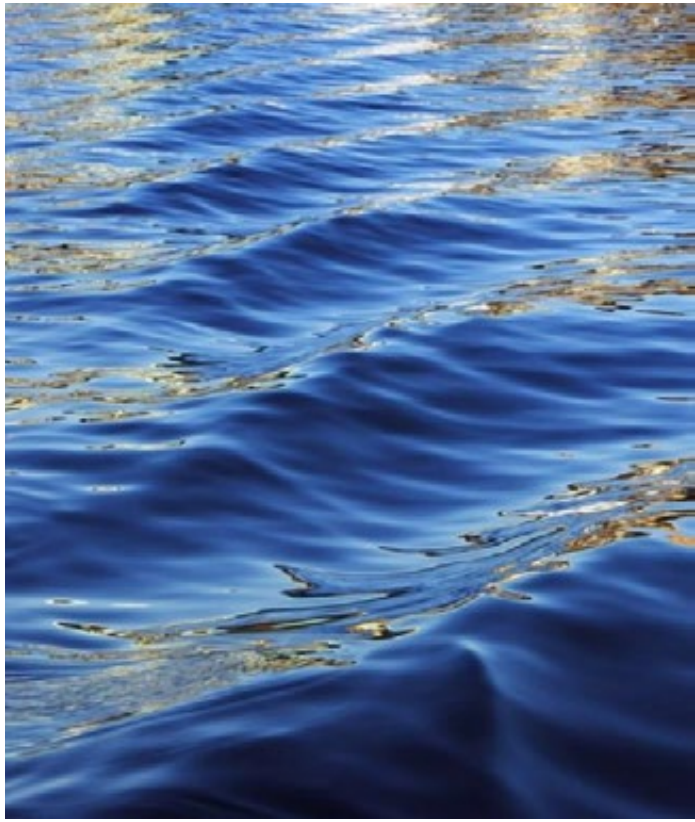
Mitigating the risk of Pest Infestation on Containers

Douglas Owen, Mike Downes, Philip Eastell

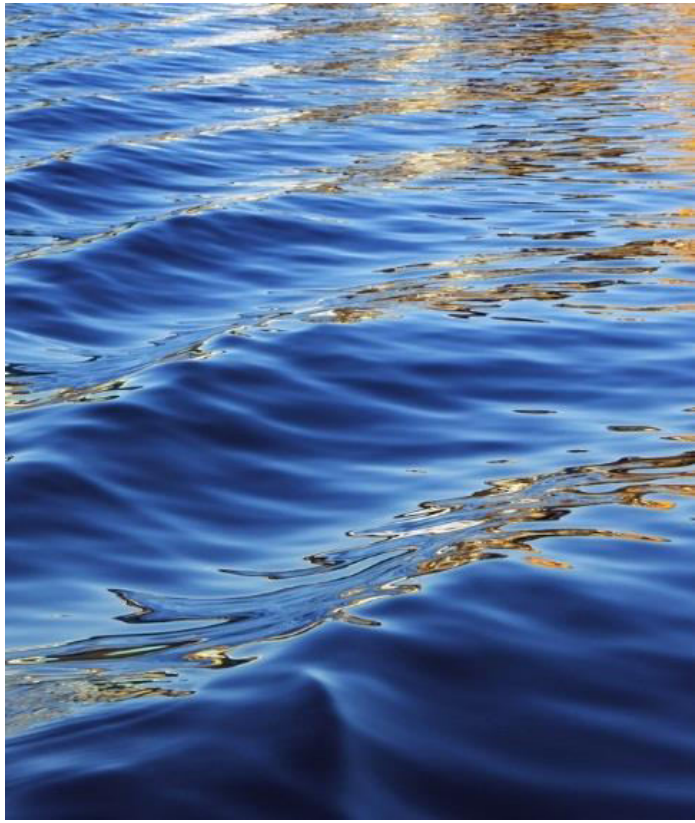


What will we cover today?

- Opening remarks – Setting the scene
- What is the Problem?
- What can be done about it?
  - Operational
  - Container Design
    - Coatings
    - Steel floor
- Summary and closing remarks – Call to Action
- Q&A

Opening remarks

Setting the scene



A couple of useful definitions:

- **IPPC**
  - The International Plant Protection Convention (IPPC) is an intergovernmental treaty signed by over 180 countries, aiming to protecting the world's plant resources from the spread and introduction of pests, and promoting safe trade. The Convention introduced International Standards for Phytosanitary Measures (ISPMs) as its main tool to achieve its goals, making it the sole global standard setting organization for plant health.

- **Pest contamination** (on containers)
  - Pest contamination means visible forms of animals, insects or other invertebrates (alive or dead, in any lifecycle stage, including egg casings or rafts), or any organic material of animal origin (including blood, bones, hair, flesh, secretions, excretions); viable or non-viable plants or plant products (including fruit, seeds, leaves, twigs, roots, bark, intact or broken wood packing material, including dunnage); or other organic material, including fungi; or soil, or water; where such products are not the manifested cargo within the container.

Source: IMO/ILO/UNECE CODE OF PRACTICE FOR PACKING OF CARGO TRANSPORT UNITS (CTU CODE)

Recent and compelling facts on invasive (pest) species

On the 4th of September 2023 the U.N. released an advance copy of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report titled:

"Summary for policymakers of the thematic assessment of invasive alien species and their control of the Intergovernmental Platform on Biodiversity and Ecosystem Services"

Following are some quotes from that report which make for very disturbing reading:

Source: IPBES - Summary for policymakers of the thematic assessment of invasive alien species and their control of the Intergovernmental Platform on Biodiversity and Ecosystem Services - 4 September 2023

KM-A1. People and nature are threatened by invasive alien species in all regions of Earth.

More than 37,000 established alien species have been introduced by human activities across all regions and biomes of Earth, with new alien species presently being recorded at an unprecedented rate of approximately 200 annually. Studies with evidence of negative impacts exist for more than 3,500 of these species, which are categorized as invasive alien species.

KM-A2. Invasive alien species cause dramatic and, in some cases, irreversible changes to biodiversity and ecosystems, resulting in adverse and complex outcomes across all regions of Earth, including local and global species extinctions.

Invasive alien species have contributed solely or alongside other drivers to 60 per cent of recorded global extinctions, and are the only driver in 16 per cent of the documented global animal and plant extinctions.

Source: IPBES - Summary for policymakers of the thematic assessment of invasive alien species and their control of the Intergovernmental Platform on Biodiversity and Ecosystem Services - 4 September 2023

KM-A3. The economy, food security, water security, and human health are profoundly and negatively affected by invasive alien species.

In 2019, global annual costs of biological invasions were estimated to exceed $423 billion. The vast majority of global costs (92 per cent) accrue from the negative impact of invasive alien species on nature's contributions to people or on good quality of life, while only 8 per cent of that sum is related to management expenditures of biological invasions

KM-B1. Many human activities facilitate the transport, introduction, establishment, and spread of invasive alien species.

…there have also been many unintentional introductions, such as contaminants of traded goods or stowaways in shipments. Indirect drivers of change, particularly those associated with economic activities, with international trade being the most important, are increasingly facilitating transport and introduction, the early stages of biological invasion……

Transport and utility infrastructures in terrestrial and aquatic environments can create corridors that facilitate the spread of invasive alien species, including into remote, undisturbed and protected areas.

Source: IPBES- Summary for policymakers of the thematic assessment of invasive alien species and their control of the Intergovernmental Platform on Biodiversity and Ecosystem Services - 4 September 2023

"KM-C2. Prevention and preparedness are the most cost-effective options and thus crucial for managing the threats from invasive alien species.

KM-D1. Through a complementary set of strategic actions, integrated governance can limit the global problem of invasive alien species throughout the biological invasion process and at local, national, and regional scales.

KM-D2. The threat of invasive alien species could be reduced with closer collaboration and coordination across sectors and countries to support the management of biological invasions.

KM-D7. There is compelling evidence for immediate and sustained action to manage biological invasions and mitigate the negative impact of invasive alien species.

IPPC Secretary Dr. Osama El-Lissy stated:

"Invasive pests remain the main drivers of biodiversity loss. As the world becomes more globalised and interconnected, the increase in the movement of people and goods has been associated with the rise of the introduction and spread of plant pests across borders."

According to Dr. El-Lissy every year as much as **40%** of global crops, valued at around **$220 Billion**, are lost due to invasive pests.

El-Lissy quote

Consequences of pest establishment - examples

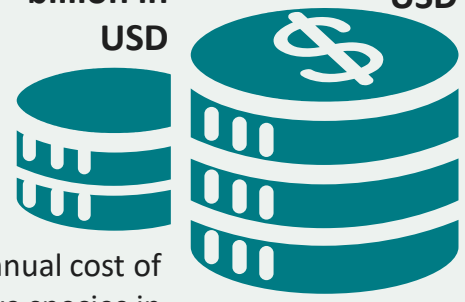
Economic impacts of invasive species can include the cost of introduced invasive species on:

- agriculture
- forestry
- fisheries
- environment
- tourism

> $120 billion in USD

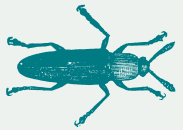
annual cost of invasive species in the USA

$165.01 billion in USD



average annual global cost of invasive terrestrial invertebrates

Economic consequences of introduced and established pests



USD $890 million for the Emerald ash borer, reported by the US.

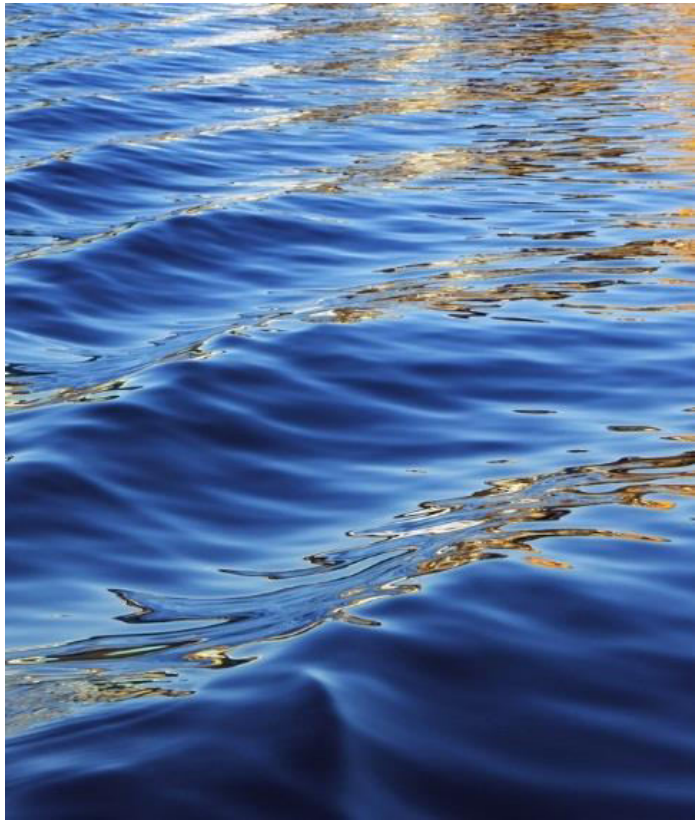
USD $200 million for the Spongy moth, reported by the US.

NZD $318 million/annum for the Red imported fire ant if established, reported by NZ.

The movement of plant and other pests on or in containers and the subsequent damage to eco-systems has been aptly described as:

“A Slow-moving Train Wreck”

What is the problem?



Container risks – no boundaries

Globally, approximately **25 million** containers are in circulation and **241 million** container movements occur annually.

- Even a small proportion of contaminated containers can lead to international spread of pests!
- Containers don't always travel between the same two countries – their movement is influenced by supply and demand.
- In addition to pests hitching a ride in containers, some pests have the ability to survive in or on containers for extended periods.

Species commonly intercepted in or on containers

• Asian Longhorn beetle	• Big-headed Ant/Brown house-ant
• Yellow Crazy Ant	• Apple Snail
• Giant African Snail	• Red imported fire ant
• Cane toad	• Khapra beetle
• Spongy moth	

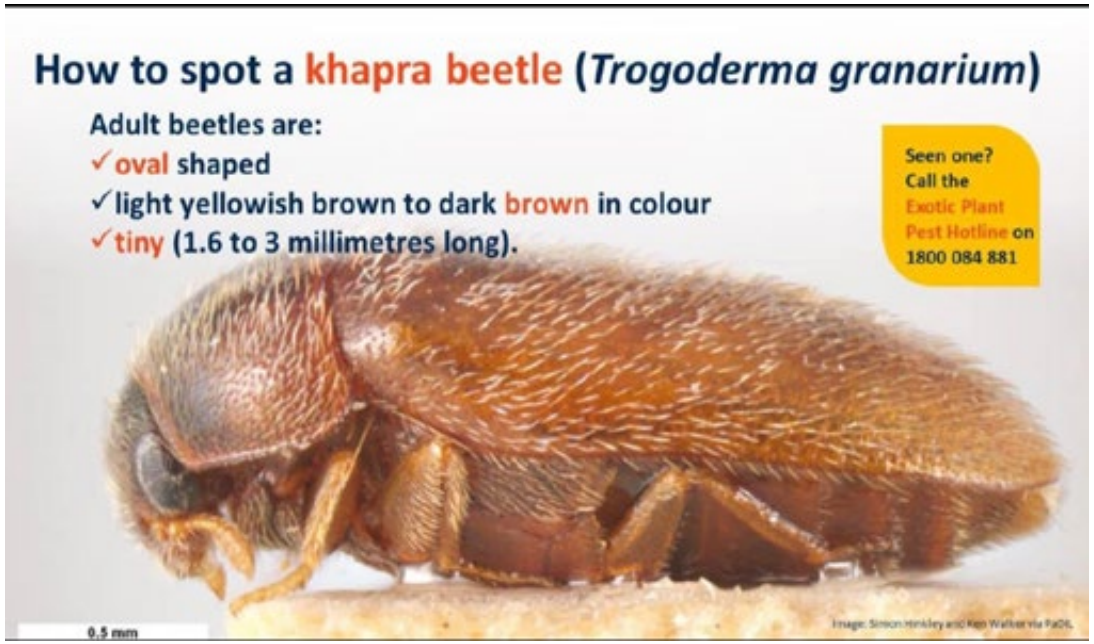
All listed in 100 of the World's Worst Invasive Species list in the Global Invasive Species Database





Criteria: Their serious impact on biological diversity and/or human activities, and their illustration of important issues surrounding biological invasion.

Difficult to find and identify pests



Khapra Beetle

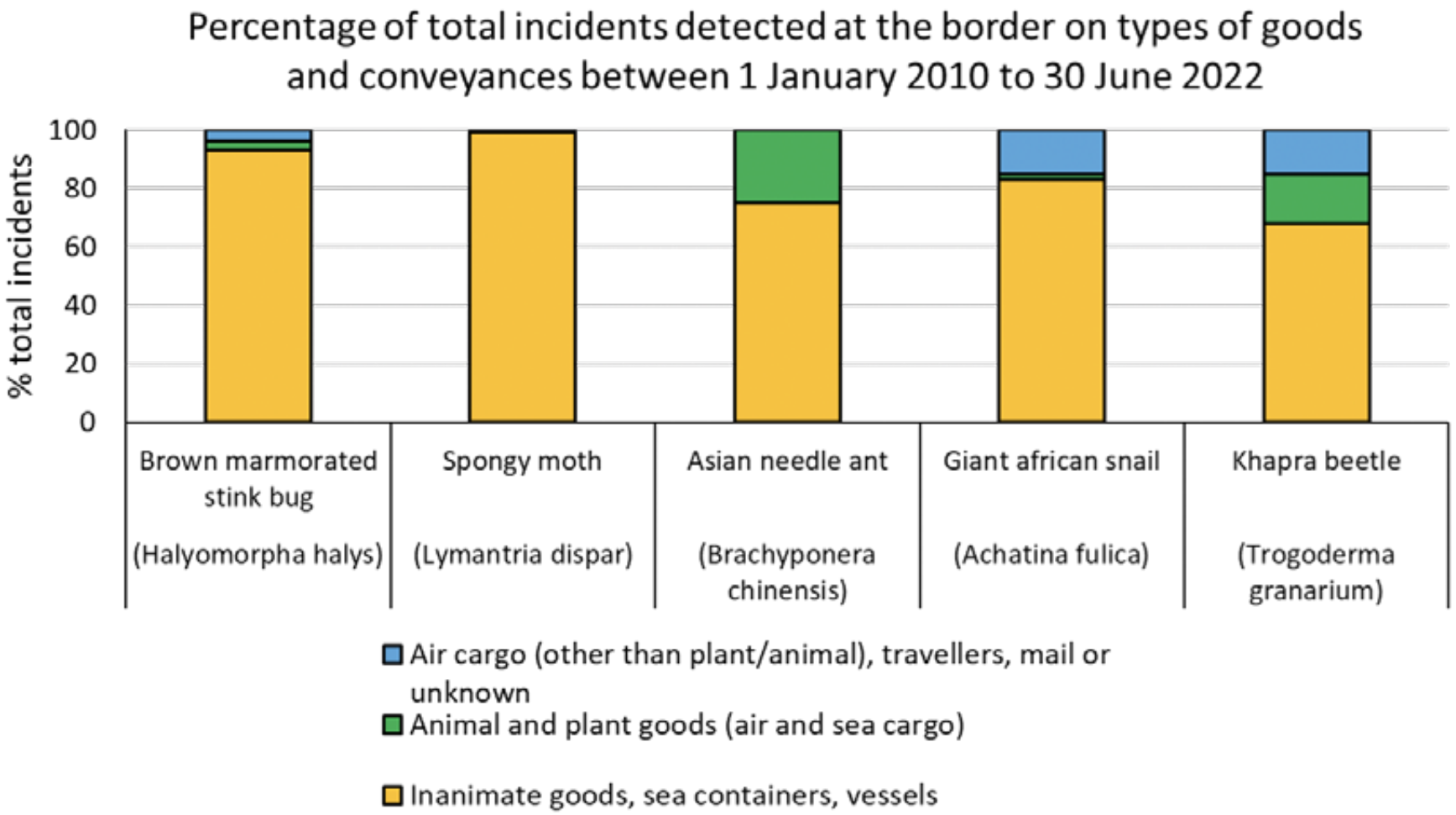
Easy to spot and recognize?

Actual size 1.6 – 3 mm!

Shown compared to grains of Rice

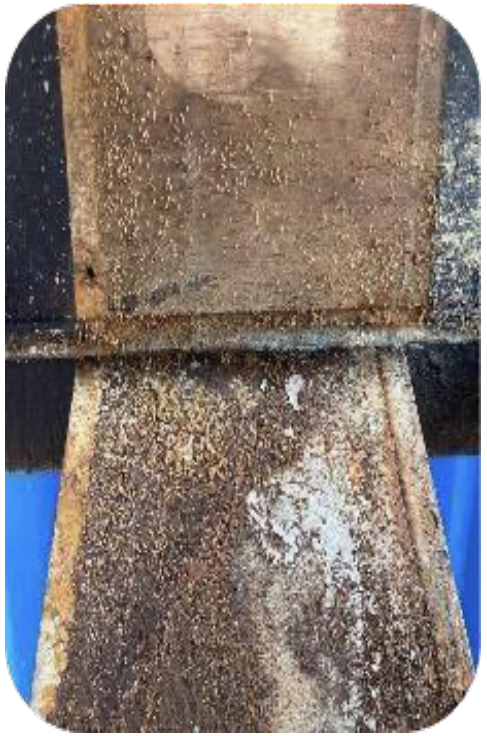
Khapra beetle actual size

Australian historical interception data



Container pest contamination

Underfloor



Container pest contamination

Understructure

Container pest contamination

How pests gain internal access to underfloor spaces.

Cracks

Nail holes

Sealant failure

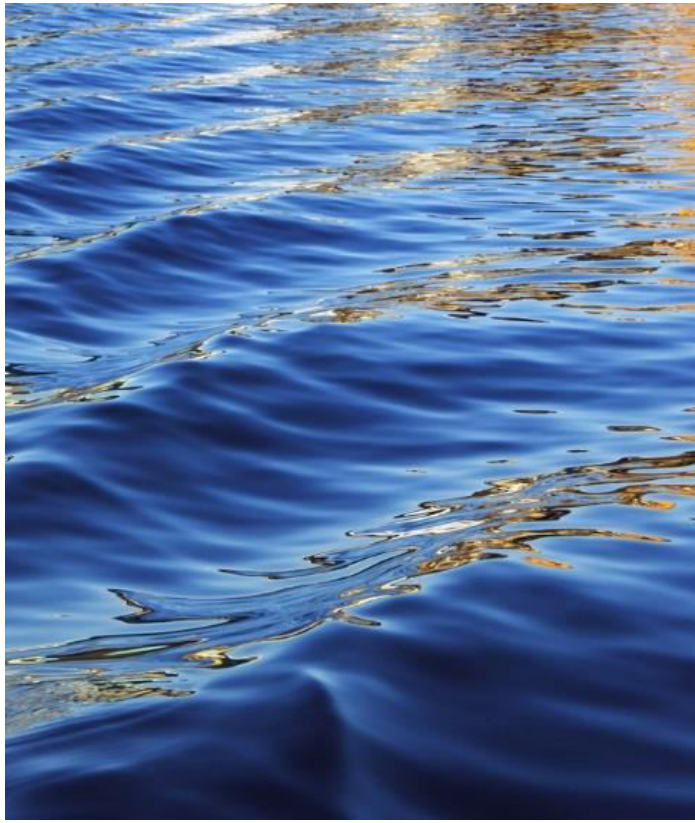
Container pest contamination

Internal floor/structure gaps

Soil on bottom rail and FLP

What can be done about it?

Operational



Operational – enhanced inspection and cleaning

New version of "Prevention of Pest Contamination of Containers: Joint Industry Guidelines for Cleaning of Containers" (JIG) issued March 2023
– jointly prepared by WSC, BIC, COA, IICL.

Both now contain references to inspecting for and cleaning of pest contamination

Updated version of "Unified Container Inspection and Repair Criteria" (UCIRC) issued June 2023
– jointly prepared by BIC, ICS, WSC.

Copies available here or from the organization's website.

Operational
Principle of "Custodial Responsibility"

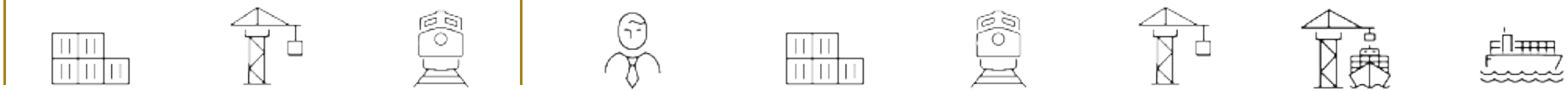
Offers guidance for each party along the international containerized supply chain that tenders and receives a container. Still work in progress.

Refers to the responsibility of the receiving container custodian to determine whether the previous custodian has met their responsibility and hold them accountable in case actions to minimize pest contamination have not been done and the container is "unclean".

Operational -Custodial Responsibility

PEST PREVENTION RESPONSIBILITY
EXPORT

POSSIBLE EMPTY RELEASE LOCATION
Carrier responsible to provide clean container



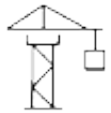
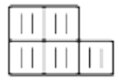
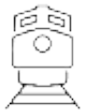
Responsibility **AT DEPOT**	Responsibility **AT TERMINAL**	Responsibility **AT RAIL YARD**	Responsibility **AT CLIENT PREMISES**	Responsibility **AT DEPOT**	Responsibility **AT RAIL YARD**	Responsibility **AT TERMINAL**	Responsibility **WHEN LOADING ON SHIP**	Responsibility **WHILE ON SHIP**
CARRIER HAULAGE								
EMPTY GATE OUT	**EMPTY GATE OUT**	**EMPTY GATE OUT**	**EMPTY GATE IN**	**FULL GATE OUT**	**FULL GATE IN**	**FULL GATE IN**	**FULL GATE IN**	**LOADING**	
Carrier trucker	Carrier trucker	Carrier trucker	Client	Carrier trucker	Depot operator	Yard operator	Terminal operator	Terminal operator	Carrier
MERCHANT HAULAGE								
EMPTY GATE OUT	**EMPTY GATE OUT**	**EMPTY GATE OUT**	**EMPTY GATE IN**	**FULL GATE OUT**	**FULL GATE IN**	**FULL GATE IN**	**FULL GATE IN**	**LOADING**	
Client trucker	Client trucker	Client trucker	Client	Client	Depot operator	Yard operator	Terminal operator	Terminal operator	Carrier

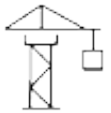
Operational - Custodial Responsibility

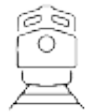
PEST PREVENTION RESPONSIBILITY
IMPORT

POSSIBLE RETURN LOCATION







Responsibility **WHILE ON SHIP**	Responsibility **WHEN UNLOADING FROM SHIP**	Responsibility **AT TERMINAL**	Responsibility **AT DEPOT** (if drayed off)	Responsibility **AT RAIL YARD** (if rail move)	Responsibility **AT CLIENT PREMISES**	Responsibility **AT TERMINAL**	Responsibility **AT DEPOT** (if drayed off)	Responsibility **AT RAIL YARD** (if rail move)

	CARRIER HAULAGE								
	DISCHARGING	**FULL GATE OUT**	**FULL GATE OUT**	**FULL GATE OUT**	**FULL GATE IN**	**EMPTY GATE OUT**	**EMPTY GATE IN**	**EMPTY GATE IN**	**EMPTY GATE IN**
Carrier	Terminal	Carrier trucker	Carrier trucker	Carrier trucker	Client	Carrier trucker	Terminal operator	Depot operator	Yard operator

	MERCHANT HAULAGE								
	DISCHARGING	**FULL GATE OUT**	**FULL GATE OUT**	**FULL GATE OUT**	**FULL GATE IN**	**EMPTY GATE OUT**	**EMPTY GATE IN**	**EMPTY GATE IN**	**EMPTY GATE IN**
Carrier	Terminal	Client trucker	Client trucker	Client trucker	Client	Client	Terminal operator	Depot operator	Yard operator

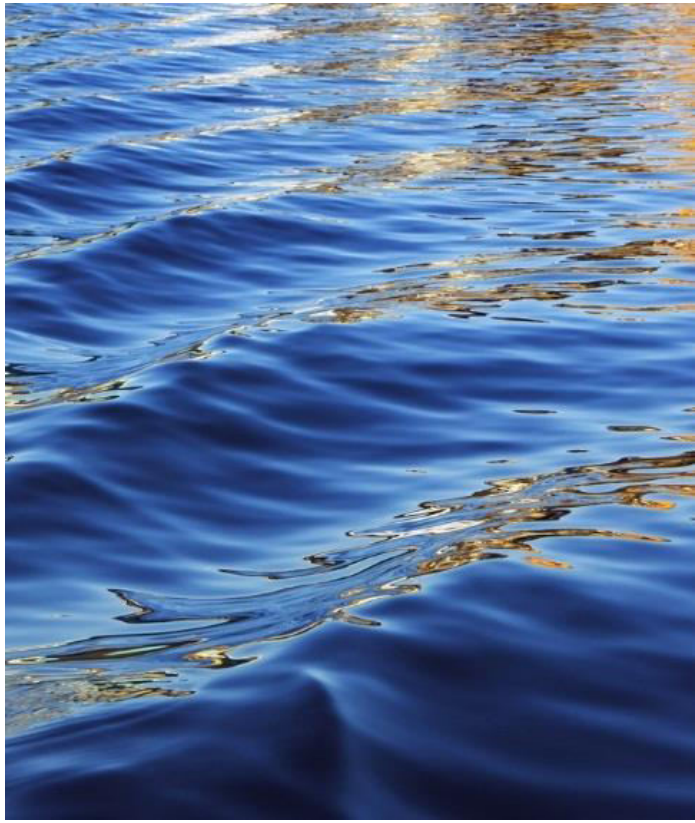
Operational -Custodial Responsibility

PEST PREVENTION RESPONSIBILITY
EMPTIES

EMPTIES LOADED	EMPTIES DISCHARGED
While containers are waiting to be loaded, the IPPC's «Sea container supply chains and cleanliness. Measures to minimize pest contamination» should apply. These responsibilities fall on the terminal based on the principle «gated in clean, stay clean».	While containers are waiting to be released to truckers, the IPPC's «Sea container supply chains and cleanliness. Measures to minimize pest contamination» should apply. These responsibilities fall on the terminal.

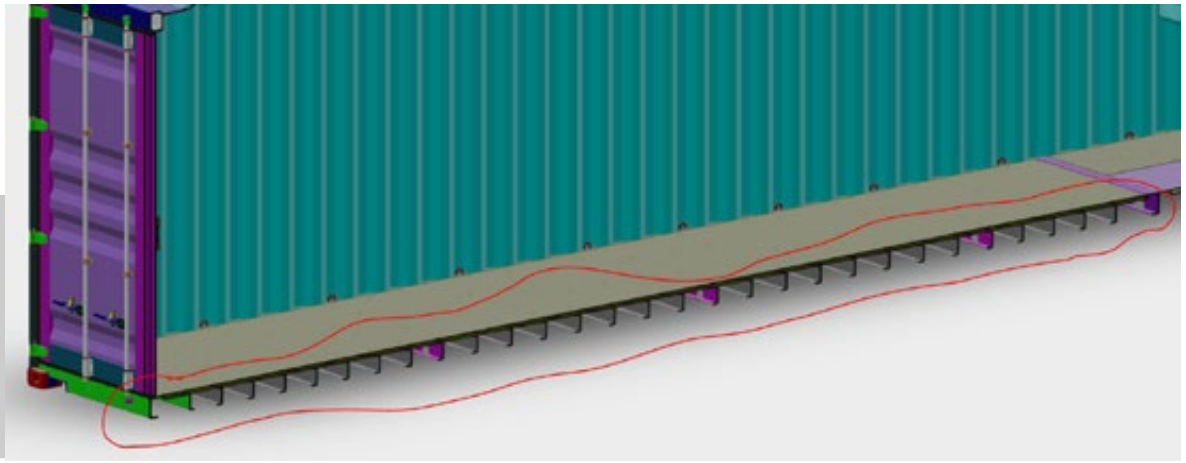
What can be done about it?

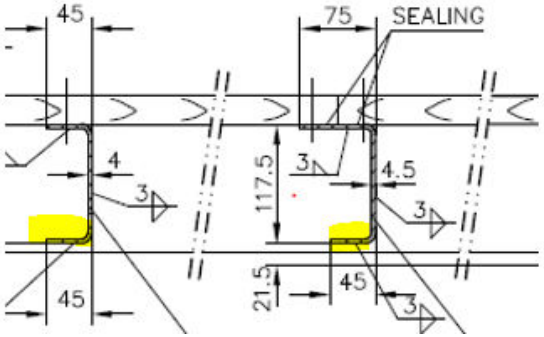
Container design improvements

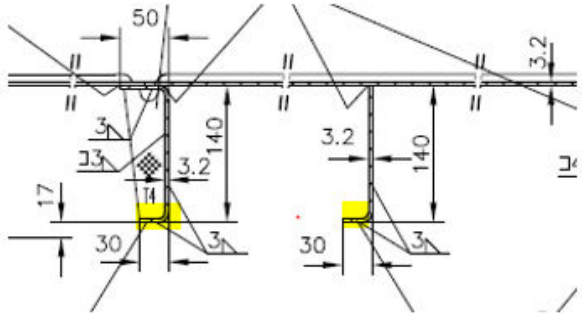


Contamination hot spots – reducing the potential

Cross-members: Remove some or reduce cross-member and rear sill lower flange dimensions to reduce opportunity for soil and pest contamination.



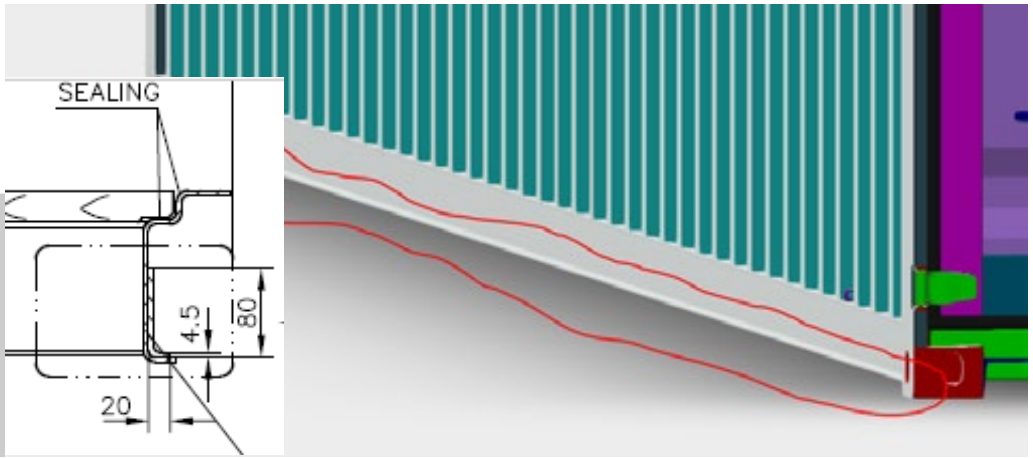




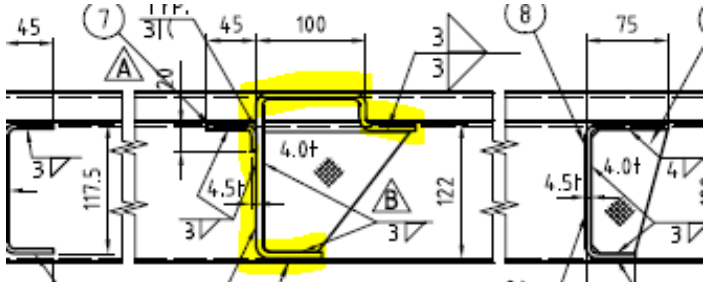
Example: Standard cross-member flange is 45mm, while steel floor is 30mm. Modifying cross section profile geometry allows for lower flange dimensional reduction.

Contamination hot spots – reducing the potential

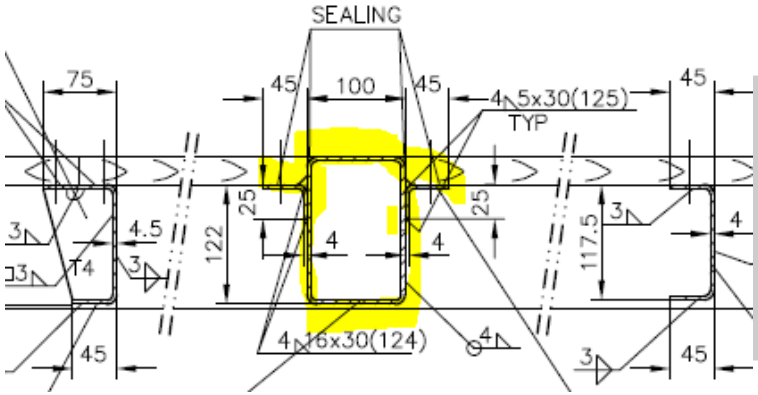
- Bottom side rail, lower flange dimension potential for reduction – currently 20 mm



Open profile Bolster



Closed profile Bolster



- Both Open and Closed profile Bolster designs are in use – align design across the industry to Closed only

Contamination hot spots – reducing the potential

- Standard vent design allows pest ingress – new designs under development

- Bitumastic base coatings are inherently "sticky" and promote movement of pests. Move to fully painted solution.

Contamination hot spots - possible solutions

- Dry container cross-member design under-structure provides opportunities for pest hitch-hikers and soil contamination

- Modified design, similar to reefer under-structure, uniform smooth surface to reduce pest hitch-hiker opportunities and soil contamination.

Contamination hot spots - possible solutions

- Plywood floor design allows for gaps at ends and sides. Sealants not effective long-term. Vertical misalignment issues.

- Steel floors provide sealed ends and sides. Sealants not required. Cleaning simplified.

Ongoing

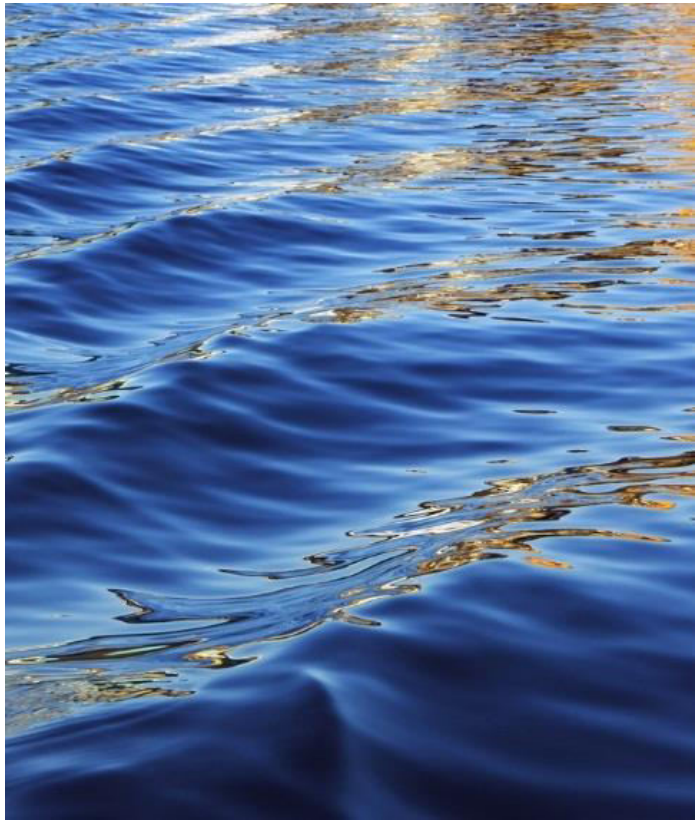
Trials to collect data on the effectiveness to resist pest contamination of different surfaces and designs

Floors
Steel floors, bamboo boards, Phenolic film coated etc…

Underside
Modified base structure
Base coating/colour

Vents
Design
Effectiveness

Container Coatings & Steel Floor option



Container Coatings

Considerations

Challenges

Solutions

Considerations

Interior, Exterior and Underside

Colour

Environmental

Challenges

Container owners have brand colours

Any controls will affect all life forms

Should be environmentally friendly

Solutions

Where possible use dark colours (except for underside)

Yellow and bright colours attract insects

Underside – "ditch the bitumen"
Solution – Steel Floors

The Eco-Friendly Innovation: Steel Floor Container

• Why Steel Floor?

Eco-Friendly

- ❑ 100 % recyclable
- ❑ Less material consumption during its life due to fewer floor repairs
- ❑ Longer lifecycle of 20 years vs. 8 years for a wooden floor
- ❑ *Supports the requirements regarding pest control*

→ **Future-oriented innovation!**

Solid

- ❑ Lighter, dimensionally stable material
- ❑ Higher point load and capability of resistance
- ❑ *Higher stability during the lifetime guaranteed*

→ **Increased payload for the customer's cargo (≈ + 100kg)!**

Clean

- ❑ More hygienic, no humidity in the floor itself
- ❑ Almost odor less
- ❑ Easier, faster and cheaper to clean
- ❑ No use of chemicals for floor treatment needed

→ **Improved transport conditions for the customer's cargo!**

→ **Extended usability for transports of high-grade foodstuffs!**

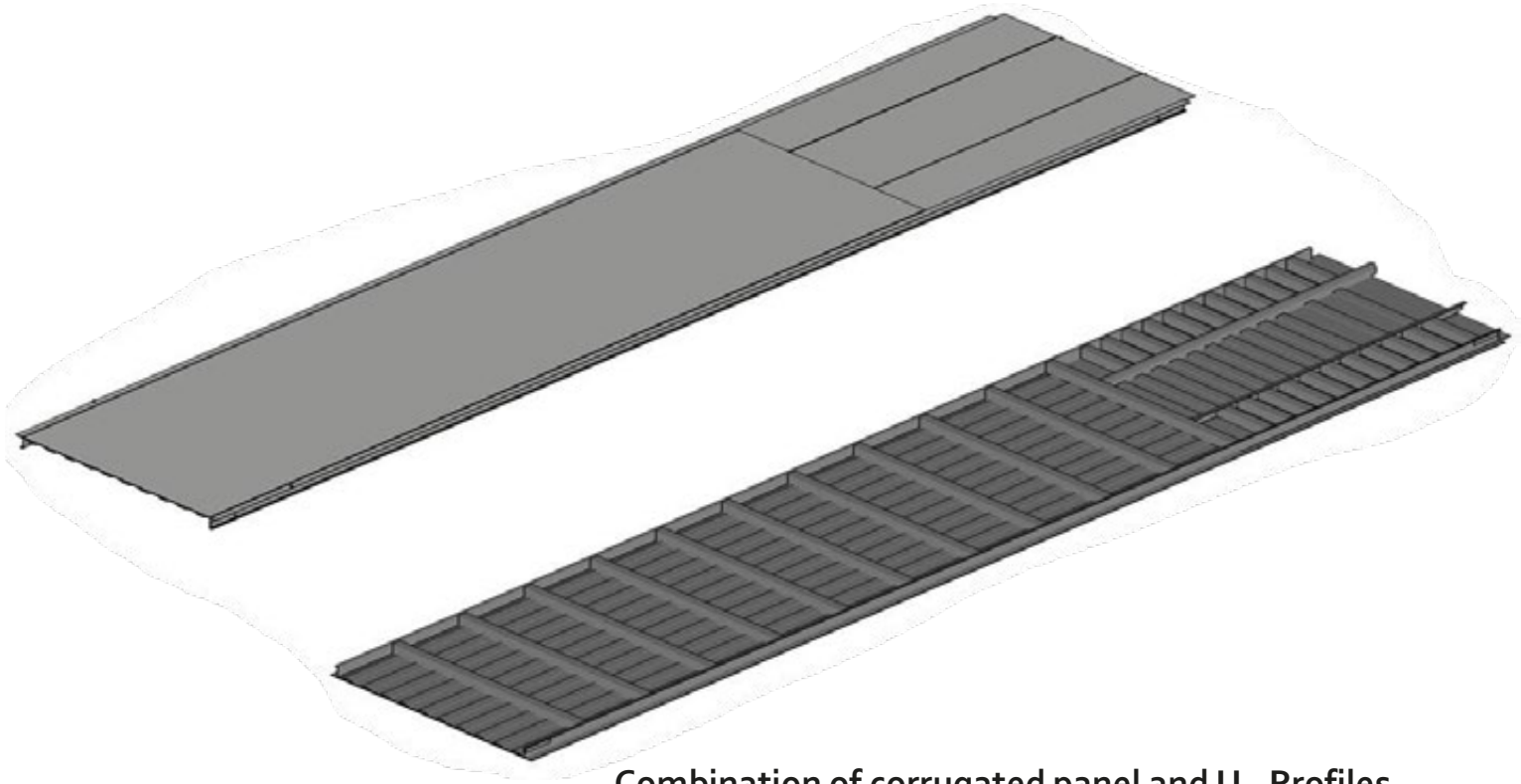
Secure

- ❑ Less slip danger due to optimized load distribution on stiff corrugations, no steps
- ❑ More lashing devices than in a wooden floor container

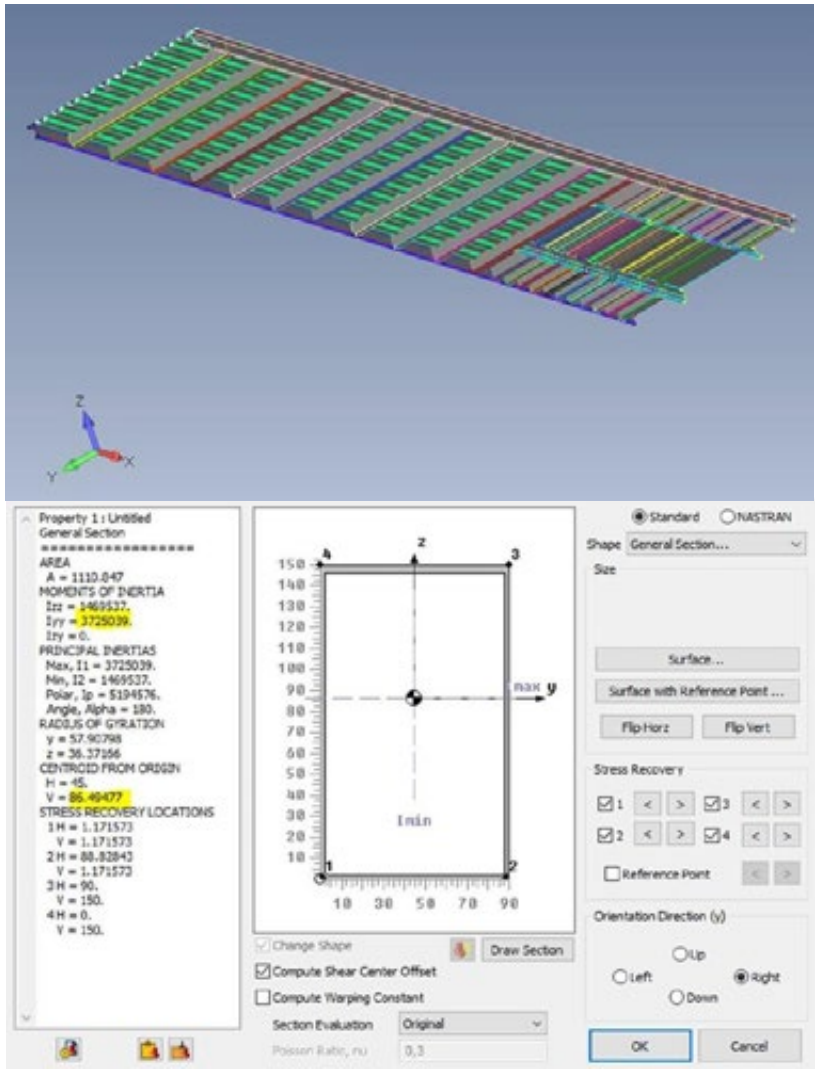
→ **Ensured load safety!**

Steel Floor the Next Generation
- Engineering Design

Most promising Concept*



Combination of corrugated panel and U - Profiles



**patent pending*

Courtesy of Hapag-Lloyd