

**TO: ICC Major Jurisdictions Committee**

**FROM: Jonathan Humble (Chair of the BCAC Shipping Container WG)**

**CC: Ed Kulik, Chair of BCAC  
Mike Nugent, BCAC oversight to shipping container WG**

**DATE: 23 January 2018**

**SUBJECT: Update on the BCAC shipping container proposal**

Ladies and gentlemen:

When asked to provide an update on the shipping container proposal I had already committed to another event, so I am unable to attend and provide you with a personal update of this code change proposal.

What you will see on the upcoming pages is the draft as completed by the BCAC on 21 January 2017. I do not have the final published version as the ICC code monograph will not be available until 28 February 2018.

Ms. Susan Dowty will scroll through the proposal so you may see the draft final content. Since my last presentation to the MJC the format has been reorganized into the following categories:

- New definition (revised slightly by removing the word “steel”),
- Scope with only three exceptions (previously we had temporary buildings shown),
- Construction documents requirements (slightly revised),
- Verification (relocated from structural)
- General pointers on protection, underfloor, roof and joints were enhanced,
- Structural which now contains three parts (general, detailed design, and simple design). This provision was the most debated and the shipping container task group expects to see one or more floor motions at the spring hearings,
- Enhancement of the detailed design provisions,
- Enhancement of the simple single unit stand-alone provisions, which now includes figures, and
- The three ISO standards

The Shipping Container WG may be holding up to 3 meetings in February 2018 in preparation for the BCAC meeting in March 2018.

My thanks to those who actively participated with the shipping container working group and the BCAC.

**BCAC – IBC Chapter 31 – Intermodal Shipping Containers  
Draft Code Change Proposal  
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**21 JANUARY 2017 PRELIMINARY DRAFT  
Subject to change by ICC code change processing**

**Red** highlighted text – delete

**Yellow** highlighted text – new text

**File name:** IBC – Chapter 31

The following is a draft code change proposal that has been developed by the Building Code Action Committee. This draft proposal has been reviewed by the BCAC and is posted for information and comments. Please direct comments to the Chair of the Shipping Containers Working Group: Jonathan Humble at [jhumble@steel.org](mailto:jhumble@steel.org). **This is a draft only and is subject to change prior to submittal to cdpACCESS by the January 8, 2018 deadline.**

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## **IBC Chapter 2 - Definitions**

**INTERMODAL SHIPPING CONTAINER.** A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

## **IBC Chapter 31**

### **SECTION 3101**

#### **GENERAL**

**3101.1 Scope.** The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, *pedestrian walkways* and tunnels, automatic *vehicular gates, awnings* and *canopies, marquees*, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, ~~and~~ solar energy systems, **and intermodal shipping containers.**

## Chapter 31, Section 310X (NEW)

### SECTION 310X INTERMODAL SHIPPING CONTAINERS

**310X.1 General.** The provisions of Section 310X and other applicable sections of this code, shall apply to *intermodal shipping containers* that are repurposed for use as *buildings* or *structures* or as a part of *buildings* or *structures*.

**Exceptions:**

1. *Intermodal shipping containers* previously approved as existing relocatable buildings complying with Chapter 14 of the International Existing Building Code.
2. Stationary storage battery arrays located in *intermodal shipping containers* complying with Chapter 12 of the International Fire Code.
3. *Intermodal shipping containers* that are *listed* as equipment complying with the standard for that equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.

**310X.2 Construction documents.** The *construction documents* shall contain information to verify the dimensions and establish the physical properties of the steel components, and wood floor components, of the *intermodal shipping container* in addition to the information required by Sections 107 and 1603.

**310X.3 Intermodal shipping container information.** *Intermodal shipping containers* shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an *approved agency*. A report of the verification process and findings shall be provided to the building owner.

1. Manufacturer's name or identification number
2. Date manufactured
3. Safety approval number
4. Identification number
5. Maximum operating gross mass (kg) (lbs)
6. Allowable stacking load for 1.8G (kg) (lbs)
7. Transverse racking test force (Newtons)
8. Valid maintenance examination date

When *approved* by the *building official*, the markings and existing data plate are permitted to be removed from the *intermodal shipping containers* before they are repurposed for use as *buildings* or *structures* or as a part of *buildings* or *structures*.

**310X.4 Protection against decay and termites.** Wood structural floors of *intermodal shipping containers* shall be protected from decay and termites in accordance with the applicable provisions of Section 2304.12.1.1.

**310X.5 Under-floor ventilation.** The space between the bottom of the floor joists and the earth under any *intermodal shipping container*, except spaces occupied by *basements* and *cellars*, shall be provided with ventilation in accordance with Section 1202.4.

**310X.6 Roof assemblies.** All *intermodal shipping containers* roof assemblies shall comply with the applicable requirements of Chapter 15.

**Exception:** Single-unit stand-alone *intermodal shipping containers* not attached to, or stacked vertically over, other *intermodal shipping containers*, *buildings* or *structures*.

**310X.7 Joints and voids.** Joints and voids that create concealed spaces between *intermodal shipping containers*, that are connected or stacked, at fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved *fire-resistant joint system* in accordance with Section 715.

**310X.8 Structural.** *Intermodal shipping containers* which conform to ISO 1496-1 that are repurposed for use as *buildings* or *structures*, or as a part of *buildings* or *structures*, shall be designed in accordance with Chapter 16 and this section.

**310X.8.1 Foundations.** *Intermodal shipping containers* repurposed for use as a permanent *building* or *structure* shall be supported on foundations or other supporting structures designed and constructed in accordance with Chapters 16 through 23 of this code.

**310X.8.1.1 Anchorage.** *Intermodal shipping containers* shall be anchored to foundations or other supporting structures as necessary to provide a continuous load path for all applicable design and environmental loads in accordance with Chapter 16.

**310X.8.2 Welds.** All new welds and connections shall be equal to or greater than the original connections.

**310X.8.3 Structural Design.** The structural design for the *intermodal shipping containers* repurposed for use as a *building* or *structure*, or as part of a *building* or *structure*, shall comply with Section 310X.8.4 or 310X.8.5.

**310X.8.4 Detailed design procedure.** A structural analysis meeting the requirements of this section shall be provided to the *building official* to demonstrate the structural adequacy of the *intermodal shipping containers*.

**Exception:** *intermodal shipping containers* designed in accordance with Section 310X.8.5.

**310X.8.4.1 Material properties.** Structural material properties for existing *intermodal shipping container* steel components shall be established by material testing when the steel grade and composition cannot be identified by the manufacturer's designation as to manufacture and mill test.

**310X.8.4.2 Seismic design parameters.** The appropriate detailing requirements of ASCE 7; response modification coefficient,  $R$ ; overstrength factor,  $\Omega_0$ ; deflection amplification factor,  $C_d$ ; and limits on structural height,  $h_n$ , for the corrugated shear wall is permitted to be developed in accordance with generally accepted procedures when approved by the building official in accordance with Section 104.11.

**310X.8.4.3 Allowable shear value.** The allowable shear values for the *intermodal shipping container* corrugated steel sheet panel side walls and end walls shall be demonstrated by testing and analysis accordance with Section 104.11. When penetrations are made in the side walls or end walls designated as part of the lateral force-resisting system, the penetrations shall be substantiated by rational analysis.

**310X.8.5 Simplified structural design of single-unit containers.** Single-unit *intermodal shipping containers* conforming to the limitations of Section 310X.8.5.1 shall be permitted to be designed in accordance with the simplified structural design provisions of Section 310X.8.5.

**310X.8.5.1 Limitations.** Use of Section 310X.8.5 is subject to all the following limitations:

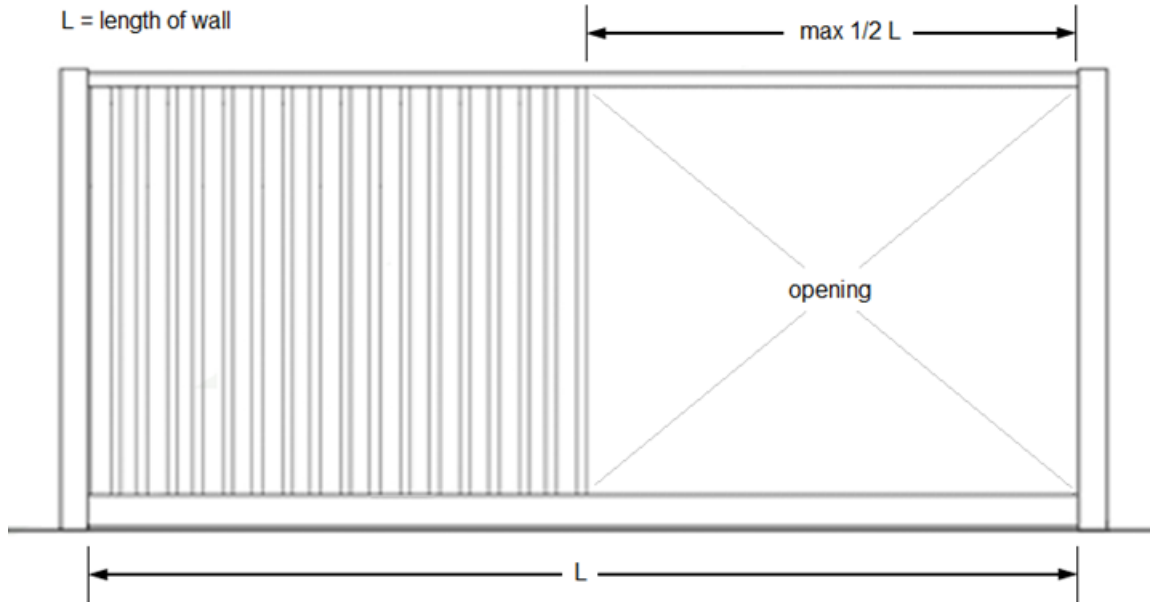
1. The *intermodal shipping container* shall be a single-unit, stand-alone unit supported on a foundation and shall not be in contact with or supporting any other shipping container or other structure.
2. The *intermodal shipping container* top and bottom rails, corner castings, and columns or any portion thereof shall not be notched, cut, or removed in any manner.
3. The *intermodal shipping container* shall be erected in a level and horizontal position with the floor located at the bottom.
4. The *intermodal shipping container* shall be located in Seismic Design Category A, B, C or D.

**310X.8.5.2 Simplified Structural Design.** Where permitted by Section 310X.8.5.1, single-unit, stand-alone *intermodal shipping containers* shall be permitted to be designed using the following assumptions is permitted to be used for the corrugated steel shear walls:

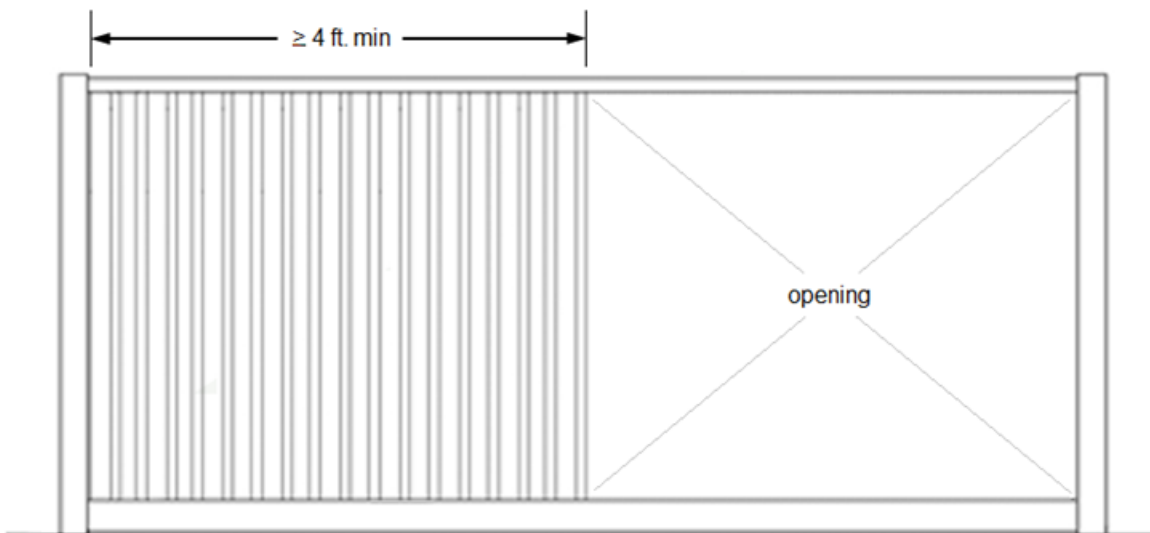
1. The appropriate detailing requirements of ASCE 7 Section 14.1 of Chapters 16 through 23,
2. Response modification coefficient,  $R=2$ ,
3. Overstrength factor,  $\Omega_0=2.5$ ,
4. Deflection amplification factor,  $C_d=2$ , and
5. Limits on structural height,  $h_n=9.5$  feet (2,900 mm).

**310X.8.5.3. Allowable strength shear.** The allowable strength shear for the corrugated steel side walls (longitudinal) and end walls (transverse) for wind design and for seismic design using the coefficients of Section 310X.8.5.2 shall be permitted to have the allowable strength shear values set forth in Table 310X.8.5.3 provided that all of the following conditions are met:

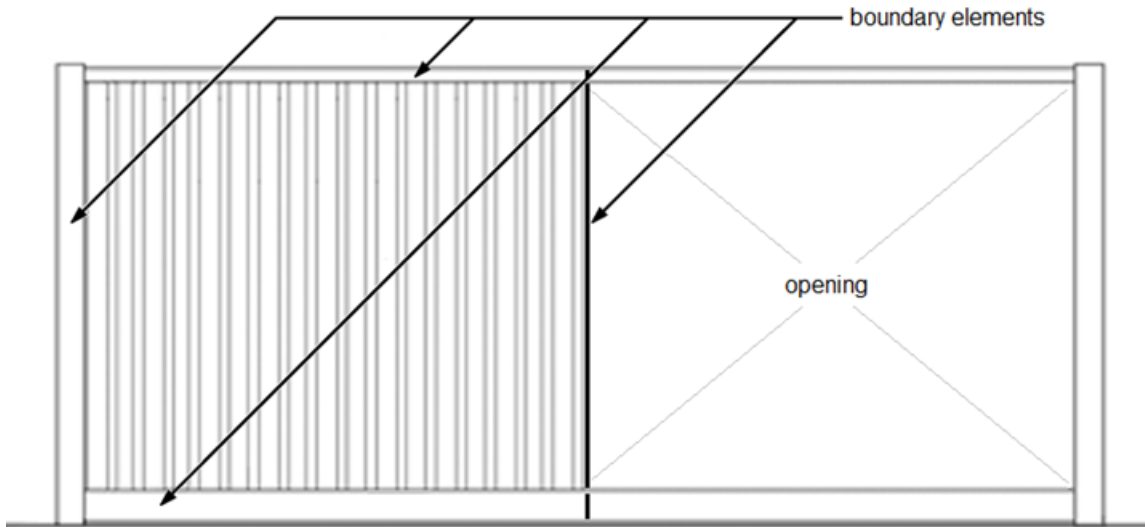
1. The total linear length of all openings in any individual side walls or end walls shall be limited to no more than 50% of the length of that side walls or end walls, as shown in Figure 310X.8.5.3(1).
2. Any full height wall length, or portion thereof, less than 4 feet (305 mm) long shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 310X.8.5.3(2).
3. All side walls or end walls used as part of the lateral force-resisting system shall have an existing or new boundary element on all sides to form a continuous load path, or paths, with adequate strength and stiffness to transfer all forces from the point of application to the final point of resistance, as shown in Figure 310X.8.5.3(3).
4. When openings are made in container walls, floors, or roofs for doors, windows and other openings:
  - a. The openings shall be framed with steel elements that are designed in accordance with Chapters 16 and Chapter 22.
  - b. The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.
5. A maximum of one penetration not greater than a 6-inch (152 mm) diameter hole for conduits, pipes, tubes or vents, or not greater than 16 square inches (10,322 sq mm) for electrical boxes, is permitted for each individual 8 foot length (2,438 mm) lateral force resisting wall. Penetrations located in walls that are not part of the wall lateral force resisting system shall not be limited in size or quantity. Existing *intermodal shipping container* vents shall not be considered a penetration, as shown in Figure 310X.8.5.3(5).
6. End wall door or doors designated as part of the lateral force-resisting system shall be welded closed.



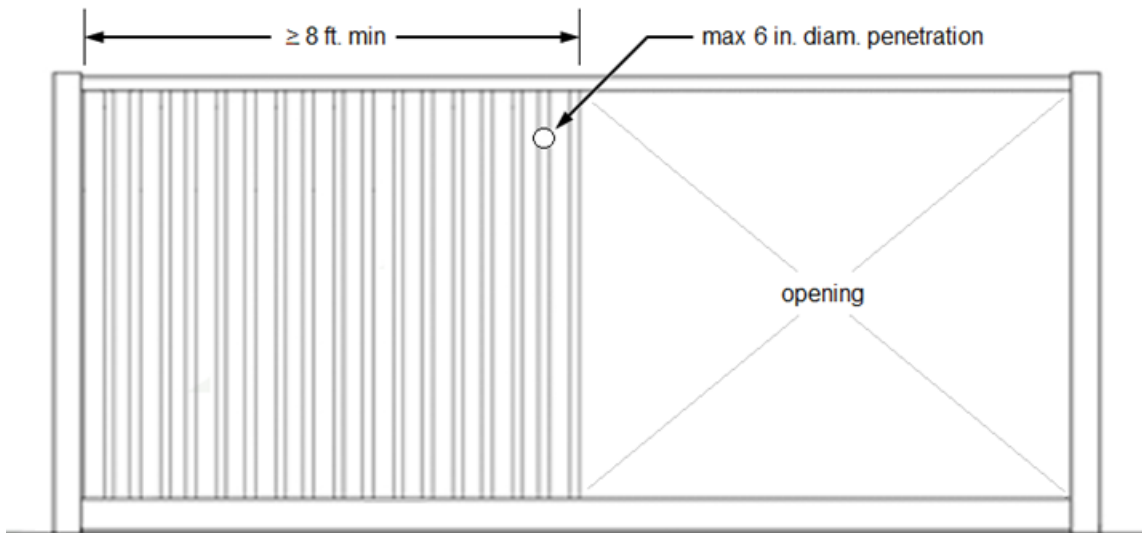
**Figure 310X.8.5.3(1)**  
**Bracing Unit Distribution – Maximum Linear Length**



**Figure 310X.8.5.3(2)**  
**Bracing Unit Distribution – Minimum Linear Length**



**Figure 310X.8.5.3(3)**  
**Bracing Unit Distribution – Boundary Elements**



**Figure 310X.8.5.3(3)**  
**Bracing Unit Distribution – Penetration Limitations**



**TABLE 310X.8.5.3  
ALLOWABLE STRENGTH VALUES FOR INTERMODAL SHIPPING CONTAINER  
CORRUGATED STEEL SIDING SHEAR WALLS FOR WIND OR SEISMIC LOADING**

<u>CONTAINER DESIGNATION</u> <sup>2</sup>	<u>CONTAINER DIMENSION (Nominal Length)</u>	<u>CONTAINER DIMENSION (Nominal Height)</u>	<u>ALLOWABLE SHEAR VALUES (PLF)</u> <sup>1,3</sup>	
			Side Wall	End Wall
<u>1EEE</u>	45 feet (13.7 M)	9.5 feet (2896 mm)	75	843
<u>1EE</u>		8.6 feet (2591 mm)		
<u>1AAA</u>	40 feet (12.2 M)	9.5 feet (2896 mm)	84	
<u>1AA</u>		8.5 feet (2592 mm)		
<u>1A</u>		8.0 feet (2438 mm)		
<u>1AX</u>		<8.0 feet (2483 mm)		
<u>1BBB</u>	30 feet (9.1 M)	9.5 feet (2896 mm)	112	
<u>1BB</u>		8.5 feet (2591 mm)		
<u>1B</u>		8.0 feet (2438 mm)		
<u>1BX</u>		<8.0 feet (2438 mm)		
<u>1CC</u>	20 feet (9.1 M)	8.5 feet (2591 mm)	168	
<u>1C</u>		8.0 feet (2438 mm)		
<u>1CX</u>		<8.0 feet (2438 mm)		
<u>1D</u>	10 feet (3.0 M)	8.0 feet (2438 mm)	337	
<u>1DX</u>		<8.0 feet (2438 mm)		

1. The allowable strength shear for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.
2. Container designation type is derived from ISO 668.
3. Limitations of Sections 310X.8.5.1 shall apply.

## Chapter 35 REFERENCED STANDARDS

<b>ISO</b>	<b>International Organization for Standardization ISO Central Secretariat 1 ch, de la Voie-Creuse, Casa Postale 566 CH-1211 Geneva 20, Switzerland</b>	
<b>Standard Reference Number</b>	<b>Title</b>	<b>Referenced in code section number</b>
ISO 1496-1:2013	Series 1 Freight Containers - Specification and Testing – Part 1: General Cargo Containers for General Purposes	310X.8, Table 301X.8.5.3
ISO 6346:1995, with Amendment 3: 2012	Freight Containers – Coding, Identification and marking	3010X.3
ISO 668:2013	Series 1 Freight Containers – Classifications,	Table 301X.8.5.3

	<u>dimensions and ratings.</u>	
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**REASON:**

This code change purpose is to introduce intermodal shipping containers into the International Building Code based on requests by code officials in the U.S. Prior to this proposal, several jurisdictions had created their own individual regulations or ordinances, or had administered additional requirements beyond the code (e.g. Section 104.11 “Alternative materials, design and methods of construction and equipment”) so as to be comfortable to ensure a safe structure. This code change proposal is in response to those requests to develop a set of consistent code provisions which cover the minimum safety requirements, but which do not duplicate existing code provisions.

This proposal covers:

- Creation of a new definition in order to separate the container from other I-code sections which refer to, but intentionally do not define, shipping containers,
- Creating exceptions so to differentiate the intermodal shipping container from other code sections which could be interpreted as applying to intermodal shipping containers under other applications (e.g. temporary storage, relocatable buildings, energy storage facilities, and listed equipment),
- Verification of containers construction, condition, and structural integrity to assist the structural engineer in the evaluation for building construction,
- References to other sections concerning foundations, decay and termite control, crawlspace ventilation, roof assemblies, interior finishes, and joints/intersections.
- Introduction of structural provisions unique to intermodal shipping containers and which do not duplicate the existing structural requirements, and
- Addition of three ISO standards for reference.

Chapter 2 - New definition - A new definition has been created in order that these provisions can be adequately enforced and not confused the other multiple varieties of definitions of containers currently in the market.

Section 310X.1 – This represents the charging statement that outlines the requirements for containers, and list the appropriate exceptions with the I-codes in order to coordinate with other provisions that may appear similar in nature and where intermodal shipping containers could possibly be used in those other applications.

Section 310X.2 – Construction documents – These provision emphasize the material requirements as specified in this section.

Section 310X.3 – Verification - These provisions focus on the characteristics of the intermodal shipping container prior to it being repurposed. In this case the provisions require a straight

forward inspection by an approved agency, and verification of the data plate which is normally found on intermodal shipping containers. There was an intent not to specify who the approved agency would be for two reasons; 1) so as to allow the code official or state law(s) to handle this aspect recognizing that in each jurisdiction their requirements may be different, and 2) to avoid dictating an international agreement onto jurisdictions that are currently employed by the shipping and container manufacturers worldwide today. In this case, the standards are regulated by the International Convention of Safe Containers (CSC) that have policies and procedures for inspecting containers worldwide. These procedures include policies for Approved Continuous Examination Program (ACEP) at the time the container is used in production, and policies for third party inspection agencies. The list shown in this section is an extract from the ISO standard and serves as a reference of items to be verified in order to validate the type of container.

301X.4 through 310X.6 – While we have strived to focus on only those provisions that recognize the unique aspects of intermodal shipping containers, we felt that some direction references were appropriate. In this case specific pointers are provided to foundations, decay and termite control, crawlspace ventilation, and roof requirements addressing drainage and weather protection.

310X.7 – Joints and voids – This provision is provided to address the interstitial spaces that may be created when multiple intermodal shipping containers are connected or stacked, whereby that concealed space between the containers is protected to prevent fire and hot gasses from passing between containers.

Section 310X.8 – Structural - The structural provisions are divided into multiple categories, as follows: 1) the general characteristics for all containers; 2) engineered structural design; and 3) simplified method for single-unit stand-alone container.

301X.8.1 – Foundations or supports – Provisions have been included to outline the two options for securing the container; a foundation or the connection to another structure. This provision makes it clear that the load path anchorage is required for all containers and to ensure the designed performance provided by the remainder of the structural provisions.

310X.8.2 – Welds – An additional provision has been added to require that any new welds be designed and installed with welds of greater structural capabilities.

Section 310X.10.4 – Detailed structural analysis - The detailed analysis engineering approach represents the general engineering practice allowed for all other types of building constructions. For this section the engineer of record is allowed to practice as they normally would for any other building type. As may be noted much of this section requires submission through the alternative means and methods provisions in order to obtain a permit as

information about intermodal shipping containers is not readily listed in the IBC provisions or referenced standards.

Section 310X.10.5 – Simplified analysis - The concept for the single container approach is to make the design and construction process simpler. The provisions include a strict listing of limitations for use of these provisions. The proposal also provides structural design information, and pre-established shear wall information that is contained in the ISO 1496-1 standard, which is used to design and construct intermodal shipping containers. The shear wall values were obtained from the ISO 1496-1 standard through engineering analysis using a factor of safety of 5. In addition, a provision was installed to limit the number and size of openings and service holes within the container, as well as to prevent building owners or designers from embellishing the size to something most engineers would define as an opening. This method is intended to address the simple structure approach and provide available information for use by the structural engineer to supplement their work.

Chapter 35 – Referenced Standards – Included with this proposal are three ISO standards which are relevant to the intermodal shipping container’s construction. These standards are part of the industry standards regulated by the International Convention of Safe Containers (CSC) that have policies and procedures for inspecting containers worldwide.

**BCAC** - The International Code Council’s Building Code Action Committee (BCAC) was established by the ICC Board of Directors to pursue opportunities to improve and enhance an assigned International Code or portion thereof. This includes both the technical aspects of the codes as well as the code content in terms of scope and application of referenced standards. Since its inception in July, 2011, the BCAC has held open meetings and numerous workgroup calls which included members of the BCAC as well as any interested party to discuss and debate the proposed changes and the public comments. Related documentation and reports are posted on the BCAC website at: <http://www.iccsafe.org/cs/BCAC/Pages/default.aspx>.

The ICC Building Code Action Committee created a task group to facilitate the development of this proposal. Members of the assigned task group included representatives from: City of Long Beach, CA; County of Mecklenburg, NC; Modular Building Institute; American Iron and Steel Institute; Underwriters Laboratories; and the Portland Cement Association. Additional contacts included the State of California (Division of State Architect, Housing and Community Development), City of San Diego; City of Los Angeles, CA; City of Seattle; Clark County, NV; Falcon Structures, RADCO a Twining Company, SEABOX Company, FEMA ATC Seismic Code Support Committee, and other guests who provided their individual expertise.

**Cost impact category:** The net effect of the public comment and code change proposal will not increase or decrease the cost of construction.

**Cost Impact:**

The code change proposal will decrease the cost of construction. This new code section will provide clarity on how to consistently design with, permit, and field inspect shipping containers that are repurposed for building construction. Current use of repurposed intermodal shipping containers requires the building owner or designee to submit through the alternative means and methods administrative provisions.

**(END)**

DRAFT