

2021 Virginia Construction Code

CHAPTER 31 SPECIAL CONSTRUCTION

SECTION 3115 INTERMODAL SHIPPING CONTAINERS

3115.1 General.

The provisions of Section 3115 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 equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.
4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3115, provided that they comply with all of the following:
 - 4.1. Such units shall be single stand-alone units supported at grade level and used only for occupancies as specified under *Risk Category I* in Table 1604.5.
 - 4.2. Such units are located a minimum of 8 feet (2438 mm) from adjacent structures, and are not connected to a fuel gas system or fuel gas utility.
 - 4.3. In hurricane-prone regions and *flood hazard areas*, such units are designed in accordance with the applicable provisions of Chapter 16.

3115.2 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.

3115.3 Intermodal shipping container information.

Intermodal shipping containers shall bear an existing data plate containing the following information as required by SO 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 or weight (kg) (lbs).
6. Allowable stacking load for 1.8G (kg) (lbs).
7. Transverse racking test force (Newtons).
8. Valid maintenance examination date.

Where 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.

3115.4 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.

3115.5 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.

3115.6 Roof assemblies.

Intermodal shipping container 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.

3115.7 Joints and voids.

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Joints and voids that create concealed spaces between connected or stacked *intermodal shipping containers* 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.

3115.8 Structural.

Intermodal shipping containers that conform to ISO 1496-1 and 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.

3115.8.1 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.

3115.8.1.1 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.

3115.8.2 Welds.

New welds and connections shall be equal to or greater than the original connections.

3115.8.3 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 3115.8.4 or 3115.8.5.

3115.8.4 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 3115.8.5.

3115.8.4.1 Material properties.

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

3115.8.4.2 Seismic design parameters.

The seismic force-resisting system shall be designed and detailed in accordance with one of the following:

1. Where all or portions of the corrugated steel container sides are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the ASCE 7, Table 12.2-1 requirements for light-frame bearing-wall systems with shear panels of all other materials.
2. Where portions of the corrugated steel container sides are retained, but are not considered to be the seismic force-resisting system, an independent seismic force-resisting system shall be selected, designed and detailed in accordance with ASCE 7, Table 12.2-1.
3. Where portions of the corrugated steel container sides are retained and integrated into a seismic force-resisting system other than as permitted by Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 112.2 and ASCE 7, Section 12.2.1.1 or 12.2.1.2.

3115.8.4.3 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 in accordance with Section 112.2. Where 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.

3115.8.5 Simplified structural design of single-unit containers.

Single-unit *intermodal shipping containers* conforming to the limitations of Section 3115.8.5.1 shall be permitted to be designed in accordance with the simplified structural design provisions of Section 3115.8.5.2.

3115.8.5.1 Limitations.

The use of Section 3115.8.5 is subject to 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.

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- The *intermodal shipping container* shall be located in Seismic Design Category A, B, C or D.

3115.8.5.2 Simplified structural design.

Where permitted by Section 3115.8.5.1, single-unit, stand alone intermodal shipping containers shall be designed using the following assumptions for the corrugated steel shear walls:

- The appropriate detailing requirements contained in Chapters 16 through 23.
- Response modification coefficient, $R = 2$.
- Overstrength factor, $\Omega_0 = 2.5$.
- Deflection amplification factor, $C_d = 2$.
- Limits on structural height, $h_n = 9.5$ feet (2900 mm).

3115.8.5.3 Allowable shear.

The allowable shear for the corrugated steel side walls (longitudinal) and end walls (transverse) for wind design and seismic design using the coefficients of Section 3115.8.5.2 shall be in accordance with Table 3115.8.5.3, provided that all of the following conditions are met:

- The total linear length of all openings in any individual side wall or end wall shall be limited to not more than 50 percent of the length of that side wall or end wall, as shown in Figure 3115.8.5.3(1).
- Any full-height wall length, or portion thereof, less than 4 feet (305 mm) shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 3115.8.5.3(2).
- 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 3115.8.5.3(3).
- Where openings are made in container walls, floors or roofs, for doors, windows and other openings:
 - The openings shall be framed with steel elements that are designed in accordance with Chapters 16 and 22.
 - The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.
- A maximum of one penetration not greater than 6 inches (152 mm) in diameter for conduits, pipes, tubes or vents, or not greater than 16 square inches (10 323 mm²) for electrical boxes, is permitted for each individual 8-foot (2438 mm) length of lateral force-resisting wall. Penetrations located in walls that are not part of the 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 3115.8.5.3(4).
- End wall doors designated as part of the lateral force-resisting system shall be welded closed.

TABLE 3115.8.5.3
ALLOWABLE SHEAR VALUES FOR INTERMODAL SHIPPING CONTAINER CORRUGATED STEEL WALLS FOR WIND OR SEISMIC LOADING

CONTAINER DESIGNATION ^b	CONTAINER DIMENSION (nominal length)	CONTAINER DIMENSION (nominal height)	ALLOWABLE SHEAR VALUES (PLF) ^a	
			Side Wall	End Wall
1EEE	45 feet	9.5 feet	75	843
1EE		8.5 feet		
1AAA	40 feet	9.5 feet	84	
1AA		8.5 feet		
1A		8.0 feet		
1AX		< 8.0 feet		
1BBB	30 feet	9.5 feet	112	
1BB		8.5 feet		
1B		8.0 feet		
1BX		< 8.0 feet		
1CC	20 feet	8.5 feet	168	
1C		8.0 feet		
1CX		< 8.0 feet		
1D	10 feet	8.0 feet	337	
1DX		< 8.0 feet		

For SI: 1 foot = 304.8 mm.

- The allowable strength shear for the side walls and end walls of the intermodal

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shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.

b. Container designation type is derived from ISO 668.

c. Limitations of Section 3115.8.5.1 shall apply.

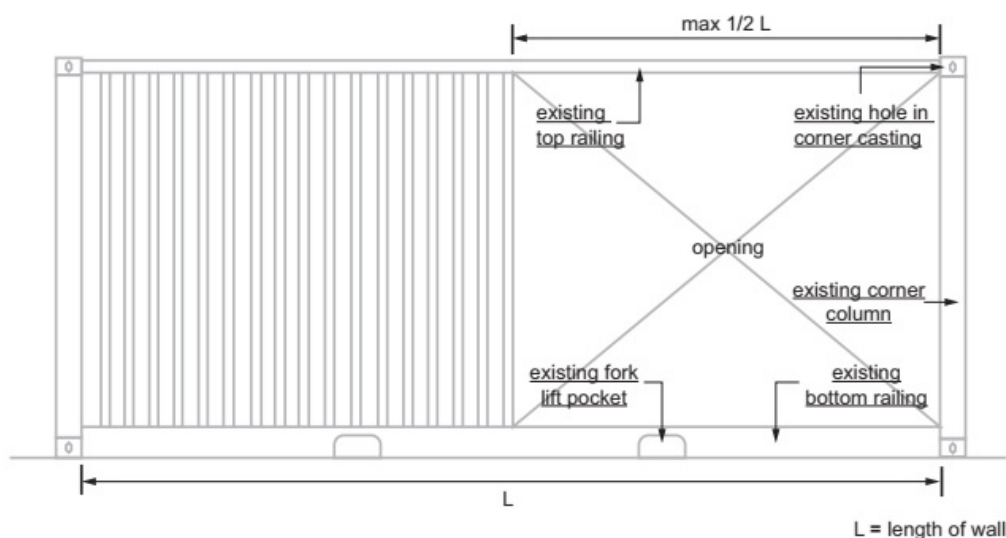


FIGURE 3115.8.5.3(1)
BRACING UNIT DISTRIBUTION—MAXIMUM LINEAR LENGTH

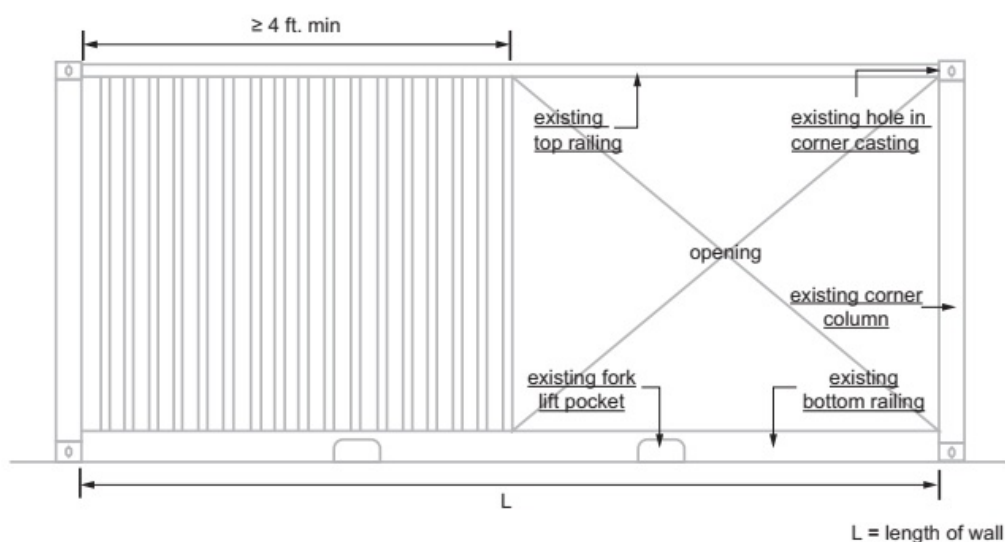


FIGURE 3115.8.5.3(2)
BRACING UNIT DISTRIBUTION—MINIMUM LINEAR LENGTH

For SI: 1 foot = 304.8 mm.

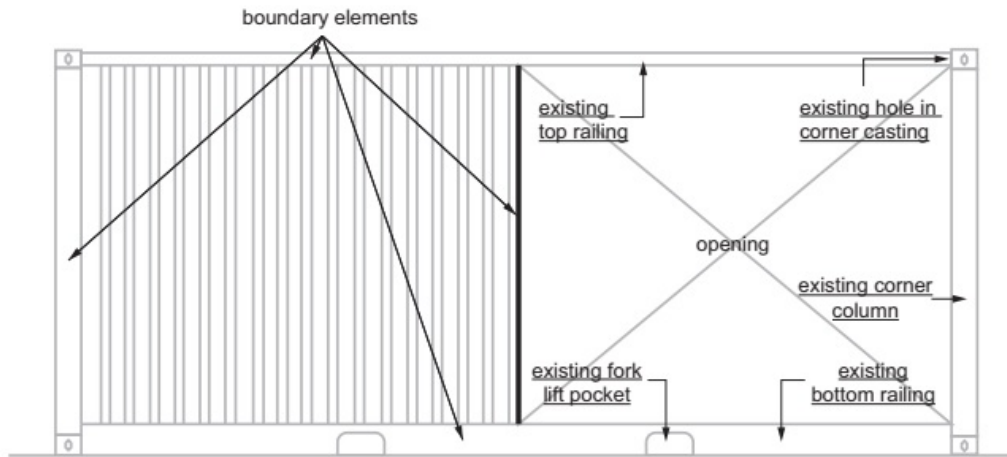
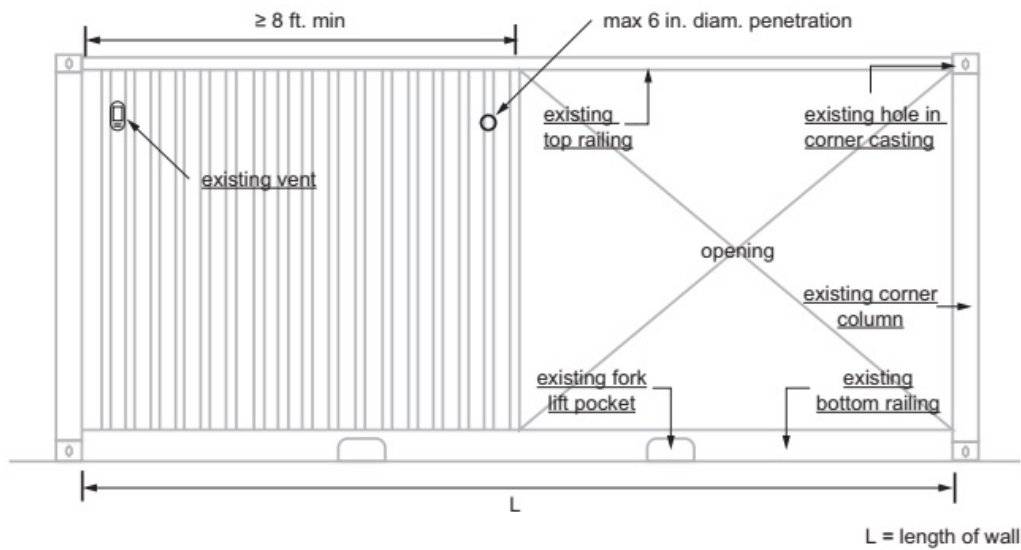


FIGURE 3115.8.5.3(3)
BRACING UNIT DISTRIBUTION—BOUNDARY ELEMENTS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 3115.8.5.3(4)
BRACING UNIT DISTRIBUTION—PENETRATION LIMITATIONS