



WHERE, WHAT, HOW, & WHEN: ACCURATE CARGO RISK ASSESSMENT

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CHALLENGES OF ASSESSING & MANAGING CARGO RISK

- **What** type of cargo is it?
- **How** is the cargo stored?
- **Where** is the cargo?
 - Cargo travels through many **regions of the world** (different perils affect each region)
 - **Within a port**, risk can vary from location to location
- **When** is the cargo at the location?
 - Cargo risks are non-stationary



MARINE CARGO IS HIGHLY DIVERSE



<http://www.crowley.com>



Cargo & Specie Risks

What is being shipped?



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Getty Images

SAME PERIL – DIFFERENT DAMAGE



- If a Hurricane causes Power Outage at a Port



SAME PERIL – DIFFERENT DAMAGE



- If a Hurricane causes storm surge of 3' at the same port



SAME PERIL – DIFFERENT DAMAGE



- If an earthquake causes significant ground-shaking at the same port



CARGO STORED IN MANY WAYS

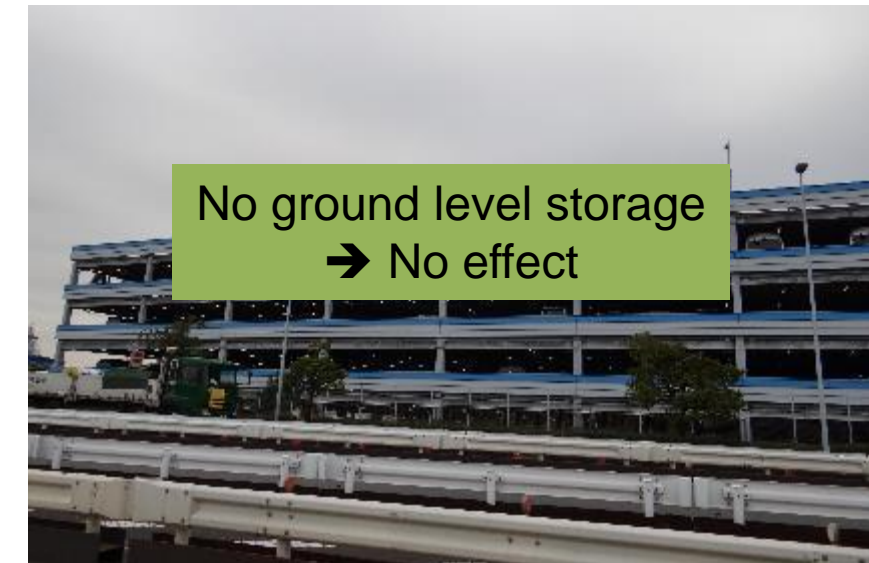
- Many ways to ship & store the same cargo
- Damage varies by storage configuration in each peril

How are goods being shipped?



CARGO IS SHIPPED MANY WAYS

- What happens in a storm surge of 3'?



CARGO IS SHIPPED MANY WAYS

- What if an earthquake occurs?



Stacked containers may fall → damaging vehicles inside



Vehicles shake:
Minimal impact



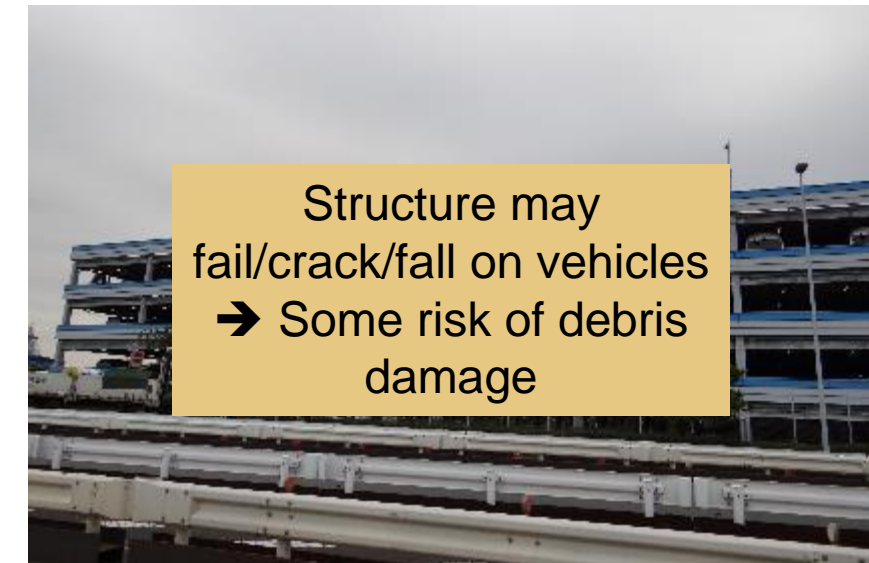
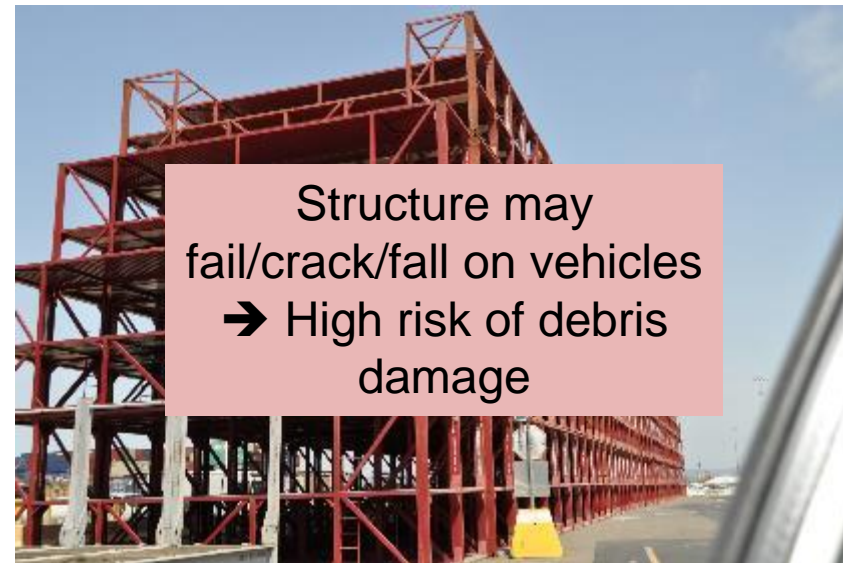
Structure may fail/crack/fall on vehicles



Structure may fail/crack/fall on vehicles

CARGO IS SHIPPED MANY WAYS

- What if the port is affected by a Tornado



SECONDARY ATTRIBUTES CAN ALTER CARGO RISK PROFILE

- **Protection measures**
 - Are hail nets in place to reduce cargo damage?



Vs.



SECONDARY ATTRIBUTES CAN ALTER CARGO RISK PROFILE

- **Salvage Potential**

- Varies by Product Type
- Brand Protection clauses & contract endorsements may limit salvage potential



Vs.



SECONDARY ATTRIBUTES CAN ALTER CARGO RISK PROFILE

- **Packaging**

- Is the cargo protected from damage?
- Are the goods in the open, a cardboard box, or a waterproof box?

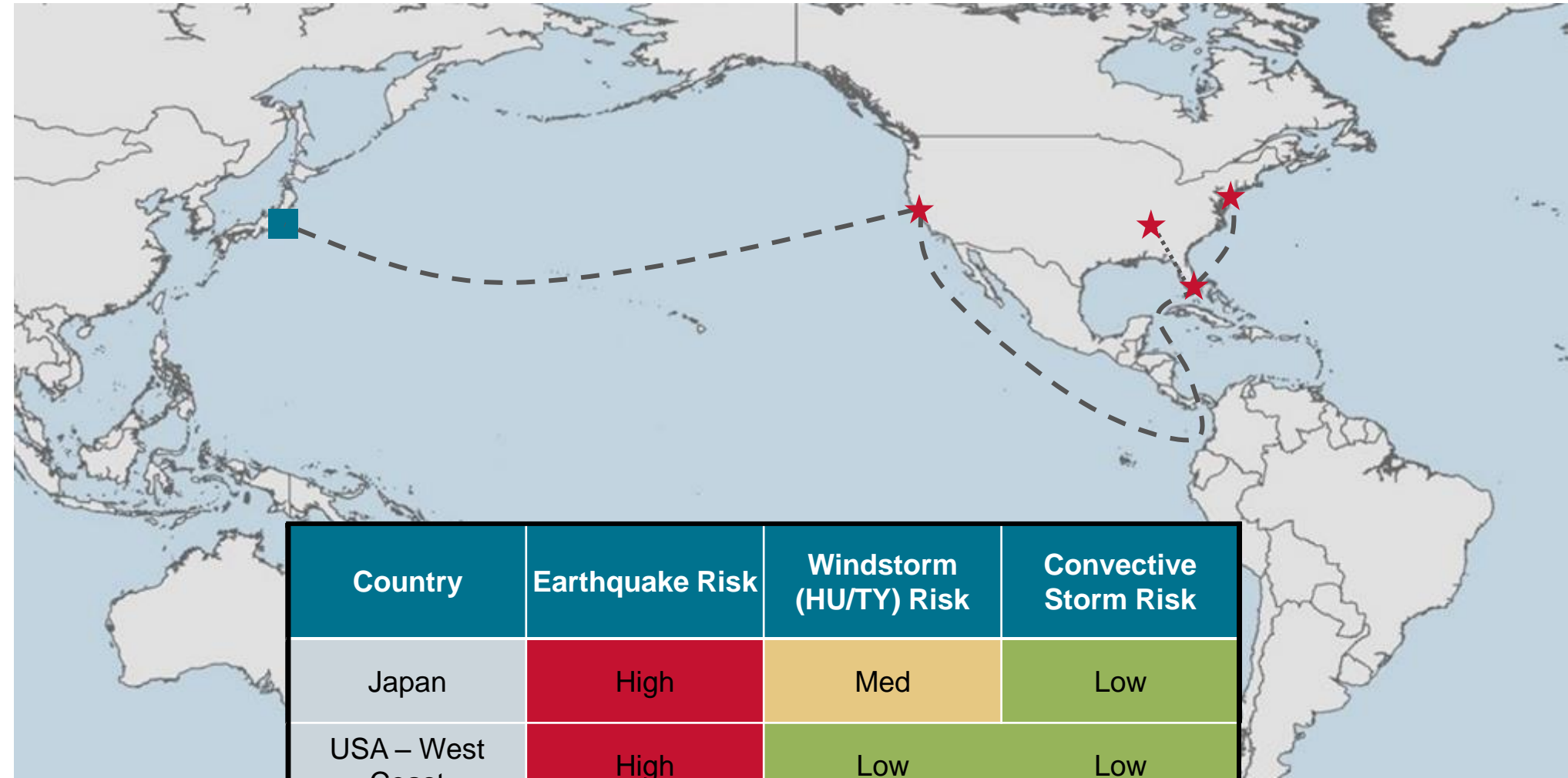


Vs.



CARGO MAY BE IN MANY PLACES

- Cargo moves around the world
- Risk varies by region
- Eg: Japanese cars Exported to US



Where is the cargo?

What are the drivers of risk in each region?

Country	Earthquake Risk	Windstorm (HU/TY) Risk	Convective Storm Risk
Japan	High	Med	Low
USA – West Coast	High	Low	Low
USA – Florida	Low	High	Low
USA - Central	Med	Low	High
USA – NYC	Low	Med	Low

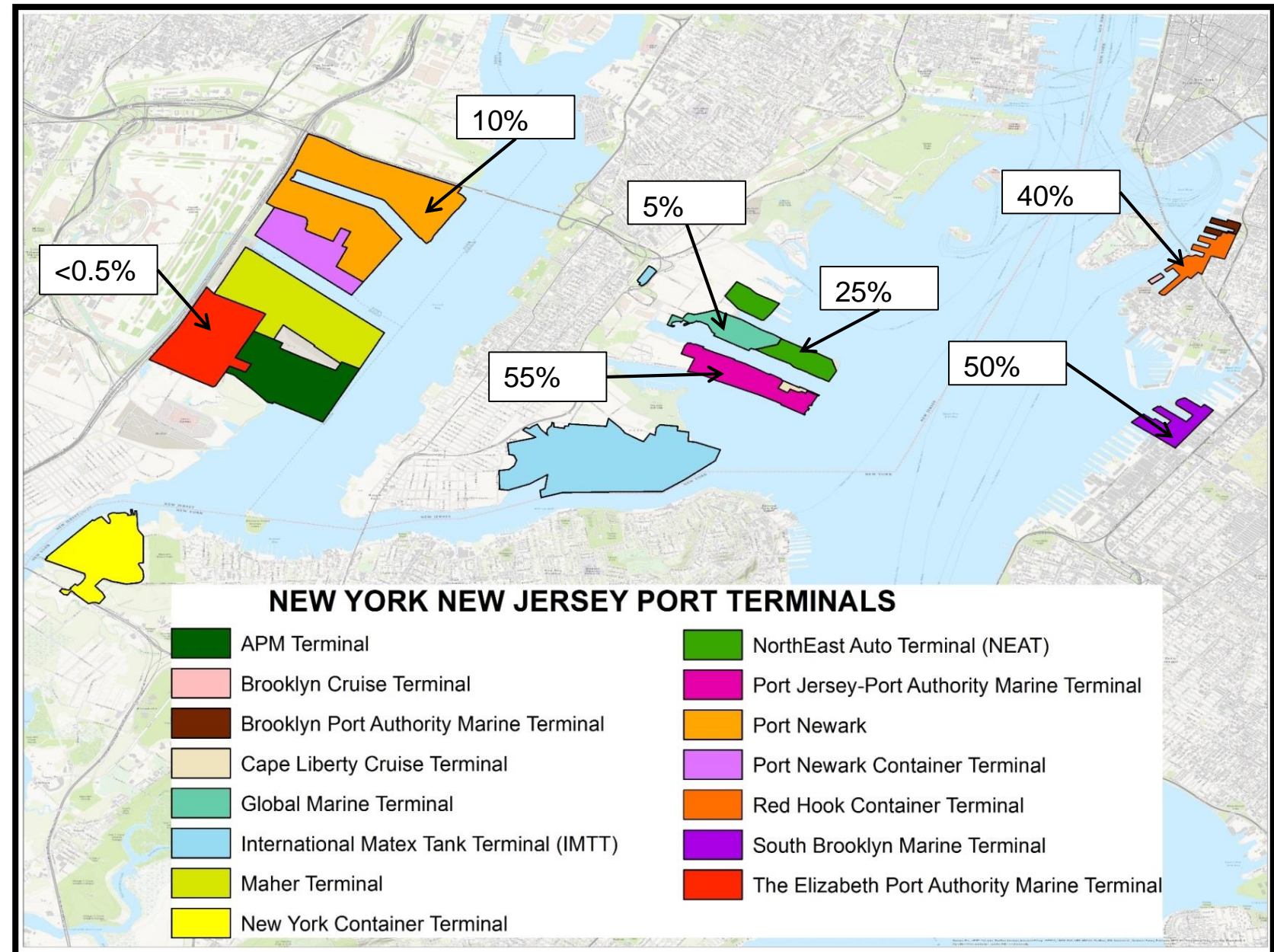
LOCATION WITHIN A PORT

- Specific information can improve risk assessment
- 2x to 10x variation in risk depending on the terminal location

Where is the cargo?

How does the risk vary by location at the same port?

Modeled Open Lot Automobile Damage – Superstorm Sandy

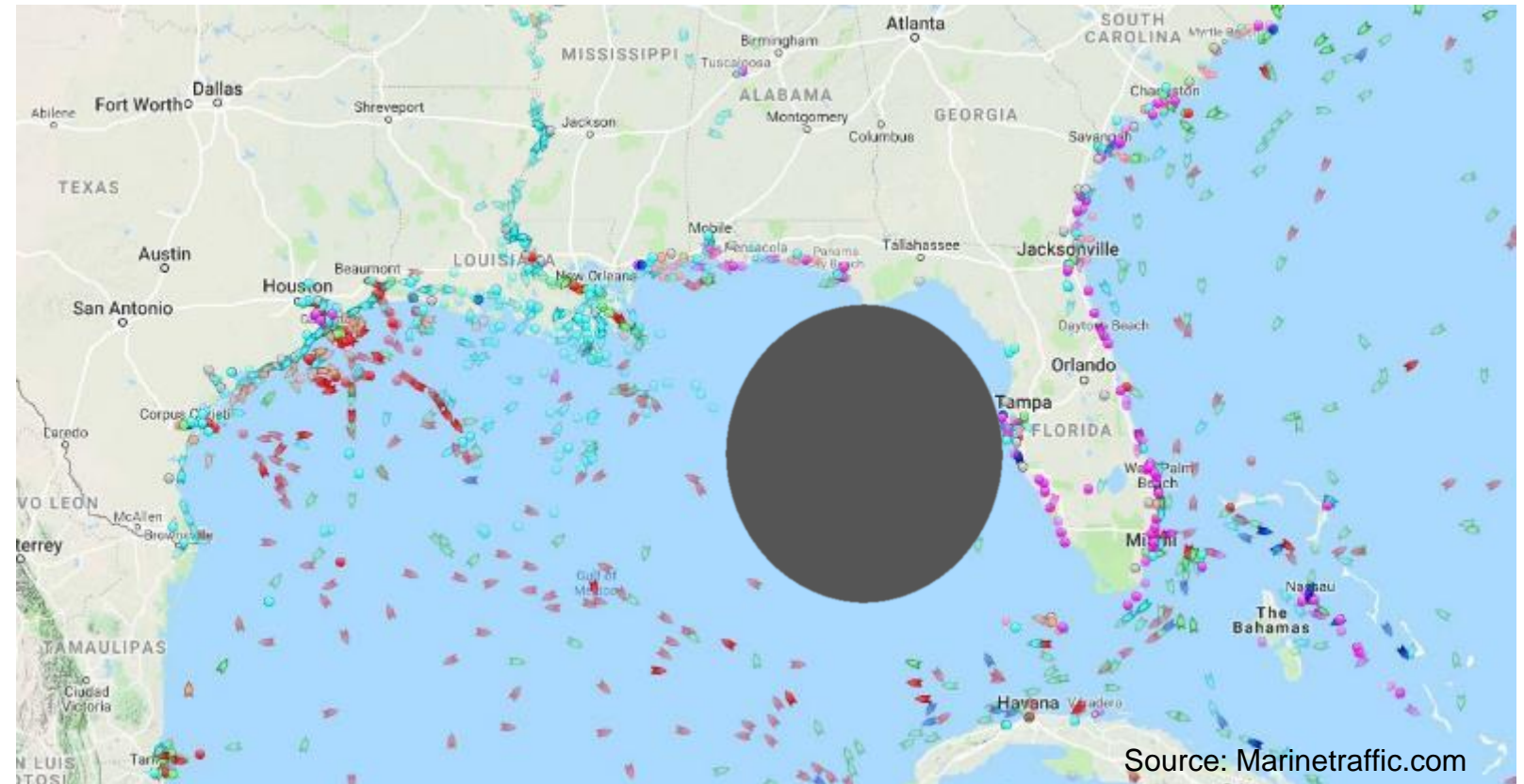


RISK AT PORT VS AT SEA

- Cargo losses occur at sea
 - Ships move around to avoid storms
- Cargo at higher risk of damage when at port or storage warehouse
 - Less likely to be moved out before an event
 - Port accumulations are the big driver of Catastrophe Risk to Marine Cargo

Knowing **when** cargo is at a specific port is critical

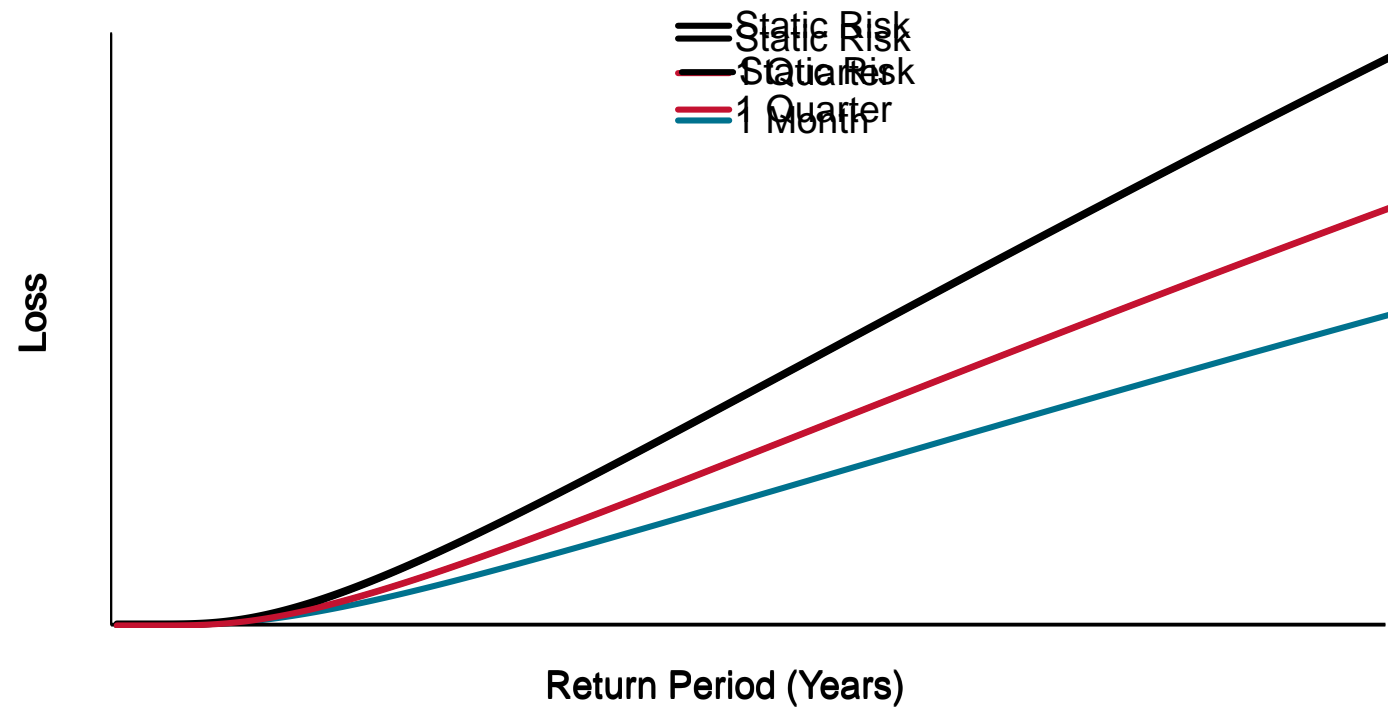
Oct 9 2018: Can you spot the Hurricane?



CARGO RISK - NON-STATIONARY

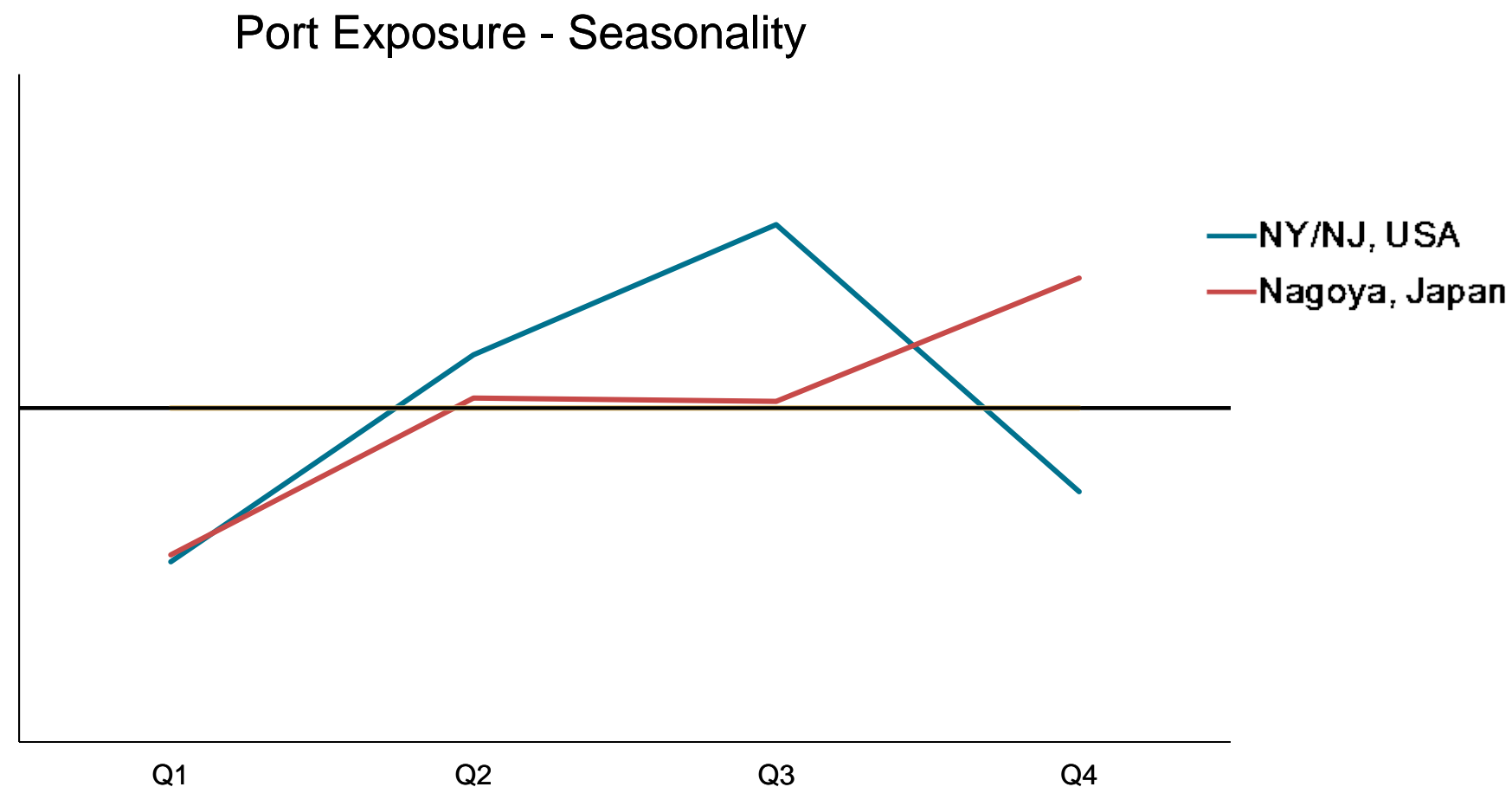
- **When** is the cargo at the port?
- Consideration of cargo movement required for accurate risk management
 - 1 month of exposure at port \neq 1/12th the risk!

Containerized General Cargo in RMS Marine Model



CARGO RISK IS SEASONAL

- Some cargo is not at port during some times of year
 - Certain types have specific seasons or higher volume times
- Time of year affects peril risk (e.g. US Hurricane Season)
- Knowing **when** during the year cargo will be at port is important



ASSESSING CARGO RISK ACCURATELY

What

MARINE CARGO IS HIGHLY DIVERSE

When goods being shipped?

Cargo & Specie Risks

How

CARGO IS SHIPPED MANY WAYS

- Many cargo lands & sizes the same way?
- Damage varies significantly by location & port?

How are things being shipped?

Where

CARGO MAY BE IN MANY PLACES

- Cargo moves around the world
- Risks vary significantly by location
- Consider long haul shipping:
 - Japan to Asia
 - Europe to USA

Where are the risks to the cargo at each location?

Origin	Destination	Maritime Risk	Port Risk
Asia	USA	High	Low
USA	Asia	Low	High
Europe	USA	Low	Low
USA	Europe	Low	Low

When

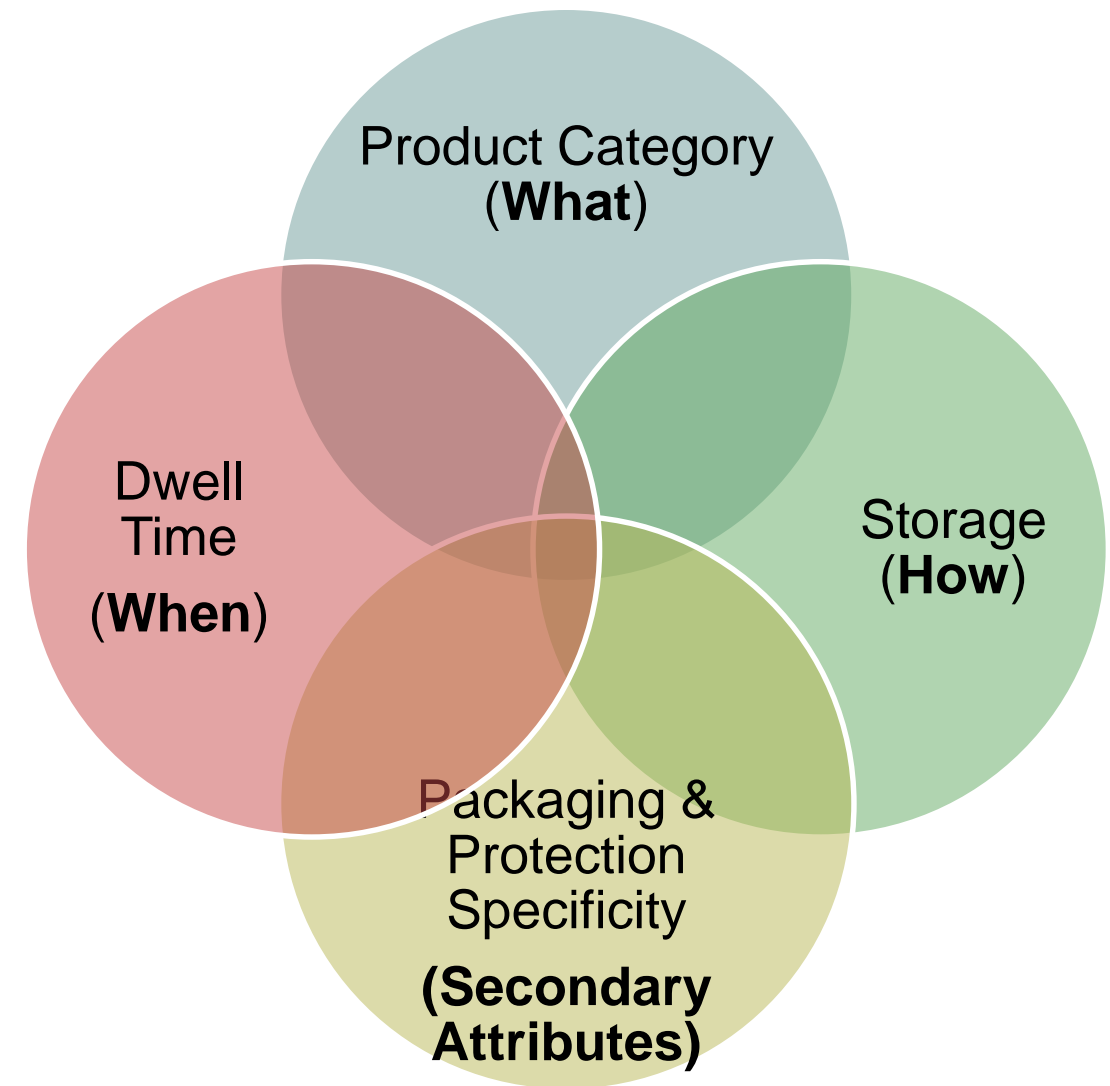
CARGO RISK - NON-STATIONARY

- When is the cargo at the port?
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Containerized General Cargo in RMS Marine Model

Additional Attributes

- Assess & manage cargo risk using a robust cat model
- ***RMS Marine Cargo Model*** allows capturing key information
 - **What?** 18 product categories
 - **How?** 12 storage methods
 - **Where?** Detailed port exposure data
 - **When?** Seasonal stats & Temporal risk adjustment
 - **Additional Attributes:** Secondary modifiers



STORAGE DIFFERENCES

- How does cargo risk vary by storage type?
- Peril dependent based on a variety of factors. Eg:
 1. Sensitivity to Power loss
 2. Water damage & Contamination
 3. Collapse (if in warehouse)



1



2



3

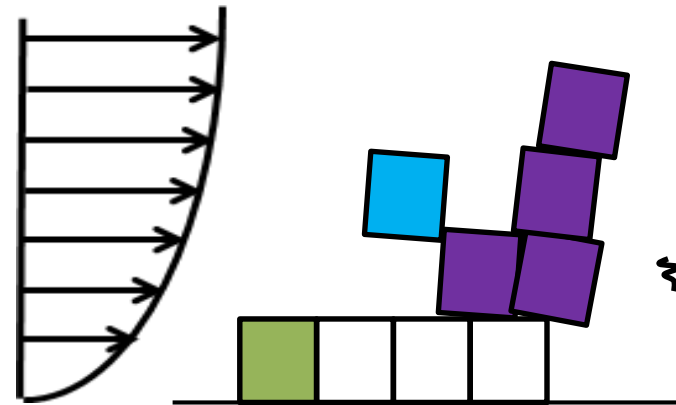
STACKED CONTAINERS

- Are stacked containers more or less vulnerable to wind than warehouses?
 - Limited research in academic community & industry on vulnerability of stacked containers
- RMS developed simulation-based analytical models to assess container stacks:
 - Wind
 - Surge & Waves
 - Shake



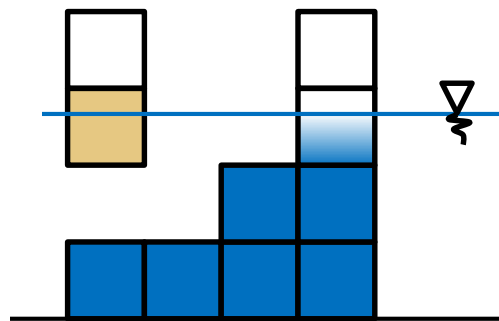
STACKED CONTAINER MODEL – WIND, SURGE & WAVE

Wind & Debris Impacts

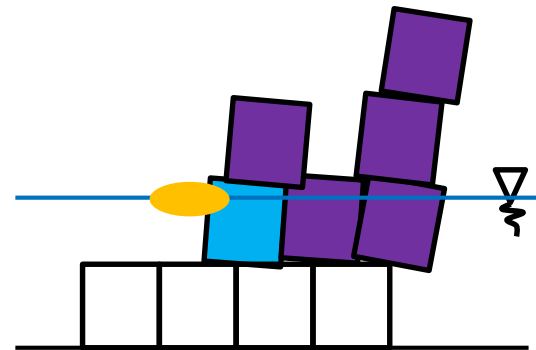


- Wind-borne Debris
- Container Exposed to winds
- Undamaged Container
- Moved container
- Breached Container

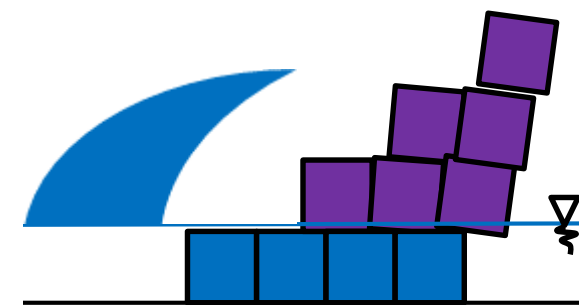
Surge Impacts



Debris Impacts



Wave Impacts



- Water-borne Debris
- Sealed container
- Undamaged Container
- Partially Submerged Container
- Fully Submerged Container
- Moved container
- Breached Container

PORT DIFFERENCES

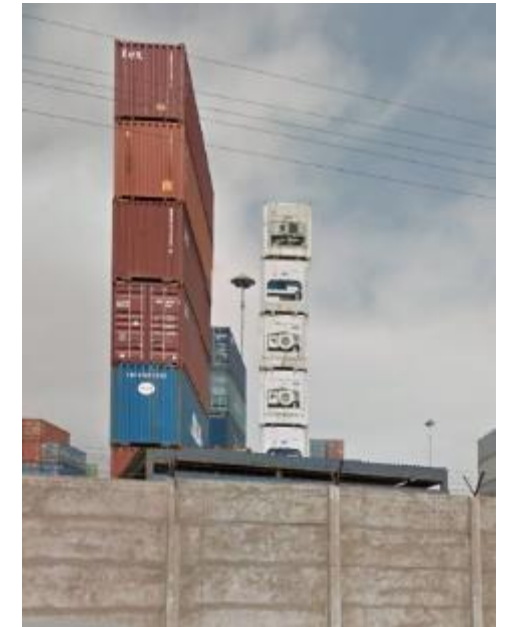
- Containers & cargo similar around the world. Storage practices are not.
→ Impacts cargo risk substantially!

- Given the same level of ground shaking, is a container stack more vulnerable in...?
 - Oakland, USA
 - Hong Kong, China
 - Iquique, Chile

Oakland, USA



Iquique, Chile



Hong Kong

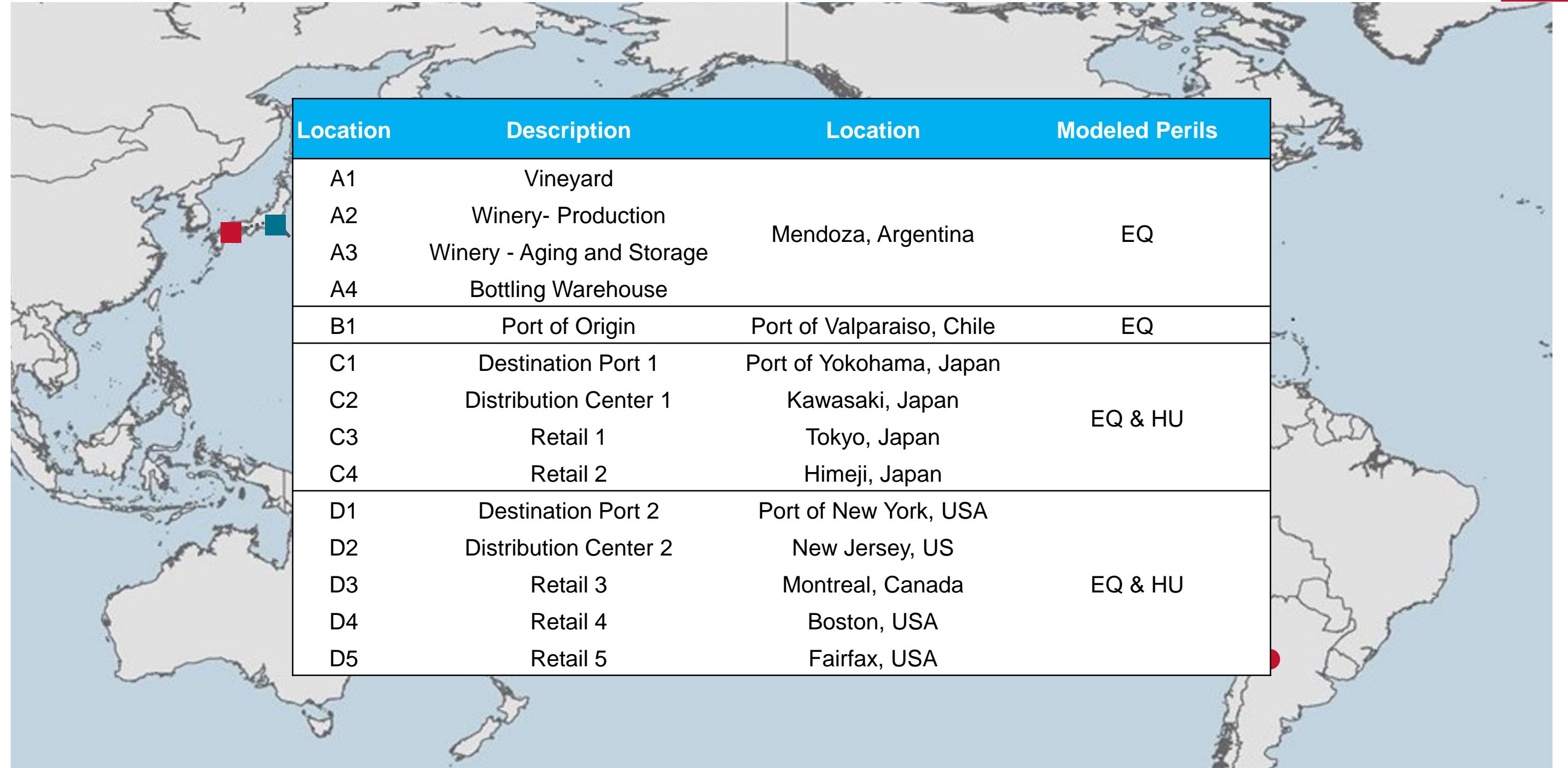


CASE STUDY: STOCK THROUGHPUT POLICY



Google Maps

CASE STUDY: STOCK THROUGHPUT POLICY



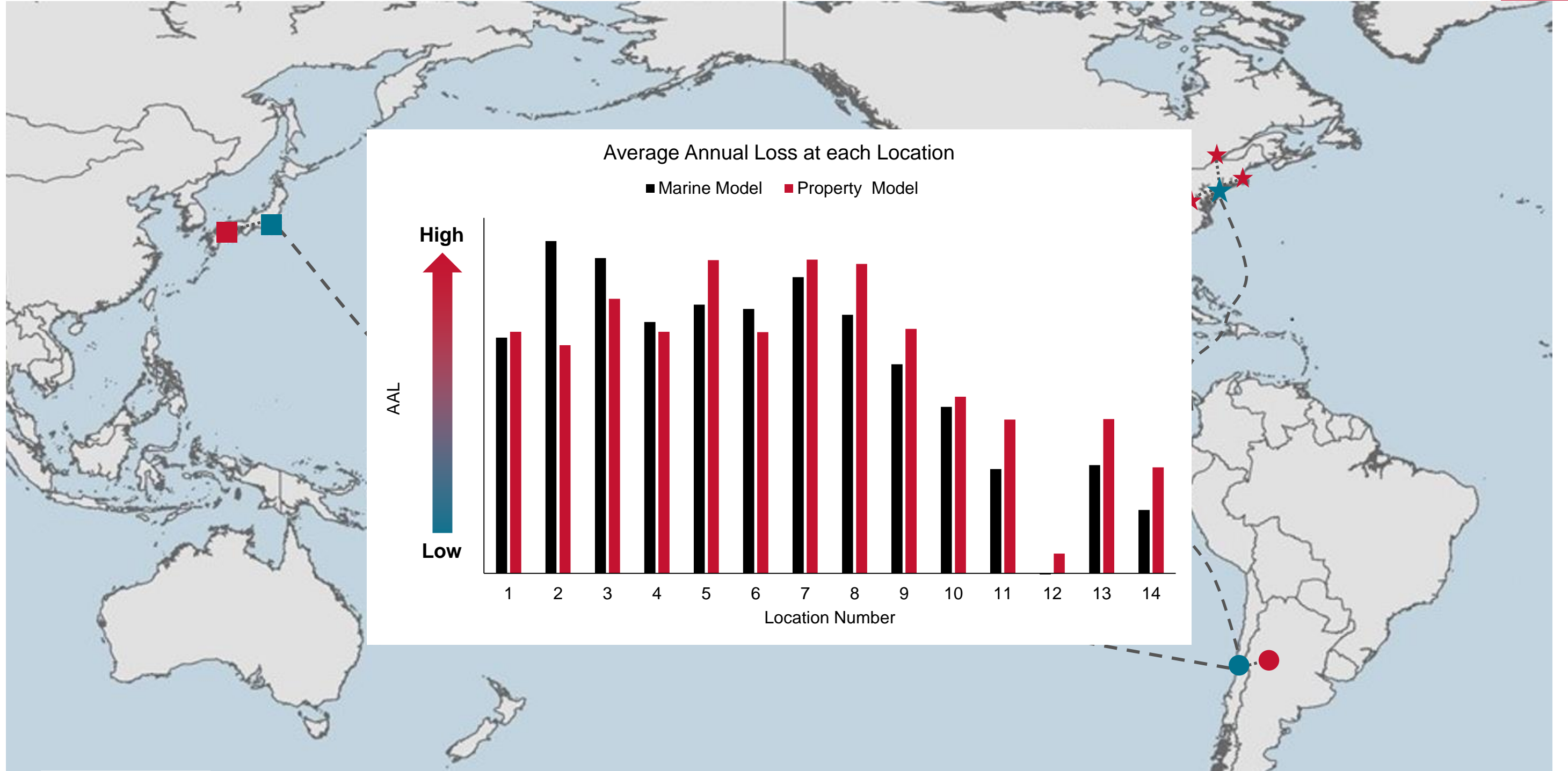
Google Maps

CASE STUDY: STOCK THROUGHPUT POLICY

Location	RMSCGSPEC CC	RMSMARINE OCC	Contents Value (\$M)	#Shipments	Dwell Time
A1	Destination Warehouse	Consumables	10		21
A2	Liquid Tanks	Temperature Controlled	30	1	30
A3	Destination Warehouse	Consumables	50		30
A4	Destination Warehouse	Consumables	10		180
B1	Inside Warehouse at Port	Consumables	5	12	3
C1	Containerized - Stacked Outside		5	6	7
C2	Destination Warehouse	Consumables	4		30
C3	Destination Retail		1	1	365
C4	Destination Retail		1		
D1	Containerized - Stacked Outside		5	6	14
D2	Destination Warehouse		4		21
D3	Destination Warehouse	Consumables	2		
D4	Destination Retail		1	1	365
D5	Destination Retail		3		

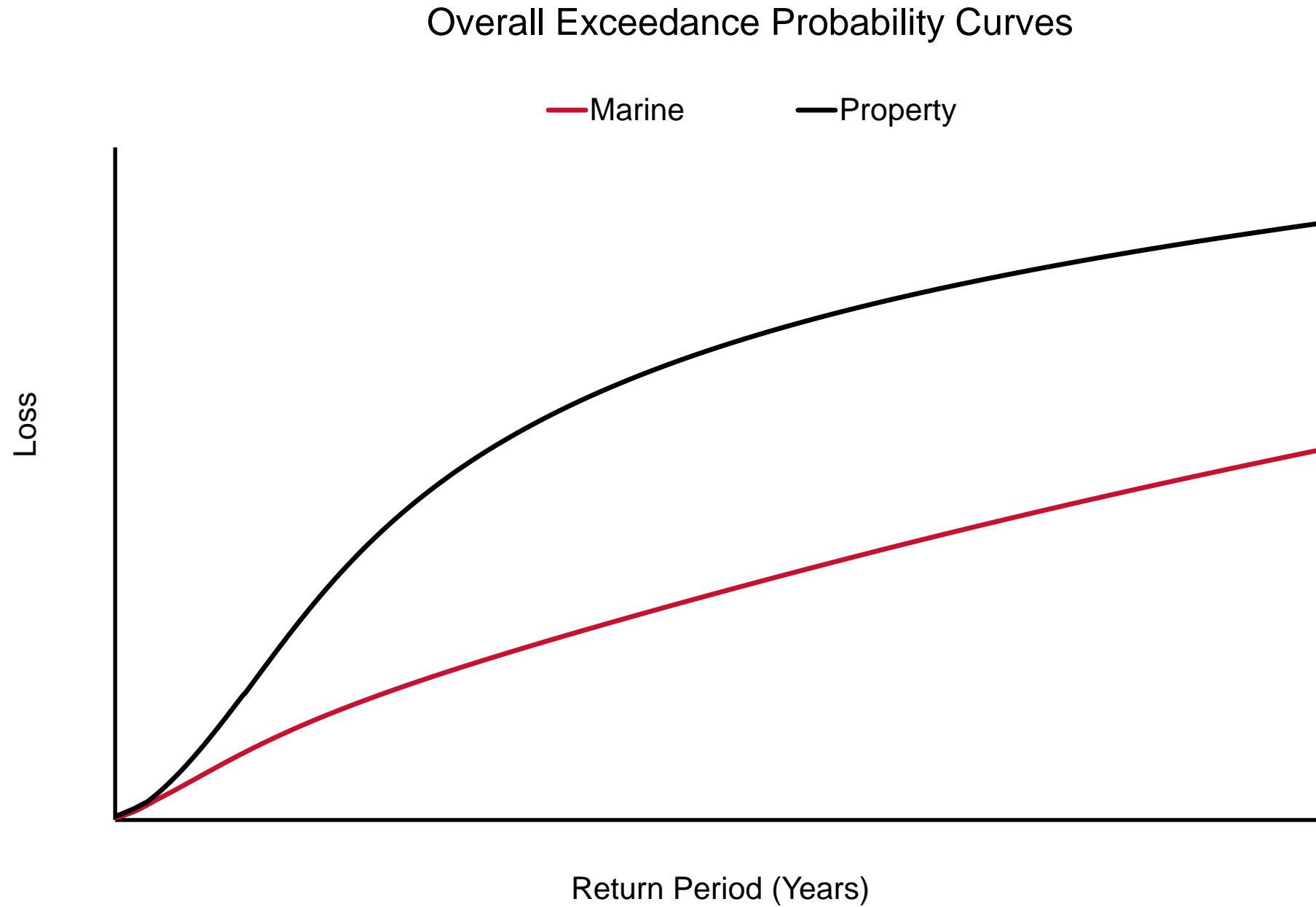
Google Maps

CASE STUDY: STOCK THROUGHPUT POLICY



Google Maps

CASE STUDY 2: STOCK THROUGHPUT POLICY



MANAGING CARGO RISKS IN THE NEW DAY

- The world is more inter-connected. Cargo risk is increasing...

- Leverage the data you have today
 - **What? How? Where? When?**

- State-of-the-science cat risk models
 - Manage cargo accumulations
 - Underwrite cargo risks profitably
 - Differentiate

