between framing members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length.

**C103.6 Fasteners.** Fasteners shall meet the requirements of Sections C103.6.1 and Section C103.6.2, and shall be permitted to be screws or nails meeting the minimum length requirement shown in figures and specified in tables. Fastener spacing shall meet the requirements of Section C103.6.3.

**C103.6.1 Screws.** Screws shall be a minimum #8 size with head diameters no less than 0.28 inches. Screw lengths shall be no less than indicated in the Figures and in Tables. Permissible screws include deck screws and wood screws. Screws shall have at least 1 inch of thread. Fine threaded screws or drywall screws shall not be permitted. Select the largest possible diameter screw such that the shank adjacent to the head fits through the hole in the strap.

**C103.6.2 Nails.** Unless otherwise indicated in the provisions or drawings, where fastener lengths are indicated in Figures and Tables as 1-¼ inches, 8d common nails with shank diameter 0.131 inches and head diameters no less than 0.28 inches shall be permitted. Unless otherwise indicated in the provisions or drawings, where fasteners lengths are indicated in Figures and Tables as 3 inches, 10d common nails with shank diameter of 0.148 inches and head diameters no less than 0.28 inches shall be permitted.

**C103.6.3 General fastener spacing.** Fastener spacing for shear connections of lumber-to-lumber shall meet the requirements shown in Figure C103.6.3 and the following conditions.

**C103.6.3.1 General fastener spacing.** Fastener spacing shall meet the following conditions except as provided for in Section C103.6.3.3

1. The distance between fasteners and the edge of lumber that is less than 3-1/2 inches deep in the direction of the fastener length shall be a minimum of 3/4 inches.
2. The distance between fasteners and the edge of lumber that is more than 2 inches thick in the direction of the fastener length shall be a minimum of ½ inches.
3. The distance between a fastener and the end of lumber shall be a minimum of 2-½ inches.
4. The distance between fasteners parallel to the grain (center-to-center) shall be a minimum of 2-1/2 inches.
5. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is less than 3-1/2 inches deep in the direction of the fastener length shall be 1 inch.
6. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is more than 2 inches thick in the direction of the fastener length shall be ½ inches.

**C103.6.3.2 Wood-to-wood connections of two members each 2 inch or less thick.** Wood-to-wood connections fastener spacing shall meet the following conditions.

1. The distance between fasteners parallel to grain (center-to-center) shall be a minimum of 2-1/2 inches.
2. The distance between fasteners across grain (center-to-center) shall be a minimum of 1 inch.
3. For wood-to-wood connections of lumber at right angles, fasteners shall be spaced a minimum of 2-1/2 inches parallel to the grain and 1 inch perpendicular to the grain in any direction.

**C103.6.3.3 Metal connectors to wood connections.** Metal connectors to wood connections shall meet the following conditions.

1. Fastener spacing to edge or ends of lumber shall be as dictated by the prefabricated holes in the connectors and the connectors shall be installed in a configuration that is similar to that shown by the connector manufacturer.
2. Fasteners in metal straps 1-1/4 inch wide that are installed on the 1-1/2 inch broad face of lumber shall be a minimum 1/4 inches from either face that is perpendicular to the 1-1/2 inch edge of the lumber. Consistent with Section C103.6.3.1 fasteners shall be allowed to be spaced according to the fastener holes provided in the strap.
3. Fasteners in metal nail plates shall be spaced a minimum of ½ inches across wood grain and a minimum of 1-1/2 inches parallel to wood grain.

## SECTION C104
## RETROFITTING GABLE END WALLS TO ENHANCE WIND RESISTANCE

**C104.1 General.**

**C104.1.1 Scope and intent.** These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end construction for out-of-plane wind loads resulting from high wind events. The retrofit method addresses four issues by strengthening the framing members of the gable end itself with the use of retrofit studs (Section C104.3), bracing the top and bottom of the gable end so that

lateral loads are transmitted into the roof and ceiling diaphragms by the use of horizontal braces (Section C104.2), making connections between horizontal braces and retrofit studs by the use of straps (see Section C104.4), and connecting the bottom of the gable end to the wall below to help brace the top of that wall by the use of right angle brackets (Section C104.5). The ceiling diaphragm shall be comprised of minimum ½ inch thick drywall, minimum nominal 3/8 inch thick wood structural panels, or plaster. An overview isometric drawing of one kind of gable end retrofit to improve wind resistance is shown in Figure C104.1.1.

The following prescriptive methods are intended for applications where the gable end wall framing is provided by a wood gable end wall truss or a conventionally framed rafter system. The retrofits are appropriate for wall studs oriented with their broad face parallel to or perpendicular to the gable end surface. Gable ends to be strengthened shall be permitted to be retrofitted using methods prescribed by provisions of this section.

**C104.2 Horizontal braces.** Horizontal braces shall be installed approximately perpendicular to the roof and ceiling framing members at the location of each existing gable end stud greater than 3 feet in length. Unless it is adjacent to an omitted horizontal brace location, horizontal braces shall be minimum 2x4 dimensional lumber as defined in Section C103.3. A single horizontal brace is required at the top and bottom of each gable end stud for Retrofit Configuration A, B, or C and two horizontal braces are required for Retrofit Configuration D. Maximum heights of gable end wall studs and associated retrofit studs for each Retrofit Configuration shall not exceed the values listed in Table C104.2. Horizontal braces shall be oriented with their broad faces across the roof or ceiling framing members, be fastened to a minimum of three framing members, and extend at least 6 feet measured perpendicularly from the gable end plus 2-1/2 inches beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end as shown in Figure C104.2(1), Figure C104.2(2), Figure C104.2(3), and Figure C104.2(4).

**TABLE C104.2**

| STUD LENGTH LIMITATIONS BASED ON EXPOSURE AND DESIGN WIND SPEED | | | | | |
|---|---|---|---|---|---|
| Exposure | Maximum 3-Sec Gust | Maximum Height of Gable End Retrofit Stud [b] | | | |
| Category | Basic Wind Speed [a] | | | | |
| C | 110 | 8'-0" | 11'-3" | 14'-9" | 16'-0" |
| C | 120 | 7'-6" | 10'-6" | 13'-6" | 16'-0" |
| C | 130 | 7'-0" | 10'-0" | 12'-3" | 16'-0" |
| C | 140 | 7'-0" | 10'-0" | 12'-3" | 16'-0" |
| C | 150 | 6'-6" | 8"-9" | 11'-0" | 16'-0" |
| B | 110 | 8'-0" | 12'-3" | 16'-0" | N/R [c.] |
| B | 120 | 8'-0" | 11'-3" | 14'-9" | 16'-0" |
| B | 130 | 8'-0" | 11'-3" | 14'-9" | 16'-0" |
| B | 140 | 7'-6" | 10'-6" | 13'-6" | 16'-0" |
| B | 150 | 7'-0" | 10'-0" | 12'-3" | 16'-0" |
| | Retrofit Configuration --> | A | B | C | D |

For SI: 1 Inch = 25.4mm, 1 Foot = 304.8mm

a. Interpolation between given wind speeds not permitted.

b. Existing gable end studs less than or equal to 3'-0" in height shall not require retrofitting.

c. N/R = Not Required. Configuration C is acceptable to 16'-0" maximum height.

**C104.2.1 Existing gable end studs.** If the spacing of existing vertical gable end studs is greater than 24 inches, a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be no greater than 24 inches. Additional gable end wall studs shall not be required at locations where their length would be 3 feet or less. Each end of each required new stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using a minimum of two 3 inch toenail fasteners (#8 wood screws or 10d nails) and a metal connector with minimum uplift capacity of 175 pounds, or nail plates with a minimum of four 1-1/4 inch long fasteners (#8 wood screws or 8d nails).

**C104.2.2 Main method of installation.** Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch long fasteners (#8 wood screws or 10d nails) as indicated in Figure C104.2(1) and Figure C104.2(3) for trusses and Figure C104.2(2) and Figure C104.2(4) for conventionally framed gable end walls. Alternative methods for providing horizontal bracing of the gable end studs as provided in Sections C104.2.3 through C104.2.9 shall be allowed in lieu of this primary installation method.

**C104.2.3 Omitted horizontal brace.** Where impediments, other permanently attached obstacles or conditions exist that prevent installation in accordance with Section C104.2.2 horizontal braces may be omitted for height limitations corresponding to Retrofit Configurations A and B as defined in Table C104.2 provided installation is as indicated in Figure C104.2.3 and provided all of the following conditions are met. This method is not allowed for Retrofit Configurations C or D.

1. There shall be at least **two horizontal braces** on each side of an omitted horizontal brace or at least one horizontal brace if it is the end horizontal brace. Omitted horizontal braces must be separated by at least two horizontal braces even if that location is comprised of two retrofit studs and two horizontal braces.

2. **Horizontal braces** adjacent to the omitted horizontal brace shall be 2x6 lumber, shall butt against the existing studs, and shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch long fasteners (#8 wood screws or 10d nails). For Retrofit Configuration B, 4 fasteners shall be required on at least one of the connections between the horizontal brace and the existing roof and ceiling framing members. Fasteners shall be spaced a minimum of ¾" from the edges of the horizontal braces and a minimum of 1-3/4" from adjacent fasteners.
3. Where the existing studs on each side of an omitted horizontal brace have their broad face perpendicular to the gable end wall, the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall be sized such that they protrude a minimum of 3-1/2 inches beyond the interior edge of the existing studs for both Retrofit Configurations A and B. The edges of the three retrofit studs facing towards the interior of the attic shall be aligned such that they are the same distance from the gable end wall.
4. Retrofit studs shall be fastened to existing studs in accordance with Section C104.3.
5. Retrofit studs adjacent to the omitted horizontal brace shall be fastened to the horizontal brace using straps in accordance with Table C104.4.1 consistent with the size of the retrofit stud. The method applicable to Table C104.4.2 is not allowed.
6. A strong back made of minimum of 2x8 lumber shall be placed parallel to the gable end and shall be located on and span between horizontal braces on the two sides of the omitted horizontal brace and shall extend beyond each horizontal braces by a minimum of 2-1/2 inches. The strong back shall be butted to the three retrofit studs. The strong back shall be attached to each of the horizontal braces on which it rests with 5 each 3 inch long fasteners (#8 screws or 8d nails). Those fasteners shall be spaced a minimum of 3/4 inch from any edge of lumber and shall be spaced a minimum of 2-1/2 inch from each other. Additional compression blocks shall not be required at locations where a strong back butts against a retrofit stud.
7. The retrofit stud at the location of the omitted horizontal braces shall be fastened to the strong back using a connector with minimum uplift capacity of 800 pounds and installed such that this capacity is oriented in the direction perpendicular to the gable end wall.
8. The use of shortened horizontal braces using the alternative method of Section C104.2.5 is not allowable for horizontal braces adjacent to the omitted horizontal braces.
9. Horizontal braces shall be permitted to be interrupted in accordance with Section C104.2.8.

**C104.2.4 Omitted horizontal brace and retrofit stud.** Where impediments, other permanently attached obstacles or conditions exist that prevent installation in accordance with Section C104.2.2 or Section C104.2.3 by not permitting installation of horizontal braces, then retrofit studs and horizontal brace shall be permitted to be omitted from those locations by installation of ladder assemblies for Retrofit Configurations A and B as defined in Table C104.2 provided all of the following conditions are met**.** This method is not allowed for Retrofit Configurations C or D.

1. No more than two ladder assemblies are permitted on a single gable end.
2. There shall be at least two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (no two ladder braces bearing on a single retrofit stud).
3. Where the existing studs on each side of an omitted horizontal brace have their broad face parallel to the gable end wall the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall be 2x6 lumber for Retrofit Configuration A and 2x8 lumber for Retrofit Configuration B.
4. Horizontal braces adjacent to the omitted horizontal brace shall be 2x6 lumber and be fastened to each existing roof or ceiling member crossed using three 3-inch long fasteners (#8 wood screws or 10d nails) as indicated in Figure C104.2(1) and Figure C104.2(3) for trusses and Figure C104.2(2) and Figure C104.2(4) for conventionally framed gable end wall. For Retrofit Configuration B, 4 fasteners shall be required on at least one of the connections between the horizontal brace and the existing roof and ceiling framing members.
5. Ladder rungs shall be provided across the location of the omitted retrofit studs as indicated in Figure C104.2.4(1) for trusses and Figure C104.2.4(2) for conventionally framed gable end walls.
6. Ladder rungs shall be made of at a minimum 2x4 lumber oriented with their broad face horizontal and spaced a maximum of 16-inches on center vertically.
7. Where ladder rungs cross structural members such as the existing stud at the omitted retrofit stud location or gable end vent framing they shall be connected to each other with a metal connector with a minimum capacity of 175 pounds in the direction perpendicular to the gable end wall.
8. Notching of the ladder rungs shall not be permitted unless the net depth of the framing member is a minimum of 3-1/2 inches.

**C104.2.5 Short horizontal brace.** Where impediments, other permanently attached obstacles or conditions exist that prevent installation in accordance with Sections C104.2.2, C104.2.3, or C104.2.4 by not permitting extension of horizontal braces across the existing framing members such that they can be fastened to a minimum of three framing members and extend at least 6-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member, the horizontal braces may be shortened provided installation is as indicated in Figure C104.2.5 and provided that all of the following conditions are met.

1. The horizontal brace shall be installed across a minimum of two framing spaces, extend a minimum of 4-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member, and be fastened to each existing framing member with three 3-inch long fasteners (#8 wood screws or 10d nails),
2. An anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure C104.2.5. The anchor block lumber shall have a minimum edge thickness of 1-1/2 inches and the depth shall be as a minimum the depth of the existing roof or ceiling framing member. Six 3-inch long fasteners (#8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
3. The anchor block shall extend into the space between the roof or ceiling framing members a minimum of one-half the depth of the existing framing members at the location where the anchor block is installed. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed $^1/_8$ inch.
4. The use of omitted horizontal braces using the method of Section C104.2.3 adjacent to a short horizontal brace as defined in this section is not permitted.

**C104.2.6 Installation of horizontal braces onto webs or vertical members of trusses.** Where existing conditions preclude installation of horizontal braces on truss top or bottom chords they shall be permitted to be installed on truss webs or vertical members of trusses provided all of the following conditions are met.

1. Horizontal braces shall be installed as close to the top or bottom chords as practical without altering the truss or any of its components and not more than three times the depth of the truss member to which it would ordinarily be attached.
2. A racking block, comprised of an anchor block meeting the definition of anchor block of Section C102 or comprised of minimum 15/32 inch plywood or 7/16 inch OSB, shall be fastened to the horizontal brace in the second framing space from the gable end wall. The racking block shall extend towards the diaphragm (roof or ceiling as appropriate) so that the edge of the racking block closest to the diaphragm is within ½ the depth of the existing framing member from the diaphragm surface. They shall be attached to horizontal braces using six fasteners (#8 wood screws or 10d nails) of sufficient length to provide 1-1/2 inches of penetration into the horizontal brace.
3. Racking blocks can be fastened to any face or edge of horizontal braces between each web or truss vertical posts to which a horizontal brace is attached. Racking blocks can be on alternate sides of horizontal braces. Racking blocks shall be installed tightly between the lumber of truss members or truss plates such that the gap at either end shall be a maximum of 1/8 inch.

**C104.2.7 Alternative method of installation of horizontal braces at truss ridges.** Where impediments such as truss plates or access for installation of fasteners limits or restricts installation of horizontal braces near the peak of the roof, ridge ties may be added to provide support for the required horizontal brace. The top of added ridge tie members shall be installed a maximum of 16-inches below the existing ridge line or 4 inches below impediments. The added ridge tie members shall be installed across a minimum of three bays, but no less than 6-feet from the gable end wall plus 2-1/2 inches beyond the last roof or ceiling framing member to permit fastening of the horizontal brace. A minimum of a 2x4 member shall be used for each ridge tie and fastening shall consist of two 3-inch long wood screws, four 3 inch long 10d nails or two 3-1/2 inch long 16d nails driven through and clinched at each top chord or web member intersected by the ridge tie as illustrated in Figure C104.2.7.

**C104.2.8 Interrupted horizontal braces.** Where impediments, other permanently attached obstacles or conditions exist that prevent installation of horizontal braces in accordance with Section C104.2.2 by preventing the installation of a single continuous horizontal braces then horizontal braces shall be permitted to be interrupted using the methods shown in Figure C104.2.8(1), Figure C104.2.8(2), and Figure C104.2.8(3). For interruptions that occur in the attic framing space closest to the gable end, nine 3 inch fasteners shall be used to connect each section of the interrupted horizontal braces. For interruptions that occur in the second attic space from the gable end, six 3 inch fasteners shall be used to connect each section of the interrupted horizontal braces. For interruptions that occur in the attic framing space farthest from the gable end, three 3 inch fasteners shall be used to connect each section of the interrupted horizontal braces. Horizontal braces shall be continued far enough to allow connections to three existing roof framing members as shown in Figure C104.2.8(1), Figure C104.2.8(2), or Figure C104.2.8(3). Fasteners shall be spaced in accordance with Section C103.6.3. Lumber members used to form horizontal braces shall be the same width and depth as required for an un-interrupted member.

**C104.2.9 Piggyback trusses.** Piggyback trusses (trusses composed of two members one above the other) shall be permitted to be retrofitted if either of the following cases is true. 1. The existing studs in both the upper truss and the lower truss to which wall sheathing, panel siding, or other wall facade are attached are sufficiently in line that retrofit studs can be installed and connections made between the two with retrofit stud(s). 2. The same as condition 1 except the studs in the upper truss are not sufficiently in line with ones below and the existing studs in the upper truss are 3 feet or shorter. For condition 1 both the lower stud and the upper stud shall be retrofitted using the methods of Section C104.2. For condition two the retrofit stud shall be connected to the lower studs using the methods of Section C104.2 and be continuous from the bottom horizontal brace to the top horizontal brace. No connection is required between the retrofit stud and the upper stud. In both conditions the bottom chord of the piggy back truss section shall be fastened to each retrofit stud using a connector with minimum axial capacity of 175 pounds.

**C104.3 Retrofit Studs.** Retrofit studs shall be installed in accordance with Section C104.3.1 and using one of the five methods of Sections C104.3.2, C104.3.3, C104.3.4, C104.3.5, or C104.3.6. Figure C104.3 shows these methods of installation. For the Retrofit Configuration derived from Table C104.2 the size of retrofit studs shall be as indicated in Table C104.4.1 or Table C104.4.2. Retrofit studs shall extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace except that a maximum gap of 1/8 inch is allowed at the bottom and ½ inch at the top. Where wall sheathing, panel siding, or other wall façade is fastened to gable end studs not manufactured into a truss, i.e. are field installed, retrofit studs shall be applied to those field installed studs in accordance with Section C104.2.1.

**C104.3.1 Fastening.** Where nail plates are not used, retrofit studs shall be attached to existing studs using 3 inch fasteners at a maximum of 6 inches on center but no closer than 2-1/2 inches on center with fasteners no closer to ends of members than 2-1/2" inches.

**C104.3.2 Method #1: Face to edge or to face method.** Retrofit studs shall be installed immediately adjacent to existing (Section C104.2) gable end wall studs as indicated in Figure C104.3(a). The retrofit studs shall overlap the edge or side of the existing stud by a minimum of 1-1/4 inches. Fasteners shall be installed as specified in Section C104.3.1.

**C104.3.3 Method #2: Face to face offset method.** Retrofit studs shall be installed against the face of existing studs as indicated in Figure C104.3(b) such that the faces overlap a minimum of 1-1/2 inch and the edge distance to fasteners is no less than ¾ inch. Fasteners shall be installed as specified in Section C104.3.1.

**C104.3.4 Method #3: Butted retrofit stud method.** Provided that all of the following fastening conditions are met retrofit studs shall be permitted to be butted by edge or face to existing studs with the addition of nail plates as indicated in Figure C104.3(c) and Figure C104.3.4.

1. The 1-1/2 inch edge of retrofit studs shall be installed against the 1-1/2 inch or the broad face of existing studs.
2. A minimum of two nail plates shall be used.
3. Fasteners used to secure nail plates to studs shall be a minimum 1-1/4 inch long (#8 wood screws or 8d nails).
4. Fasteners placed in nail plates shall be a minimum of 2-1/2 inches along the length of lumber. A fastener shall be placed in nail plates a maximum of 6 inches from the ends of the shorter stud.
5. Fasteners shall be placed a minimum of ½ inches from the edges of studs. Fasteners shall be placed a maximum of 1-1/2 inches from the abutting vertical edges of existing studs and retrofit studs.
6. There shall be at least 3 fasteners through nail plates into all existing and retrofit studs to which it is attached.
7. Where there are 3 fasteners through nail plates onto a single existing or retrofit stud then nail plates shall be spaced a maximum of 15 inches on center.
8. Where there are more than 3 fasteners though nail plates onto a single existing or retrofit stud then nail plates shall be spaced a maximum of 20 inches on center.
9. In line fasteners used to secure nail plates shall be spaced vertically a minimum of 1-1/2 inches on center. Staggered fasteners used to secure nail plates shall be spaced horizontally a minimum of ½ inches.

**C104.3.5 Method #4: Offset retrofit stud method**. Where retrofit studs are placed as indicated on Figure C104.3(d) retrofit studs may be offset from existing studs by use of nail plates such that the vertical corner of a retrofit stud shall be placed at the vertical corner of an existing stud as indicated in Figure C104.3(d) and Figure C104.3.4 provided the fastening conditions of Section C104.3.4 are met.

**C104.3.6 Method #5: Nailer with retrofit stud method.** Retrofit studs and existing studs shall be permitted to be connected using non-continuous 2x4 nailers as indicated in Figure C104.3(e) provided the following conditions are met.

1. Both the existing stud and the retrofit stud shall be butted to nailers and both shall be fastened to the nailer with 3 inch long fasteners (#8 wood screws or 8d nails). Fasteners connecting each stud to the nailer shall be a spaced 6 inches o.c.
2. Fasteners into nailers from any direction shall be offset vertically by a minimum of 2-1/2 inches.
3. Fasteners into nailers shall be a minimum of 2-1/2 inches but not more than 6 inches from the end of the shorter of the existing stud and retrofit stud to which they are fastened.

**C104.3.7 Reduced size of retrofit studs.** Retrofit studs may be reduced in size by notching, tapering, or other methods at any number of locations along their length provided that all of the following conditions are met.

1. Retrofit stud to be notched shall be sized such that the remaining minimum depth of member at the location of the notch (including cross cut kerfs) shall not be less than that required by Table C104.4.1 or Table C104.4.2.
2. Notched retrofit stud shall not be spliced within 12 inches of the location of notches. Splice members shall not be notched.
3. The vertical extent of notches shall not exceed 12 inches as measured at the depth of notches.
4. Notched retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section C104.3.1. Two additional 3 inch fasteners (#8 wood screws or 10d nails) shall be installed on each side of notches in addition to those required by Section C104.3.1.

**C104.3.8 Retrofit stud splices.** Retrofit studs greater than 8 feet in height may be field spliced in accordance with Figure C104.3.8.

**C104.4 Connection between horizontal braces and retrofit studs.** Connections between horizontal braces and retrofit studs shall comply with Section C104.4.1 or Section C104.4.2. Each retrofit stud shall be connected to the top and bottom horizontal brace members with a minimum of a 20 gauge 1-1/4 inch wide flat or coil metal strap with pre-punched holes for fasteners. Straps shall be fastened with 1-1/4 inch long fasteners (#8 wood screws or 8d nails) with the number of fasteners as indicated on Table C104.4.1 and Table C104.4.2. Fasteners shall be no closer to the end of lumber than 2-1/2 inches.

**C104.4.1 L-bent strap method.** Retrofit studs shall be connected to horizontal braces or to strong backs in accordance with Figure C104.2(1), Figure C104.2(2), or Figure C104.2.3, and shall comply with the following conditions.

1. Straps: A strap shall be applied to the edges of a retrofit stud nearest the gable end wall and to the face of horizontal braces using at each end of the straps the number of fasteners specified in Table C104.4.1. Straps shall be long enough so that each strap extends sufficient distance onto the vertical face of the retrofit stud that the fastener closest to the ends of the studs is a minimum of 2-1/2 inches from the end of the stud. Straps shall be allowed to be twisted to accommodate the transition between the tops of retrofit studs and horizontal bracings following roof pitches.
2. Compression Blocks: Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. Figure C104.2(1) (trusses) and Figure C104.2(2) (conventionally framed) show the installation of the compression block against the existing vertical gable end wall stud with the strap from the retrofit stud running beside the compression block. Compression blocks shall be allowed to be placed over straps. Compression blocks shall be fastened to the horizontal braces with at least the minimum number of 3 inch long fasteners (#8 wood screws or 10d nails) specified in Table C104.4.1. End and edge distances for fasteners shall be in accordance with Section C103.6.3.

| | TABLE C104.4.1 | | | |
|---|---|---|---|---|
| | ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD | | | |
| | Retrofit | Retrofit | Retrofit | Retrofit |
| | Config. | Config. | Config. | Config. |
| Retrofit Elements | A | B | C | D |
| Minimum size and number of | | | | |
| Horizontal Braces | 2x4 | 2x4 | 2x4 | 2 each 2x4 |
| Minimum size and number of | | | | |
| Retrofit Studs | 2x4 | 2x6 | 2x8 | 2 each 2x8 |
| Minimum number of fasteners | | | | |
| connecting each end of | | | | |
| straps to Retrofit Studs or to | 6 | 9 | 12 | 8 on each |
| Horizontal Braces | | | | strap |
| #8 screws or 10d nails 1-1/4" long | | | | |
| Minimum number of fasteners | | | | |
| to connect | | | | |
| Compression Blocks to | 6 | 8 | 10 | 12 |

| | | | | |
|---|---|---|---|---|
| | TABLE C104.4.1 | | | |
| | ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD | | | |
| | Retrofit | Retrofit | Retrofit | Retrofit |
| Horizontal Braces | | | | |
| #8 screws or 10d nails 3" long | | | | |
| For SI: 1 Inch = 25.4mm, 1 Foot = 304.8mm | | | | |

**C104.4.2 U-bent strap method.** Retrofit studs shall be connected to horizontal braces in accordance with Figure C104.2(3) or Figure C104.2(4), shall be limited to Retrofit Configurations A and B (Table C104.2), and shall comply with the following conditions.

1. Straps of sufficient length to meet the requirements for the number of fasteners in accordance with Table C104.4.2 and meet the end distance requirements of Section C103.6.3 shall be shaped around retrofit studs and fastened to the edges of horizontal braces. Straps shall wrap the back edge of the retrofit stud snuggly with a maximum gap of ¼ inches. Rounded bends of straps shall be allowed. One fastener shall be installed that connects each strap to the side of the associated retrofit stud.
2. The horizontal brace shall butt snugly against the retrofit stud with a maximum gap of ¼ inches.
3. Straps shall be allowed to be twisted to accommodate the transition between the tops of retrofit studs and horizontal braces that follow the roof pitch.

| | | | | |
|---|---|---|---|---|
| | TABLE C104.4.2 | | | |
| | ELEMENT SIZING AND SPACING FOR U-BENT RETROFIT METHOD | | | |
| | | | | |
| | Retrofit | Retrofit | Retrofit | Retrofit |
| | Config. | Config. | Config. | Config. |
| Retrofit Elements | A | B | C | D |
| Minimum size and number of | | | | |
| Horizontal Braces | 2x4 | 2x4 | 2x4 | 2 each 2x4 |
| Minimum size and number of | | | | |
| Retrofit Studs | 2x4 | 2x6 | 2x8 | 2 each 2x8 |
| Minimum number of fasteners | | | | |
| connecting | | | | |
| Straps to each edge of | 6 | 7 | 7 | 6 on side of |
| Horizontal Braces | | | | each strap |
| #8 screws or 10d nails 1-1/4" long | | | | |
| For SI: 1 Inch = 25.4mm, 1 Foot = 304.8mm | | | | |

**C104.5 Connection of gable end wall to wall below.** The bottom chords or bottom members of wood framed gable end walls shall be attached to the wall below using one of the methods prescribed in Sections C104.5.1 or C104.5.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered.

**C104.5.1 Truss gable end wall.** The bottom chords of the gable end wall shall be attached to the wall below using right angle brackets. A minimum of two fasteners shall be installed into the bottom chord. The right angle brackets shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet at the spacing specified in Table C104.5.1. Connection to the wall below shall be by one of the methods listed below:

1, For a wood frame wall below, a minimum of two fasteners shall be installed. The fasteners shall be of the same diameter and style specified by the bracket manufacturer and sufficient length to extend through the double top plate of the wall below.
2. For a concrete or masonry wall below without a sill plate, the type and number of fasteners into the wall shall be consistent with the bracket manufacturer's specifications for fasteners installed in concrete or masonry.
3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the bracket manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the bracket can be anchored to the sill plate using 4 each 1-1/2 inch long fasteners of the same type as specified by the bracket manufacturer for wood connections, provided that the sill plate is anchored to the wall on each side of the bracket by a 1/4-inch diameter masonry screw with a 2-3/4 inches of embedment into the concrete or masonry wall. A ¼ inch washer shall be placed under the heads of the masonry screws.

Table C104.5.1

Spacing of Right Angle Brackets

| Exposure Category | Maximum 3-Sec. Gust Wind Speed - V mph | Spacing of Right Angle Brackets [a.] |
|---|---|---|
| C | 110 | 38-inches |
| C | 120 | 32-inches |
| C | 130 | 28-inches |
| C | 140 | 24-inches |
| C | 150 | 20-inches |
| B | 110 | 48-inches |
| B | 120 | 40-inches |
| B | 130 | 36-inches |
| B | 140 | 30-inches |
| B | 150 | 26-inches |

a. See Section C102 for definition of right angle bracket.

**C104.5.2 Conventionally framed gable end wall.** Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3 feet, shall be attached to the bottom or sill plate using a stud to plate connector with minimum uplift capacity of 175 pounds. The bottom or sill plate shall then be connected to the wall below using one of the methods listed below:

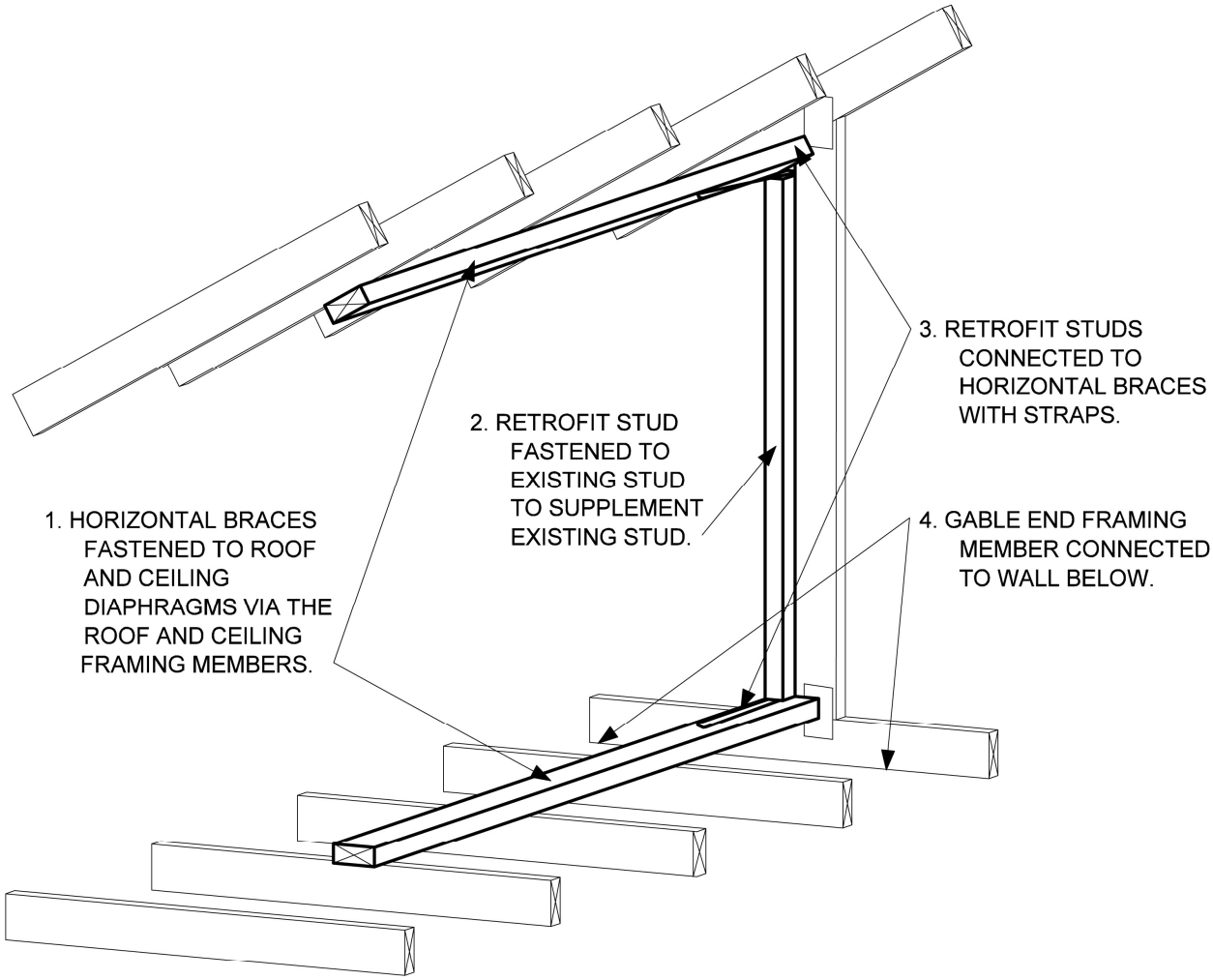
1. For a wood frame wall below, the sill or bottom plate shall be connected to the top plate of the wall below using ¼ inch diameter lag bolt fasteners of sufficient length to penetrate the bottom plate of the upper gable end wall and extend through the bottom top plate of the wall below. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.
2, For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼ inch diameter concrete or masonry screws of sufficient length to provide 2-3/4 inches of embedment into the top of the concrete or masonry wall. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.

TABLE C104.5.2 SPACING OF LAG OR MASONRY SCREWS USED TO

CONNECT SILL PLATE OF GABLE END WALL TO TOP OF THE WALL BELOW

| Exposure Category | Maximum 3-Sec. Gust Wind Speed - V mph | Spacing of Lag Screws or Masonry Screws |
|---|---|---|
| C | 110 | 19-inches |
| C | 120 | 16-inches |
| C | 130 | 14-inches |
| C | 140 | 14-inches |
| C | 150 | 10-inches |
| B | 110 | 24-inches |
| B | 120 | 20-inches |
| B | 130 | 18-inches |
| B | 140 | 15-inches |
| B | 150 | 13-inches |

FIGURE C104.1.1
BASIC GABLE END RETROFIT METHODOLOGY




THIS FIGURE SHOWS A TRUSS GABLE END.

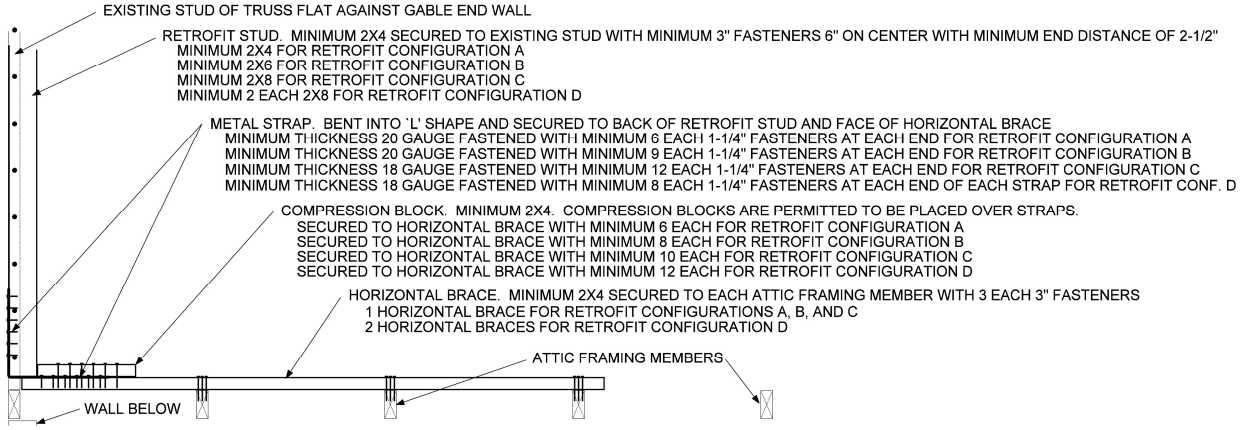
THE METHODOLOGY FOR A CONVENTIONALLY FRAMED GABLE END IS SIMILAR.

THE NUMBERS INDICATE A TYPICAL SEQUENCE OF INSTALLATION.

IN ORDER TO SHOW STRAPS COMPRESSION BLOCKS ARE NOT SHOWN.

FIGURE C104.2 (1)
TRUSS FRAMED GABLE END. L-BENT STRAP

ELEVATION VIEW




FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".

FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.

THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.

PLAN VIEWS

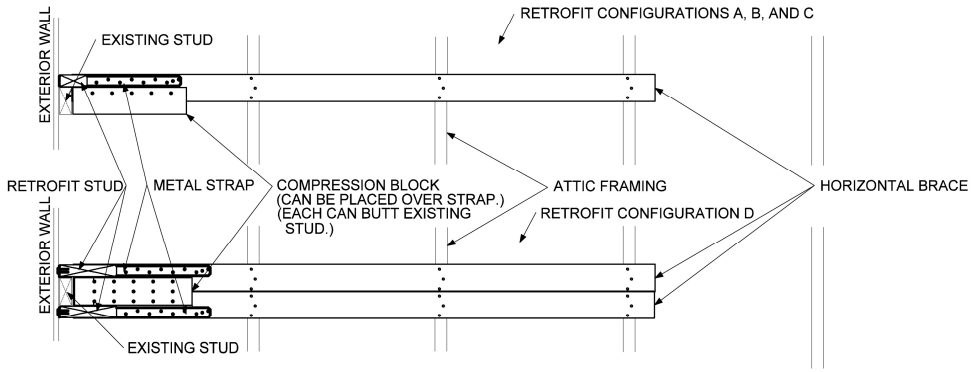
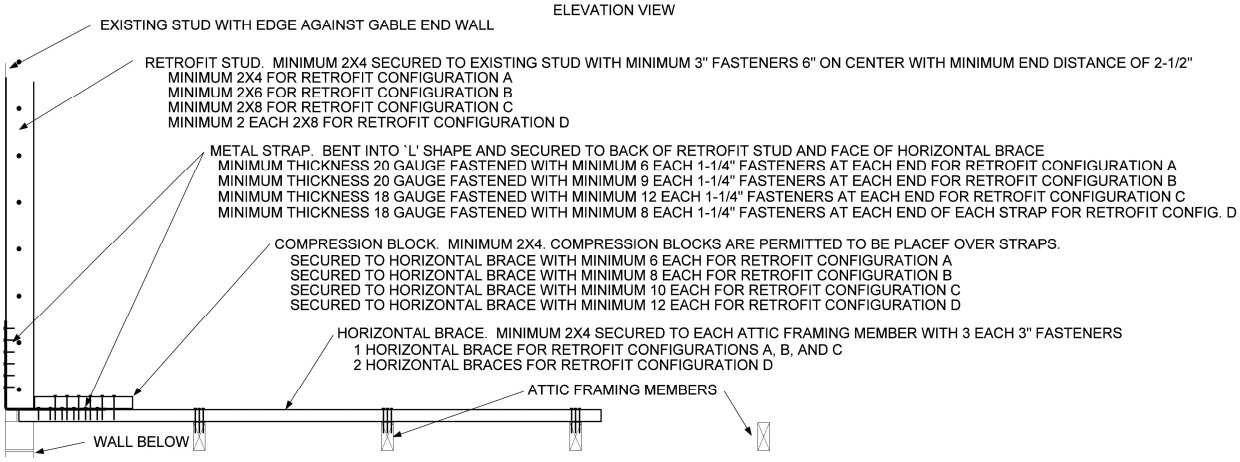


FIGURE C104.2 (2)
CONVENTIONALLY FRAMED GABLE END. L-BENT STRAP
ELEVATION VIEW




FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".

FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.

THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.

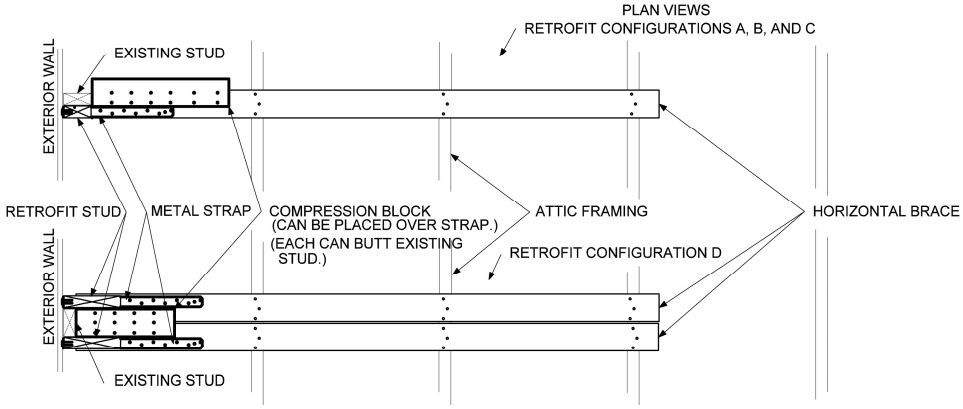
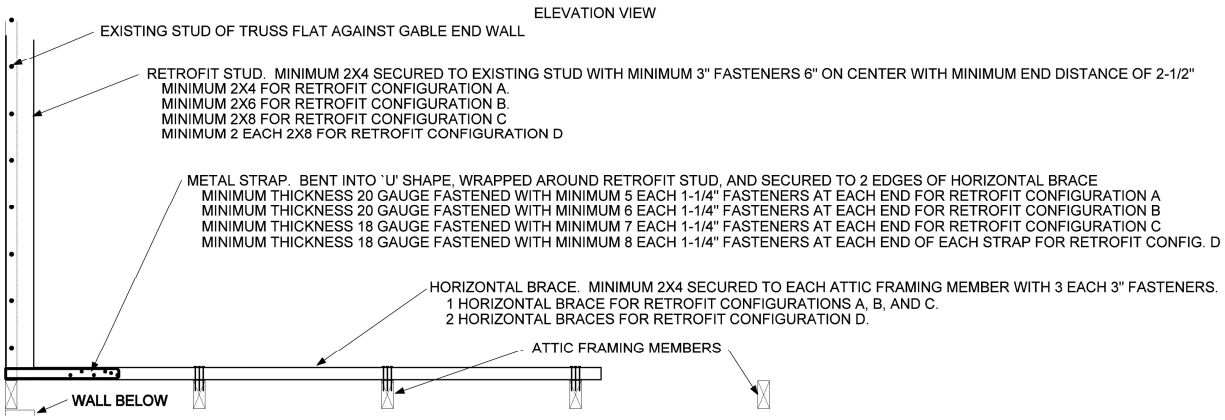


FIGURE C104.2 (3)
TRUSS FRAMED GABLE END. U-BENT STRAP




FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".

FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.

THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.

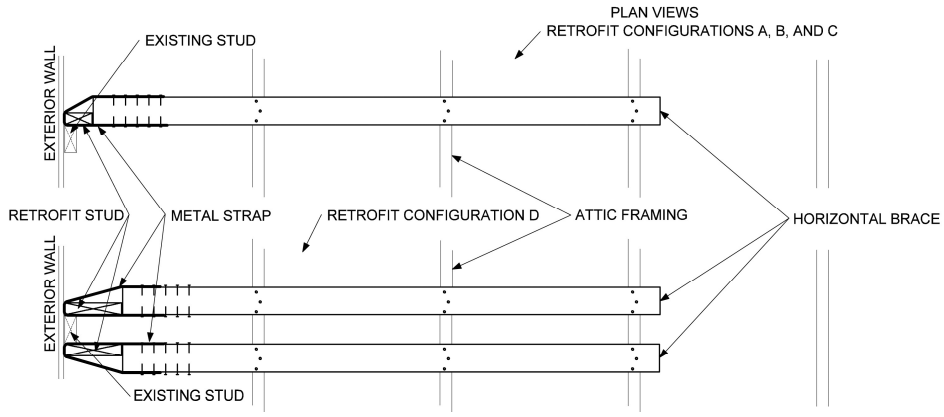
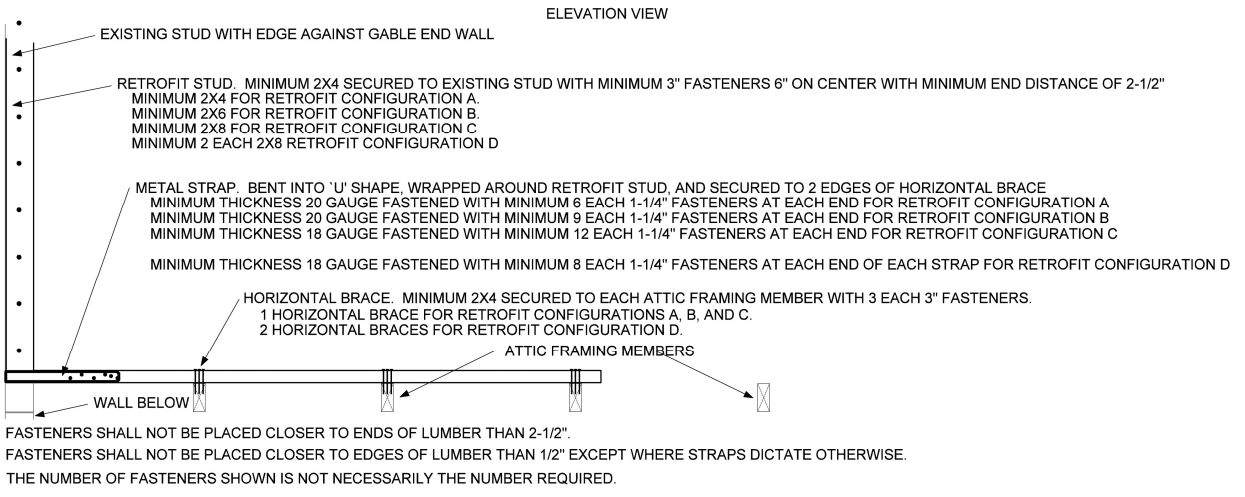


FIGURE C104.2 (4)
CONVENTIONALLY FRAMED GABLE END. U-BENT STRAP




FASTENERS SHALL NOT BE PLACED CLOSER TO ENDS OF LUMBER THAN 2-1/2".

FASTENERS SHALL NOT BE PLACED CLOSER TO EDGES OF LUMBER THAN 1/2" EXCEPT WHERE STRAPS DICTATE OTHERWISE.

THE NUMBER OF FASTENERS SHOWN IS NOT NECESSARILY THE NUMBER REQUIRED.

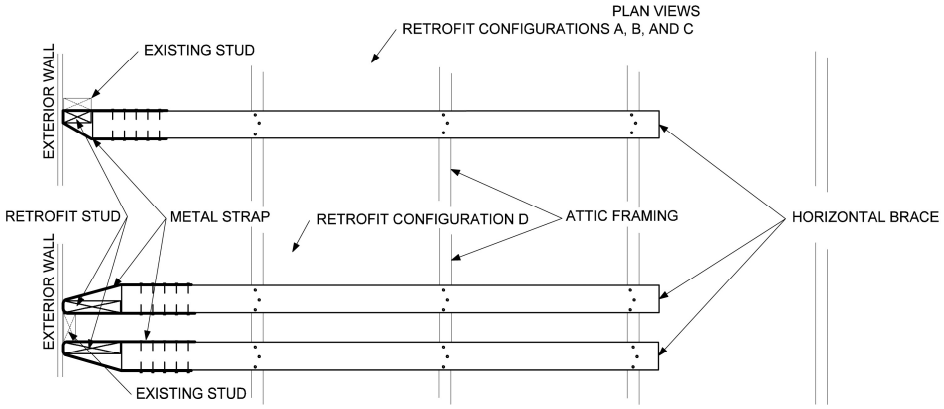
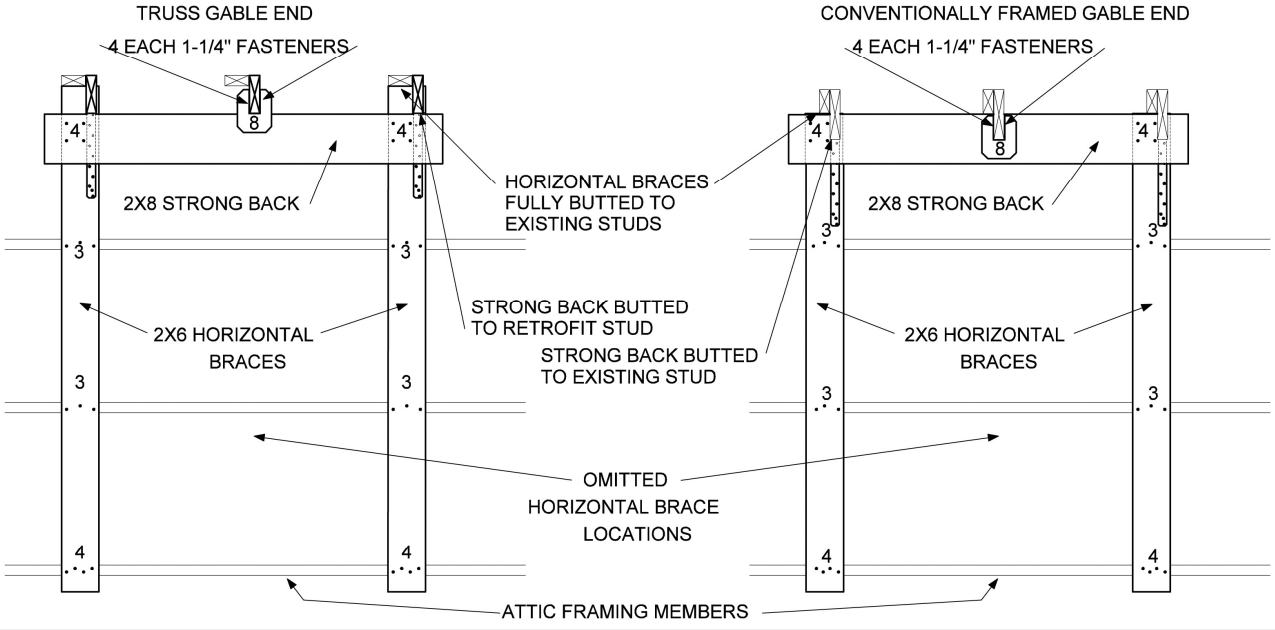


FIGURE C104.2.3
OMITTED HORIZONTAL BRACE

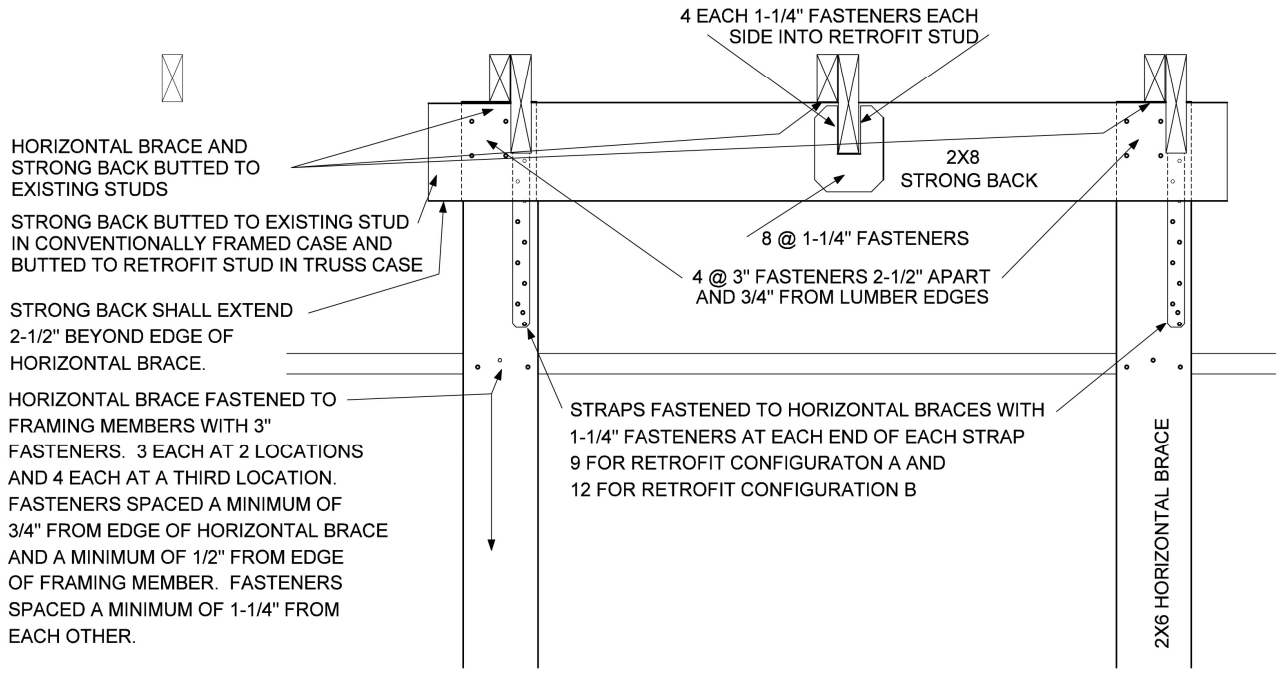
OVERVIEW

PLAN VIEWS
RETROFIT CONFIGURATION A AND B ONLY
NOT ALLOWED FOR RETROFIT CONFIGURATION C OR D

UNIDENTIFIED NUMBERS INDICATE THE NUMBER OF FASTENERS.




DETAILS OF CONVENTIONALLY FRAMED GABLE



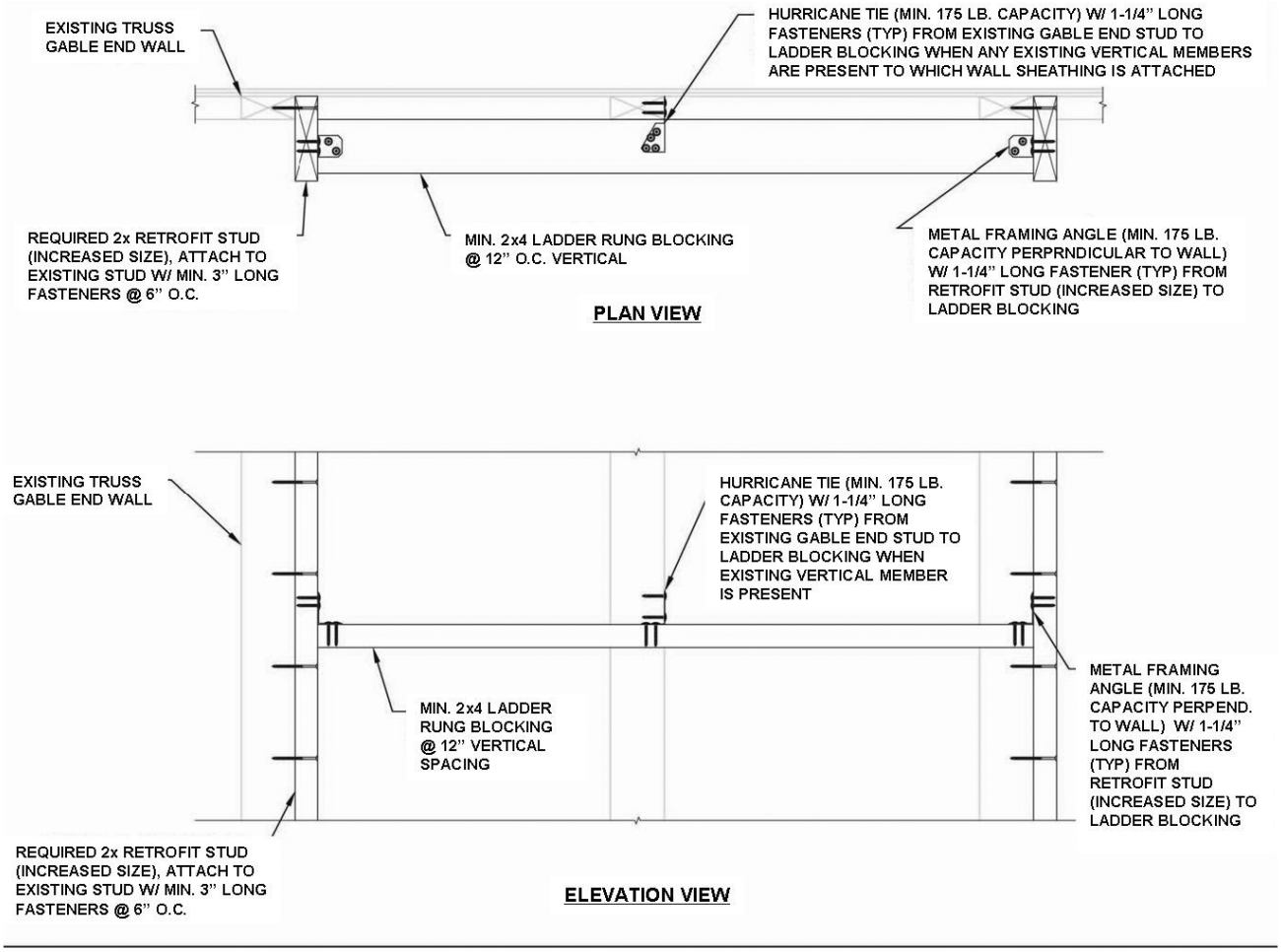



**FIGURE C104.2.4(1) DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (TRUSS GABLE END)**

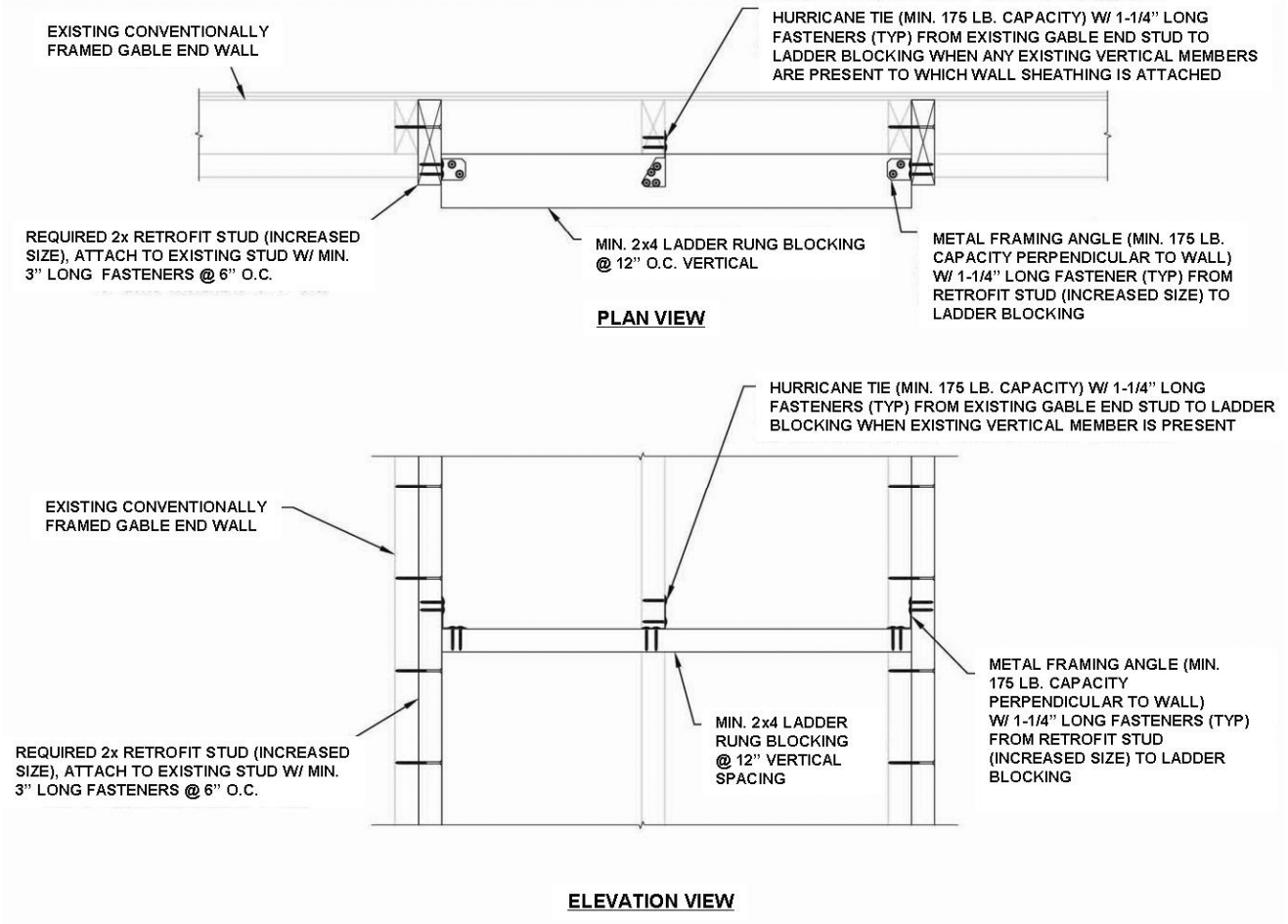



**FIGURE C104.2.4(2) DETAIL OF LADDER BRACING FOR OMITTED RETROFIT STUD (CONVENTIONAL FRAMING)**

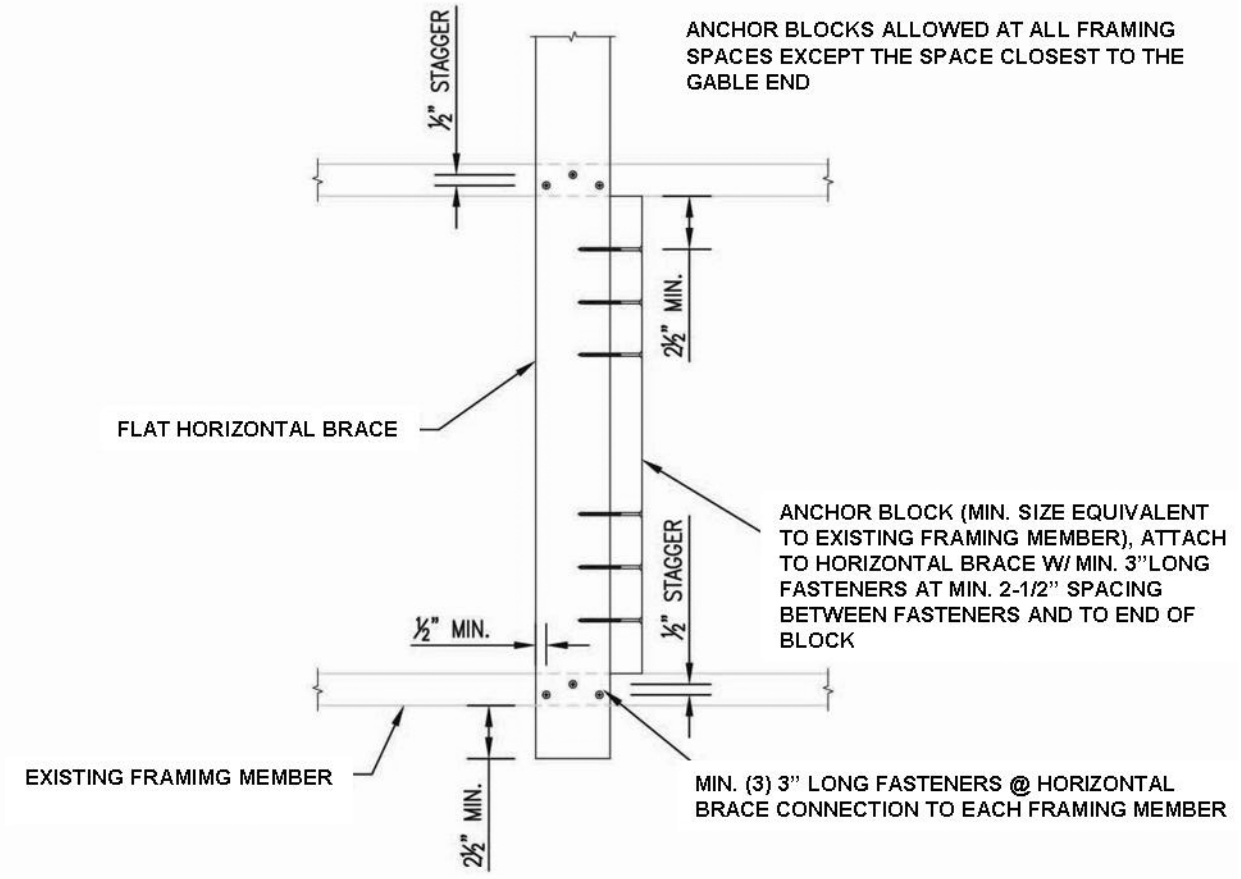



**FIGURE C104.2.5 DETAIL OF ANCHOR BLOCK INSTALLATION**

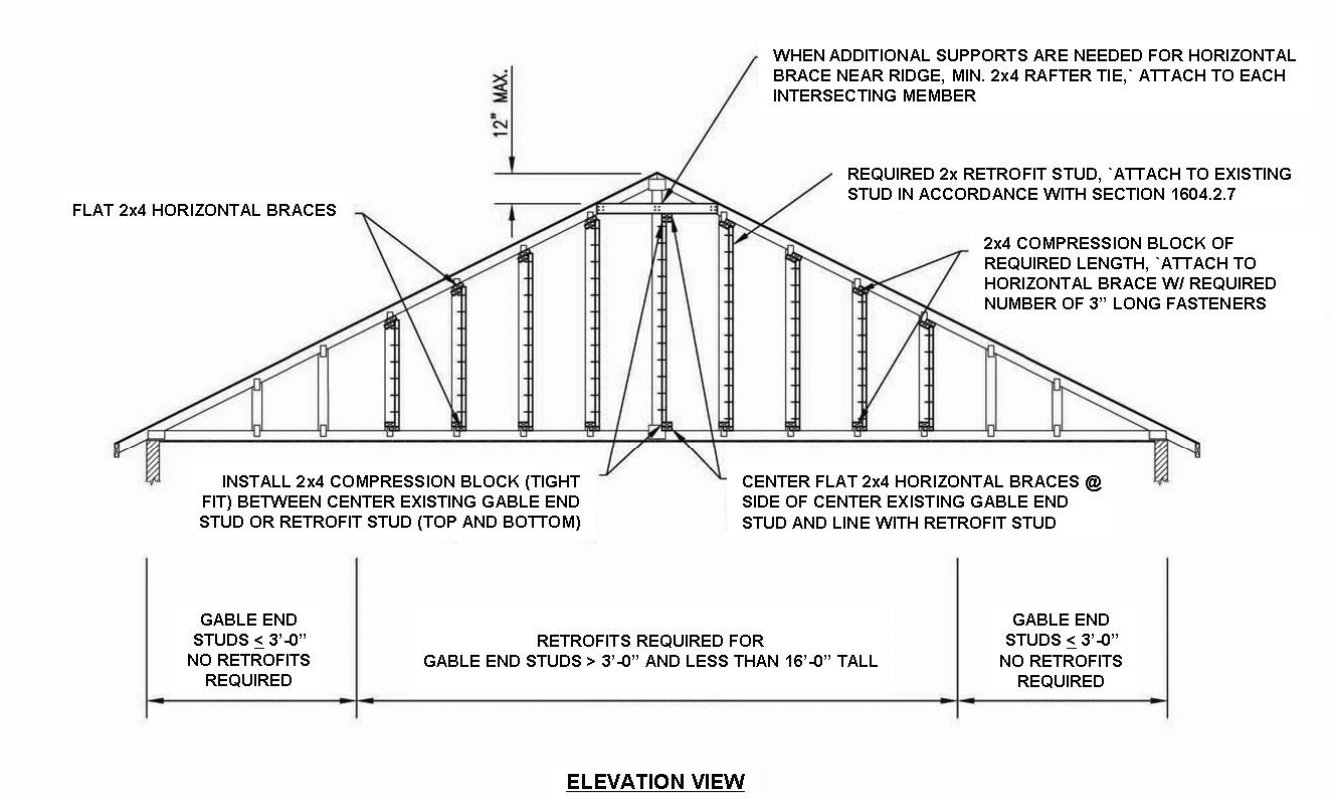
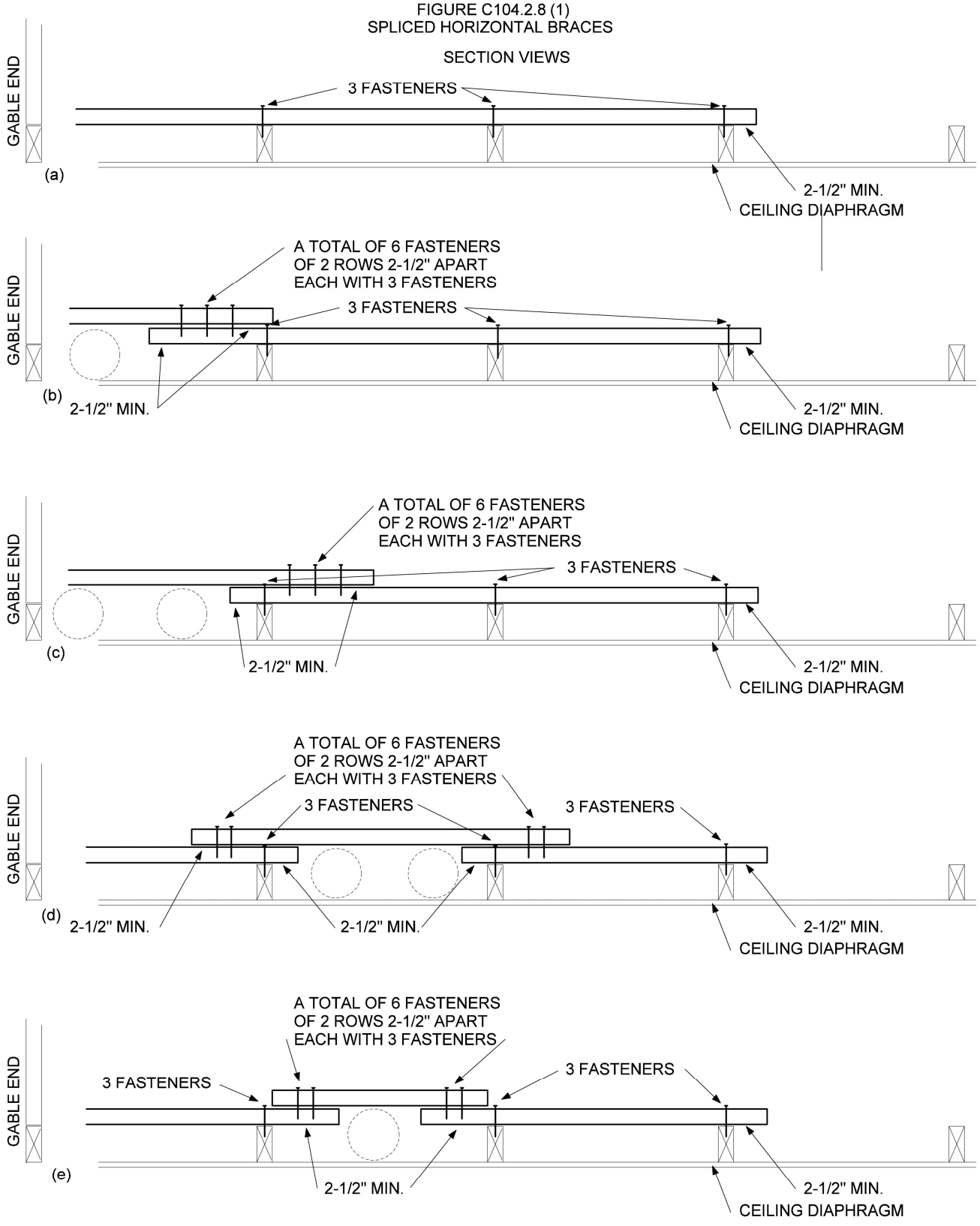



**FIGURE C104.2.7 DETAIL OF RETROFIT TIE INSTALLATION**

FIGURE C104.2.8 (1)
SPLICED HORIZONTAL BRACES

SECTION VIEWS




ALL FASTENERS 3"

FIGURE C104.2.8 (2)
SPLICED HORIZONTAL BRACES

SECTION VIEWS

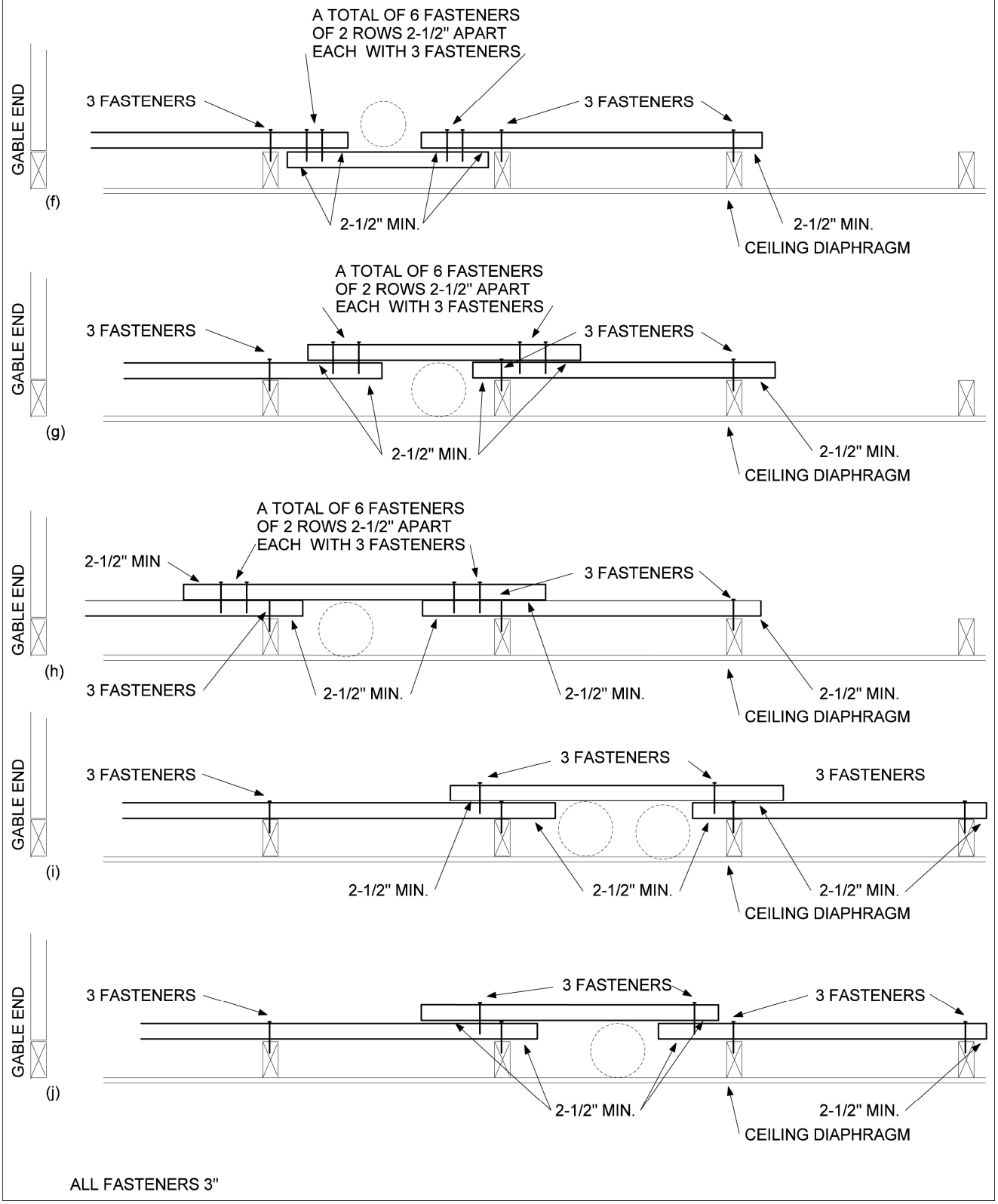
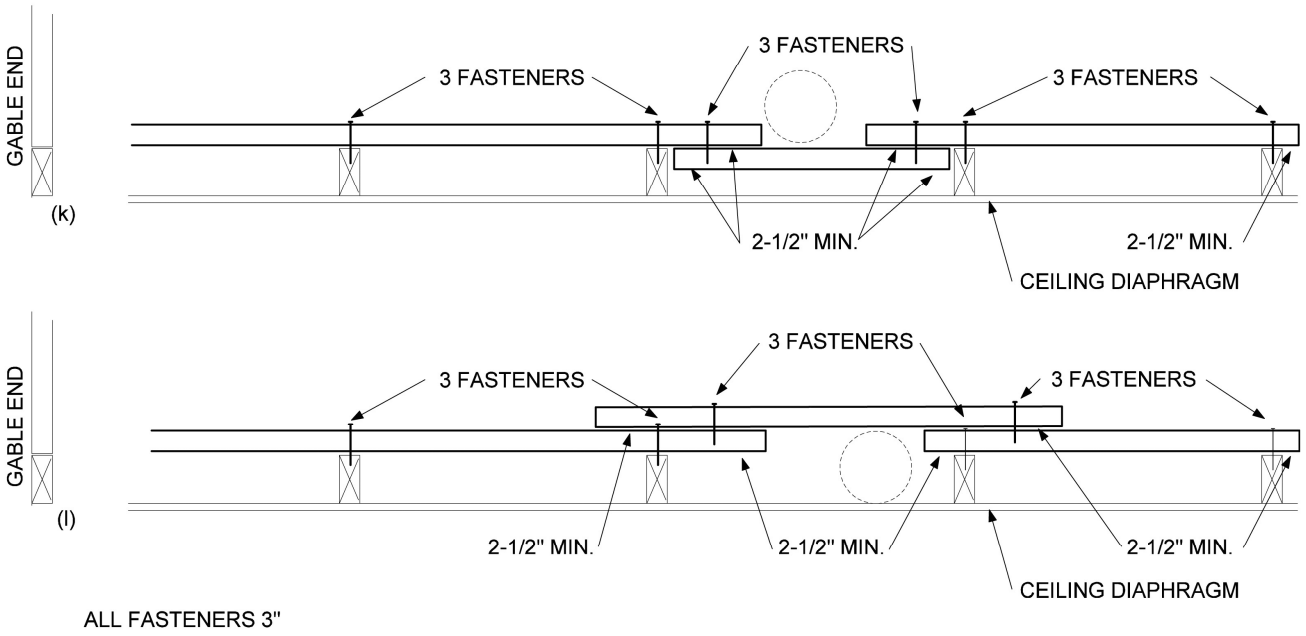


FIGURE C104.2.8 (3)
SPLICED HORIZONTAL BRACES

SECTION VIEWS




ALL FASTENERS 3"

FIGURE C104.3

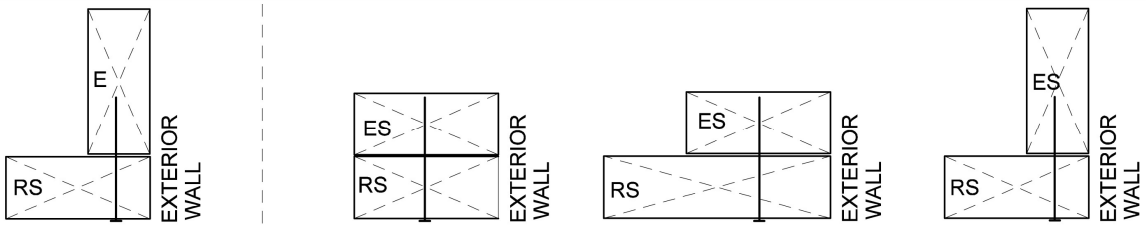
METHODS OF INSTALLING RETROFIT STUDS

TRUSS FRAMING
PLAN VIEWS

CONVENTIONAL FRAMING
PLAN VIEWS

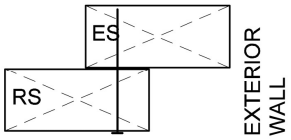
STUD FACES PERPENDICULAR TO WALL

STUD FACES PARALLEL TO WALL



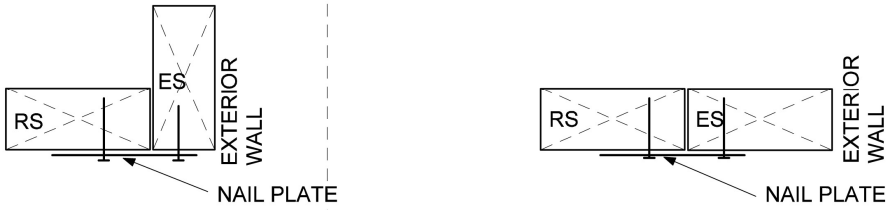

(a) METHOD #1: FACE TO EDGE OR TO FACE METHOD OF C104.3.2

MINIMUM 1-1/2" PENETRATION OF FASTENER INTO SECONDARY MEMBER



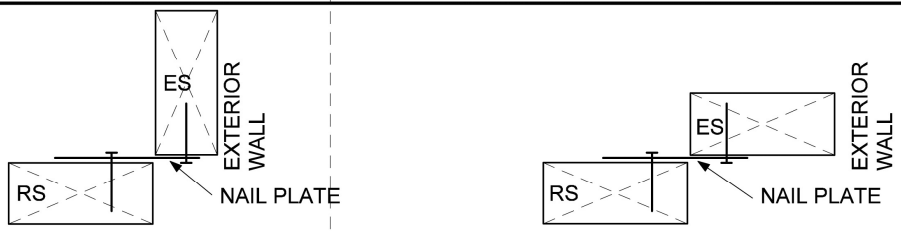

(b) METHOD #2: FACE TO OFFSET FACE METHOD OF C104.3.3

MINIMUM 1-1/2" PENETRATION OF FASTENER INTO SECONDARY MEMBER



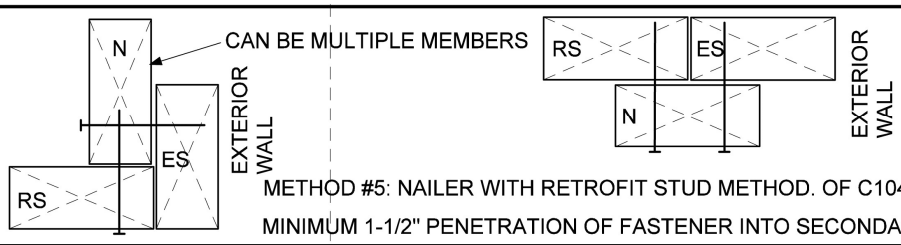

(c) METHOD #4 BUTTED RETROFIT STUD METHOD OF C104.3.4

MINIMUM 1-1/4" PENETRATION OF FASTENER INTO LUMBER




(d) METHOD #4: OFFSET RETROFIT STUD METHOD OF C104.3.5

MINIMUM 1-1/4" PENETRATION OF FASTENER INTO LUMBER

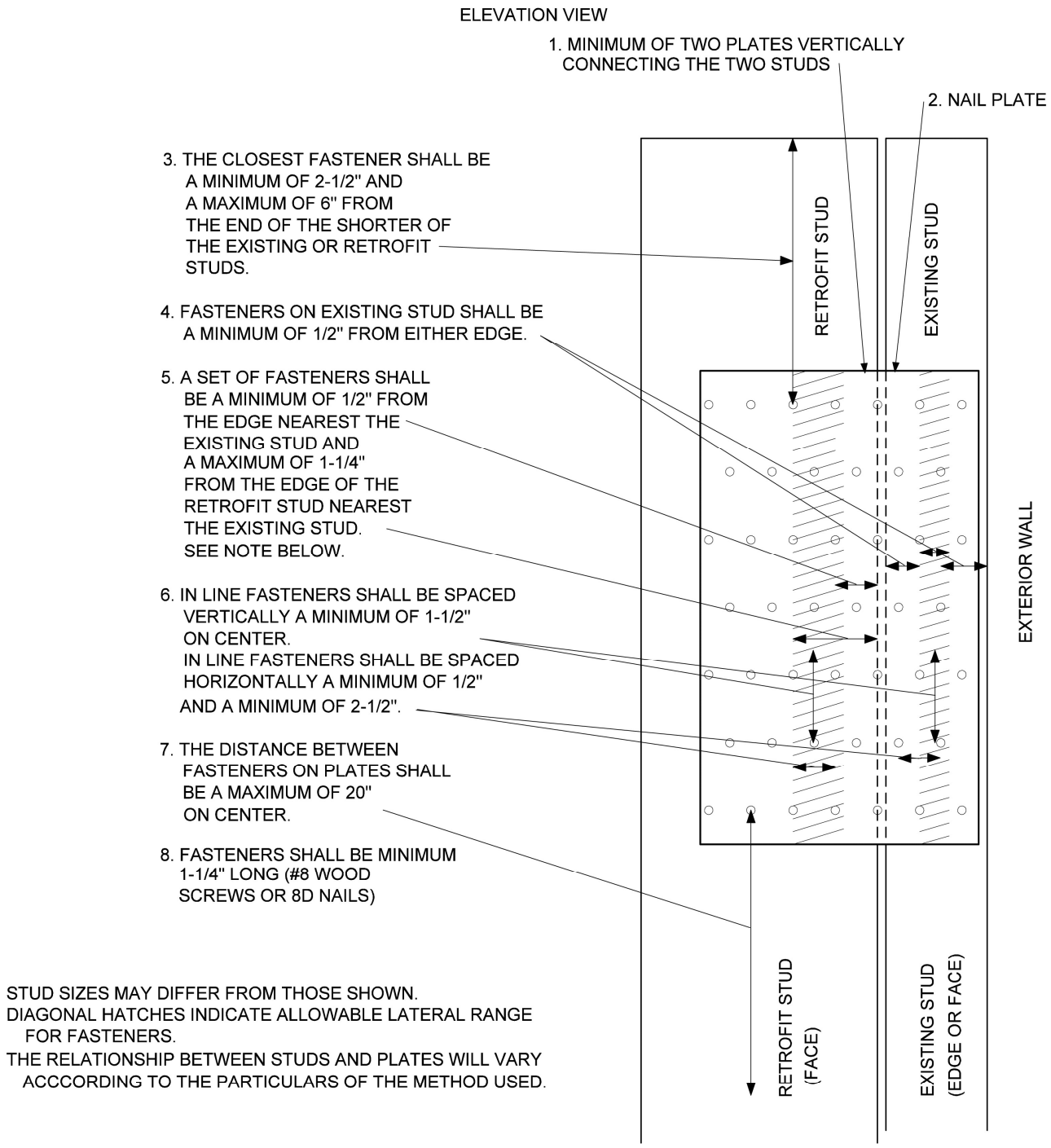



(e) METHOD #5: NAILER WITH RETROFIT STUD METHOD. OF C104.3.6

MINIMUM 1-1/2" PENETRATION OF FASTENER INTO SECONDARY MEMBER

THE FIGURES DO NOT REFLECT THE NUMBER OF REQUIRED FASTENERS OR SHOW HORIZONTAL BRACES OR STRAPS.
FASTENERS SHALL BE PLACED MAXIMUM 6" ON CENTER AND A MINIMUM OF 2-1/2" FROM ENDS.
3" FASTENERS CAN BE INSTALLED FROM EITHER SIDE OF LUMBER AS LONG AS THERE IS 1-1/2" FASTENER PENETRATION
ES INDICATES AN EXISTING STUD. RS INDICATES A RETROFIT STUD. N INDICATES A NAILER.

FIGURE C104.3.4
NAIL PLATE FASTENING




STUD SIZES MAY DIFFER FROM THOSE SHOWN.
DIAGONAL HATCHES INDICATE ALLOWABLE LATERAL RANGE FOR FASTENERS.
THE RELATIONSHIP BETWEEN STUDS AND PLATES WILL VARY ACCCORDING TO THE PARTICULARS OF THE METHOD USED.

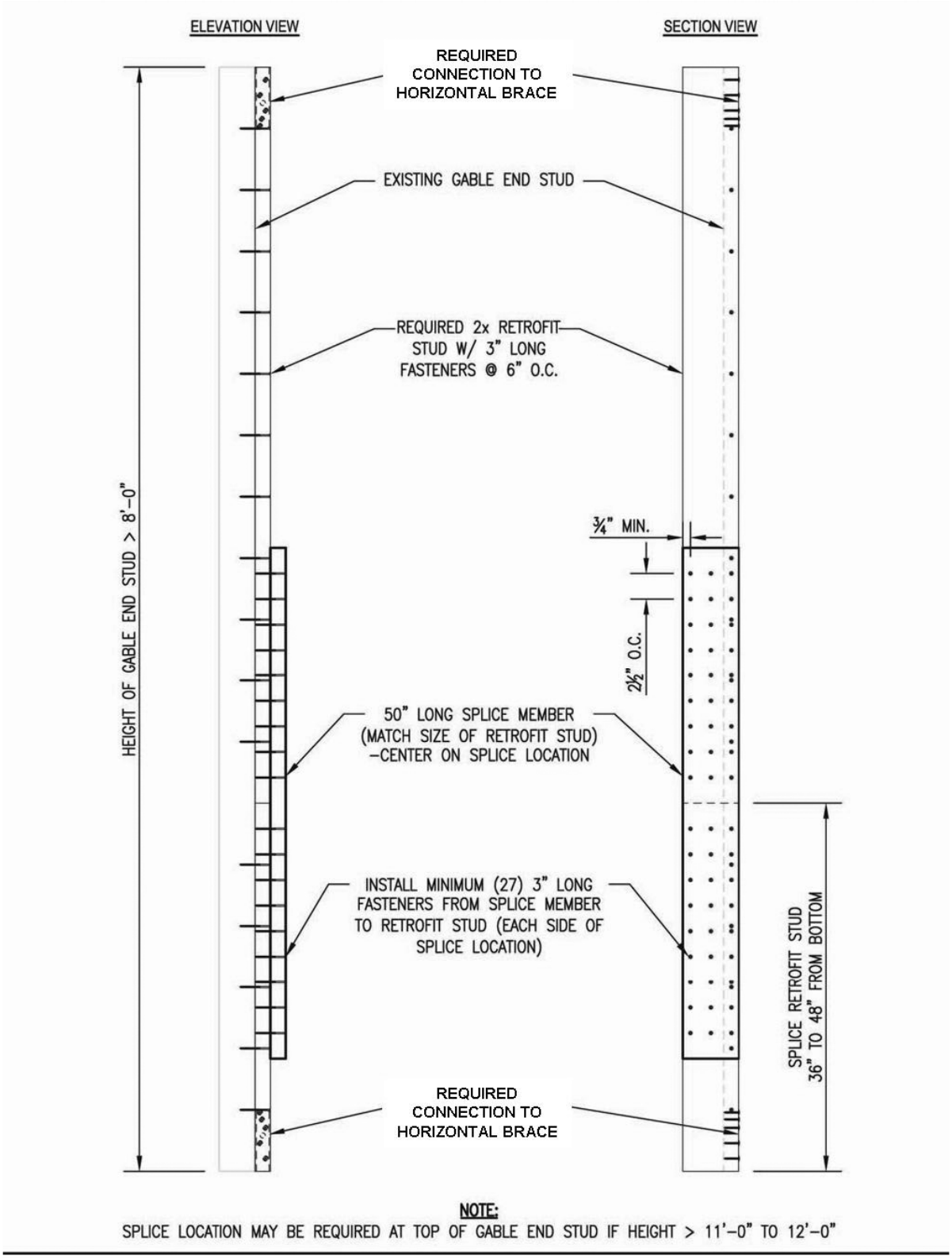



**FIGURE C104.3.8 DETAIL OF RETROFIT STUD SPLICE**

**Commenter's Reason:** The purpose of this Public Comment is to address the specific concerns raised by the Existing Building Committee. The primary reason for disapproving this code change was that the committee felt that these prescriptive provisions more appropriately belonged in an Appendix. The code change has subsequently been modified by this public comment and relocated as Appendix C. Also, references to certain figures that were not provided have been corrected, as noted by the committee. We feel that this vital information should be in the code to provide homeowners and contractors with a prescriptive approach for retrofitting gable end walls to reduce retrofitting costs, facilitate retrofitting, minimize the need for costly engineering, and supplement the code review and inspection process. With the modifications proposed by this public comment, we stand on our supporting reason published in the original code change.

Final Action: AS AM AMPC____ D