Welcome to the
2019 Annual Conference
Educational Sessions

Safe Use of Modified Shipping Containers
Sponsored by the MBI
2018-04-18

Agenda

1. Container Task Force
2. Working with the ICC
   1. MBI / ICC MDU
   2. ICC Guidelines
   3. ICC BCAC
3. Falcon & AC462
4. Georgia IBA
### Industry Stats

**Today**
- $500 million in GLOs (Ground Level Offices)
- 650,000 storage containers
- Industry economics
- Public safety

**Tomorrow**
- Acceleration of container adoption
- Increasing the size of the industry

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### ICC-ES AC462 – Feb 2016

- What is an Acceptance Criteria?
- Some Positives
- Confusion
  - Industry surprised
  - Purpose built container?
  - Go forward or retroactive?

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### Container Task Force

- Stephen Shang, Falcon Structures - Co-Chair
- Mike McCall, Wilmot Modular Structures - Co-Chair
- Ralph Touzene, MCC Structures Association
- Andrew Carter, BMD, MIRC, Pyramid 2 Inc.
- Stephen Arampatz, Container Services International
- Alan Ragsdale, West Coast Containers
- Roland Brown, West Beach Building Solutions
- Tom Harbison, Modular Building Institute
- Gary Pears, Pears Service
- Lindsey Schotten, Active Modular
- Daniel Arevalo, Mobile Modular Management Corporation
- Victor Zavala, Urban Mini
- Roger Campbell, Beacon Solutions
- Mike Jawed and Member Inc., MIRC, PECO, a Twining Company
- Randy Eyres, Sea Box, Inc.
- Gary Buckwell, Empire Container Service
Industry Whitepaper

- Published Jun 2017
  - Overview
  - Current Code Environment
  - Industry Segments
  - Structural Integrity
  - Toxicity
  - Industry Positions of Segments
  - Summary of Industry Positions
- Calling card with code officials

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How code feels

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Key Take-Away #1

The ICC is dedicated to developing model codes and standards used in the design, build and compliance process to construct safe, sustainable, affordable and resilient structures. Most governments trust the ICC’s suggested codes and adopt the IBC into law.

MOU between ICC & MBI

- Executed April 2017
- Laid the groundwork for relationship
- Streamline use of Offsite Construction

MOU: Memorandum of Understanding
**Key Take-Away #2**

ICC and MBI are working together to create safe and sensible shipping container building code

**Simplified Code Ecosystem**

**ICC Guidelines**

- Task Force formed in June 2017
- Not regulatory doc
- Open for public comments

Scope

Many code officials, when presented with a request for a shipping container to be used in their jurisdiction, are challenged in terms of what is in the best interest of their jurisdiction. This is primarily due to the lack of regulatory information in today's codes.

This guideline is intended to provide direction to all those involved in the use and application of shipping containers in terms of the health, safety, or welfare of the built environment.
Current Regulatory Environment

- Until 2016, container structures were risky to develop
  - Developers were at the mercy of local AHJ’s
  - “Alternative Means & Methods”
  - NOCD
- Code community starts to pay attention
  - Patchwork of inconsistent regulations
  - ICC-ES AC462 Published

Industry Segments

<table>
<thead>
<tr>
<th>SINGLE UNIT</th>
<th>TEMPORARY</th>
<th>PERMANENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>I GROUND LEVEL OFFICE</td>
<td>CONSTRUCTION OFFICE</td>
<td></td>
</tr>
<tr>
<td>II POP-UP RETAIL</td>
<td>TRADE SHOW STRUCTURES</td>
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<tr>
<td>III INDUSTRIAL WORKSPACE</td>
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<td>IV INDUSTRIAL HOUSING</td>
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<tr>
<td>MULTI-UNIT</td>
<td>SECURITY ENCLOSURES</td>
<td></td>
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<td></td>
<td>SECURITY ACCESS POINTS</td>
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</tbody>
</table>

Industry Segments 1 & 3

Example of Type 1: Single unit Temporary - Mobile Ground Level Office

Example of Type 3: Single unit Permanent – Poolside cabana
Industry Segments 2 & 4

Example of Segment 2: Temporary multi-unit tailgate
Example of Segment 4: Permanent multi-unit Stadium

Key Take-Away #3

It doesn’t make sense to regulate a single-unit ground level office the same way we’d regulate a multi-story apartment complex.

Shipping container building code should not be one-size fits all.

Referenced Standards

- CSC – Convention for Safe Containers
  - International Agreement in 1972
  - Allows containers to operate worldwide
- ISO 1496
  - International Standards Organization
  - World-class specifications
  - 164 standards bodies
ISO Standards

ISO rigidity test 180 mph winds

The ISO rigidity test demonstrates that anchored shipping containers can withstand 180 mph winds without warping.

Testing & Certification

- Classification Society
  - American Bureau of Shipping
  - Lloyd's Register
  - Bureau Veritas
- Testing & Certification
  - Review container design
  - Load tests
  - Dimension check
  - Regular Inspection

CSC Safety Approval Placard

Worldwide safety regulations & standards
- ISO 1496
- Convention for Safe Containers (CSC)
- Classification Societies
Key Take-Away #4

Shipping industry already tests the structural integrity of each container.

We should be able to use container industry standards to inform the performance of containers that will be used as building elements.

Interior and Wood Floor Treatment

- Published Sep 2017
- Evaluate toxicity of four commonly used wood treatments:
  - Basileum
  - Meganium
  - Radaleum
  - Tailileum
- Review of the peer-reviewed toxicological literature
  - World Health Organization (WHO)
  - Food and Agricultural Organization of the United Nations (FAO)
  - Environmental Protection Agency (EPA).

Key Take-Away #5

“[It is] not expected that any potential exposure to these pesticides present in the flooring of the storage containers would pose an immediate or long-term health concern.”

– Toxicological Evaluation of Four Wood Treating Products, TRC
Don’t scrap AC462. Just clarify it.

- Not meant for overall building code compliance
- But establishes the physical & chemical properties of a shipping container.
- AC462 is not retroactive on existing buildings and GLO’s
- Differences in single vs multi container
- AC462 is not the only path forward for shipping container
- Clarifies CSC & ISO and the role of Classification Societies such as ABS

FAQ #1

What is the process to determine the presence of other possible chemicals or toxins such as those used in the packing material contained in the shipped cargo or used in the construction of the container?

Several national & international protocols and procedures in place by the shipping container industry that minimize chance that a contaminated could not be properly cleaned

- International Maritime Dangerous Goods (IMDG) Code
- US Customs & Border Patrol / EPA

FAQ #2

- Can a container-based structure have any use or occupancy?
- There are no restriction on the type of use or occupancy provided all applicable code requirements for that specific use or occupancy are satisfied
FAQ #3

- What is the fire-resistance rating for shipping container walls?
- There has been no conclusive study or testing performed to determine what the minimum fire-resistance rating is.

Simplified Code Ecosystem

- Initiated in Oct 2016 by ICC
- Launched in June 2017
- Code Hearings April 15-25, 2018 – Approved 14-0
- Incorporate into chapter 31 into IBC 2021

ICB Building Code Action Committee (BCAC)

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Revised:
This code change attempts to introduce intermodal shipping containers into the International Building Code based on requests by Code officials in the US. Prior to the proposed, review procedures have included verification of materials, methods of construction and assembly, and test methods as needed to ensure that no added costs are introduced, or that the increased additional requirements beyond the code (Sec. 1403).

“Alternative materials, designs and methods of construction and assembly” as those which does not duplicate existing code provisions but which do not reduce the required level of safety.
Sample – Ch 31

- **Scope**
  - Simplified structural design of single-unit containers
  - Guidance on multi-unit container structures

**Scope**

- Intermodal shipping containers that are repurposed for use as buildings or structures or part of buildings or structures

**Exceptions:**
1. Previously approved with Ch 14 of IIBC
2. Stationary storage battery arrays complying with Ch 12 of IFC
3. Listed as equipment
Data Plate

- Containers shall bear a data plate per ISO 6346 / Verified by approved agency
- Permitted to be removed when repurposed

Key Sections 3114.4 to 3114.8

- Protection against decay & termites – Section 2304.12.1.1
- Underfloor ventilation – Section 1202.4
- Roof assemblies – Ch 15
  - EXCEPTION: Single unit intermodal shipping containers not attached to other buildings or structures
- Joints & Voids – Section 715

Structural design - Detailed

- Detailed design procedure
  - Material properties – properly identify or test
  - Seismic design – ASCE 7 Table 12.2.1
  - Allowable shear value – Testing & analysis Section 104.11
Structural design - Simplified

- Simplified structural design of single-unit containers

- Limitations
  - Not in contact with or supporting other containers or structure
  - Top & bottom rails, corner castings, columns shall not be notched, cut or removed
  - Horizontal with floor at the bottom
  - Seismic Design Cat A,B,C,D

- Assumptions for steel shear walls
  1. The resistance of enclosing requirements contained in Chapters 14 through 23
  2. Response modification coefficient, M = 1.0
  3. Ground motion attenuation factor, A = 0.5
  4. Limits on structural height, h ≤ 35 feet (1068 cm)

Structural design - Simplified #2

- Conditions
  1. Openings < 50% of length of side or end walls
  2. Full height wall length > 4'
  3. Boundary element
  4. Openings are framed
  5. Max penetrations per 8’ length
  6. End wall doors shall be welded closed

Simplified Code Ecosystem

- Acceptance Criteria (AC)
- Evaluation Service Report (ESR)
- Building Code Action Committee (BCAC)
- Guidelines

ICC-ES AC462 Update

- May 2017 – 1st ESR issued
- May 2018 – 2nd ESR issued
- Multiple states incorporate AC462
- Open Issues
  - Classification Societies
  - Practicality of used containers

BCAC & AC462

- Chapter 31 will co-exist with AC462
- AC462 cannot be incorporated into IBC
- "Non-consensus developed documents"

Simplified Code Ecosystem

- Guidelines
- Acceptance Criteria (AC)
- Evaluation Service Report (ESR)
- Building Code Action Committee (BCAC)
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Falcon - AC462 Timeline
- Kicked off in Aug 2017
- Quality Manual (AC10)
- Selecting manufacturer
- Train employees
- Revamp operational process
- 3rd party inspector came out to inspect
- Receive ESR

Key resources & challenges
- Selecting container manufacturer
- JIS - Comparable, not equivalent
- Quality system
- Design guide
- Resources - ~$100k
- Timeline – Aug 2017 to April 2018
Key Take-Away #6

Viable paths for code compliance are emerging.

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   2. Toxicology Report
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Georgia’s IBAC*

- Initial presentation – Aug 2016
- IBAC Vote – Dec 2017
- Effective Date – July 2018
- Highlights
  - Accepts AC462, but also CSC & IICL
  - Up to 4 years old
  - Temporary storage use exempt
  - Open issue: Toxicity

* IBAC – Industrialized Buildings Advisory Committee
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Conclusions

- ICC is dedicated to developing model codes for SAFE structures
- ICC and MBI are working together to create safe and sensible shipping container building code
  1. Shipping container building code should not be one-size fits all
  2. Shipping industry already tests the structural integrity of each container.
  3. Floor treatments are safe for humans.

Conclusions

- Viable paths for code compliance are emerging.
  - Guidelines
  - Ch 31 IBC
  - AC462
Questions?

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Think Inside the Box™

Thank You For Attending