


MIT MASSACHUSETTS INSTITUTE OF TECHNOLOGY


MIT Center for Transportation & Logistics



Port Resilience

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MIT – CLI Academic Workshop

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The National Center for Secure and Resilient Maritime Commerce

- Basic research in support of technology development for **Maritime Domain Awareness**
- Basic research in support of **Resiliency**
- Education, Training, and Outreach

U.S. DEPARTMENT OF HOMELAND SECURITY | MIT Center for Transportation & Logistics | STEVENS Institute of Technology

CSR – A Department of Homeland Security National Center of Excellence for Port Security

Resilient Maritime Commerce

- Key Components of the MTS
 - Navigable waterways
 - Ports
 - Intermodal connections
 - Vessels
 - People/Users
- How do we make these more resilient?
- For reference... Supply Network Resilience
 - The ability of system to sustain and recreate itself after disruption, minimizing impact on end customer
 - Achieve through Flexibility (reconfigurable resources) and Redundancy (additional capacity, inventory)

US Maritime Commerce Today

- Increases/shifts in port volumes/sources bring uncertainty
- Volumes concentrated at limited # of ports
- Port operations are critical to business success
- High frequency of disruptions/delays with modest to high impact
- Regulatory initiatives add complexity, constraints
- Capacity: some evidence suggests there isn't enough 'port' capacity to handle disruption.
 - It hasn't been studied yet.
 - Need to understand at least 3 elements of capacity: waterway, terminal intermodal.
 - US Port Capacity Study

US Port Capacity Study

Two Driving Questions

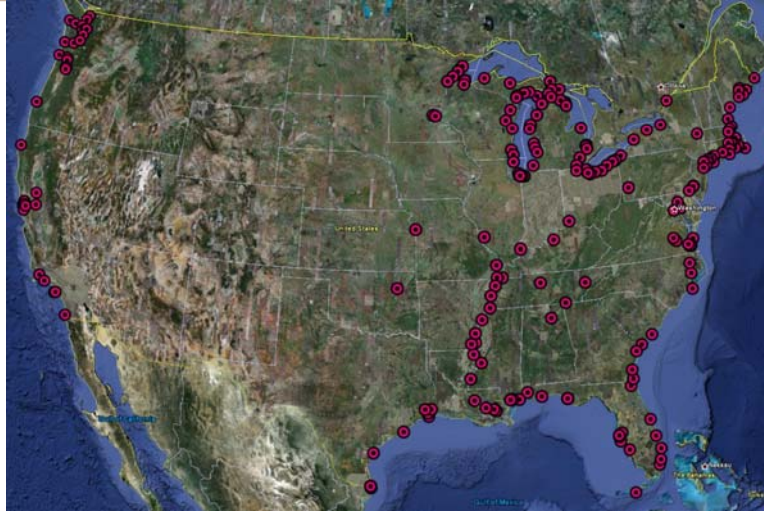
Q1

- What is the capacity of the United States port system?

Q2

- Can the system absorb a port failure

U.S. Port Locations (310)




US Port Capacity needed to absorb volume

- Total Capacity = 2,351,850,980 tons/yr
 - Max capacity utilization for ports to absorb loss of largest port's volume = 91.7%
 - Estimated additional capacity required = 196,144,372 tons/yr
- Container Capacity = 29,257,079 TEU/yr**
 - Max capacity utilization for ports to absorb loss of largest container port* = 75.5%
 - Estimated additional container capacity required = 7,178,224 TEU/yr
- Chemical Capacity = 196,948,017 tons/yr
 - Max capacity utilization for ports to absorb loss of largest chem port = 70.9%
 - Estimated additional capacity required = 57,286,403 tons/yr
- Petroleum Capacity = 956,692,790 tons/yr
 - Max capacity utilization for ports to absorb loss of largest petro port = 82.4%
 - Estimated additional capacity required = 168,618,658 tons/yr
- Food & Farm Capacity = 294,707,086 tons/yr
 - Max capacity utilization for ports to absorb loss of largest food & farm port = 41.7%
 - Estimated additional capacity required = 171,961,011 tons/yr

*Data from ACOE 2007 volumes; capacity utilization presented represents maximum utilization in order to clear volume, min ½ vessel unload per stop

** TEU data from ACOE 2007 volumes from US container ports

Absorbing Volume Post-disruption

Commodity/Conveyance Top 3 Ports for the commodity	Min Capacity Needed to Absorb Volume (all ports available)	Min Capacity Needed to Absorb Volume (excluding top 3 ports)
Container Top 3 Ports: Los Angeles, Long Beach, NY/NJ	25%	7%
Chemicals Top 3 Ports: Houston, South Louisiana, Baton Rouge	29%	7%
Coal Top 3 Ports: Mobile, Pittsburgh, Hampton Roads	16%	9%
Food and Farm Products Top 3 Ports: So. Louisiana, New Orleans, Plaquemines	58%	4%
Manufactured Equipment Top 3 Ports: Los Angeles, NY/NJ, Hampton Roads	26%	6%
Manufactured Goods Top 3 Ports: Houston, South Louisiana, Los Angeles	11%	8%
Petroleum Top 3 Ports: Houston, NY/NJ, South Louisiana	18%	8%
Raw Materials Top 3 Ports: Duluth-Superior, NY/NJ, So. Louisiana	7%	4%
Waste and Scrap Top 3 Ports: Port Arthur, South Louisiana, Vancouver	81%	19%
 All Other Top 3 Ports: NY/NJ, Los Angeles, Houston	23%	8%

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- Capacity: some evidence suggests there isn't enough 'port' capacity to handle disruption.
- Result: system in flux, concentration of volume at few ports, capacity constraints, frequent delays

Port Survey – Reference

- 525 Respondents
 - Shippers, Carriers, Terminal Operators, Port Authorities, Freight Forwarders, Customs Brokers, 3Ps
 - Likely a stronger orientation towards container volume
 - Mostly NA HQ but global presence
- 11 questions about experience with port disruptions and opinions about important processes and actions
- Convenience sampling method used
- We didn't know what we didn't know
- Purpose: Seek practitioner info to guide our next steps
 - Gauge current thinking in maritime community on resilience
 - Understand major issues increasing or reducing resilience
 - Understand frequency and causes of port disruptions
 - Assess current thinking regarding regulations

Survey: Critical Systems and Actions

	Must Be Resilient	Take Action to Make Resilient
Flex Labor	Critical	Critical
Terminal Equipment	Critical	Important
Intermodal Connections	Critical	Important
Berths	Critical	Important
Yard/Storage Ops	Critical	Important
Gate Ops	Critical	Important
Waterway Ops	Critical	Important
Maritime Transportation	Critical	Important
Electric Utilities	Critical	Important
Comm/Info Systems	Critical	Critical/Important

Suggestions/Next Steps

- Deeper study
 - By MTS component to identify system dependency for key processes
 - At the port level to understand the critical constraints at each port. A blanket solution wont work – but a common approach can. Failure mode analysis, Business continuity planning for the port including all port actors.
 - Of the US system of ports with daily volume data to understand ability of system to handle capacity considering daily and seasonal variations.
- Port Authorities
 - Absent Federal, national or other leadership, take the lead in BCP for ‘the port’ – but this might be like herding cats
 - Conduct capacity analysis of waterway, terminals, intermodal connections for port
 - Assist in developing desirable flexibility in future labor contracts
 - Expand, make more robust the waterways and intermodal connections
- Terminal Operators
 - Develop BCP for your terminal, work with vessel operators on contingency plans
 - Establish back up plans for various failure modes
- US Government
 - Consider supporting capacity building at smaller ports (large ports constrained)
 - Federal/National port policy

THANK YOU

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Research/MIT Port Resilience Project