

Transport 1:

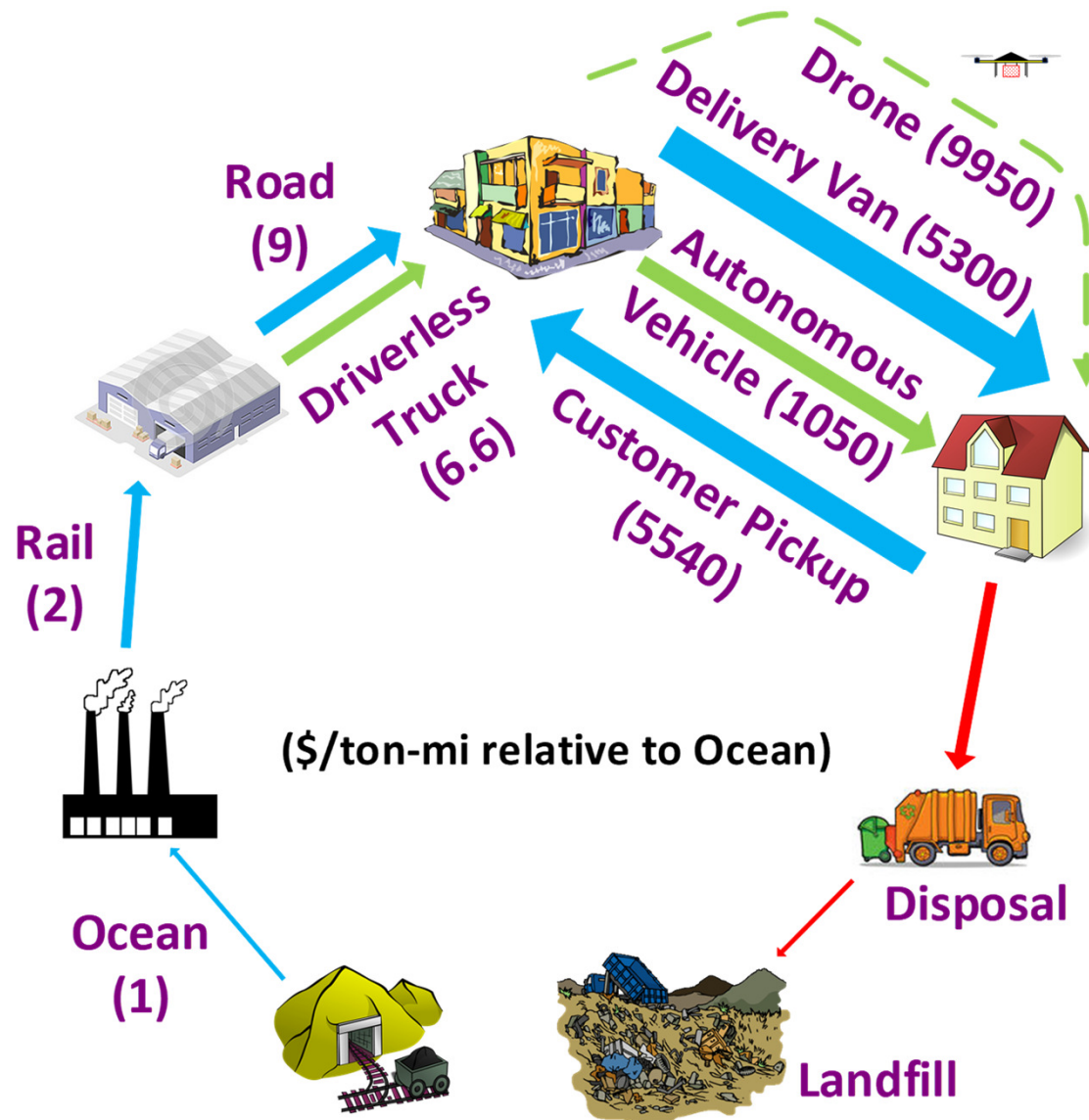
Overview of Freight Transport

- ChatGPT 4o: say something insightful about freight transport
 - Freight transport is not just about moving goods from one point to another; it's about optimizing the flow of goods through complex, interconnected systems. One key insight is the critical role of **modal integration**—combining different forms of transportation (road, rail, sea, air) to maximize efficiency. The most effective freight systems don't rely on a single mode but use a multimodal approach, leveraging the strengths of each.

Transport Modes

Mode	Cost in Cents per Ton-Mile	Cost Relative to Water
Water	2.11	1
Rail	4.23	2
Road	18.83	9
Air	137.49	47

Dirt-to-Dirt Logistics Costs



Carrier vs. Shipper

- Carrier:
 - Company that transports a shipment using its equipment
- Shipper:
 - Person or company that owns the shipment

Total 2021 U.S. Logistics Costs

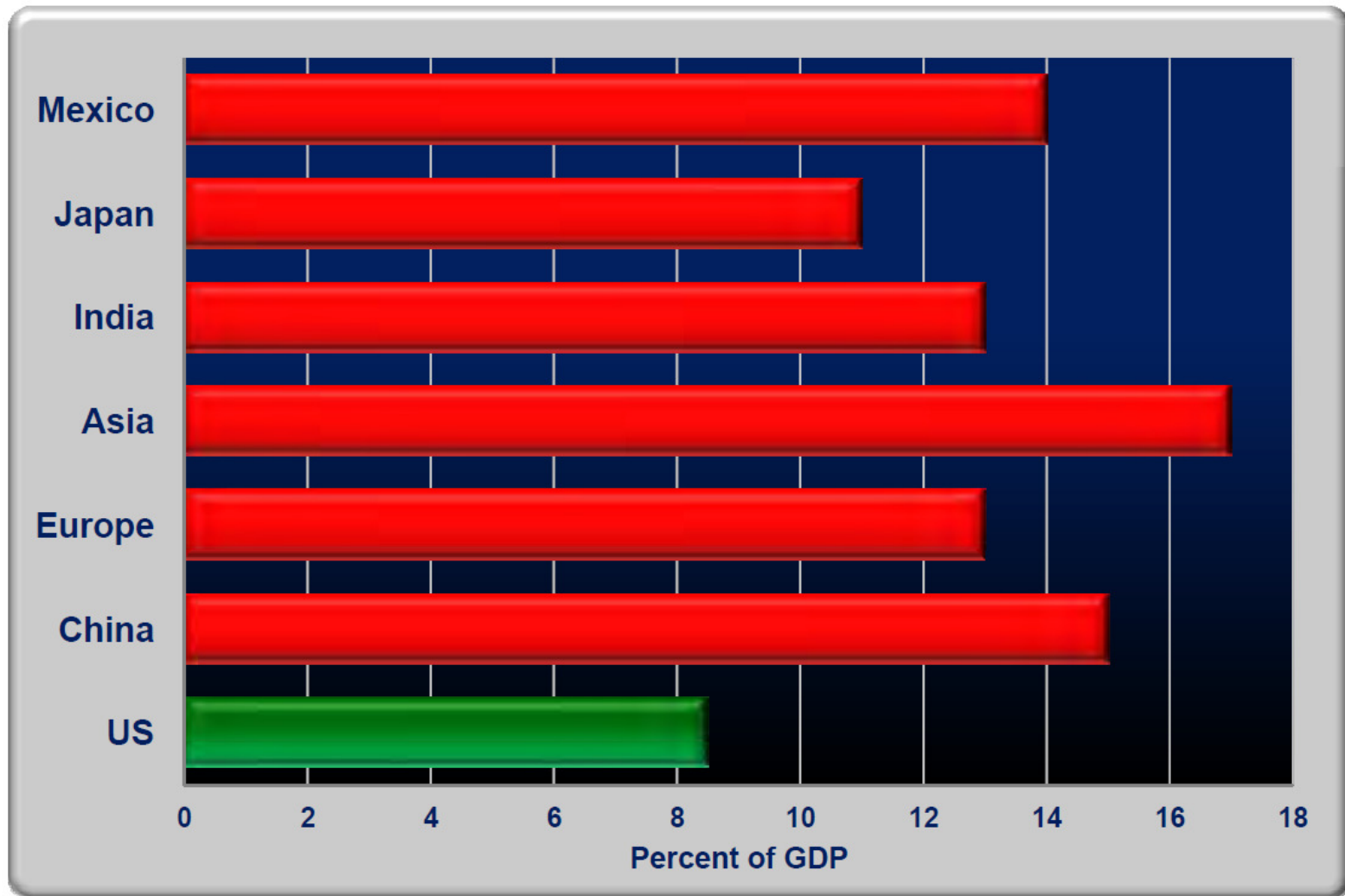
Transportation Costs		\$ Billion
Motor Carrier:	Full truckload	332
	Less-than truckload	83
	Private or dedicated	415
Parcel		135
Rail:	Carload	72
	Intermodal	16
Airfreight		53
Water		32
Pipeline		67
Total Transportation Costs		1,206
Inventory Carrying Costs (\$3,202 ⁶ billion total inv.)		
	Financial cost (WACC × total inventory)	165
	Storage	186
	Other (obsolescence, shrinkage, insurance, others)	150
Total Carrying Costs		501
Other Costs		
	Carriers' support activities	77
	Shippers' administrative costs	63
Total Logistics Costs		1,847

$$h \approx \frac{501}{3202} = 15.65\%$$

Yearly Logistics Costs	Percent of GDP (Tran/Inv%)
1981	16.2% (45/51)
2000	10.2%
2004	8.6%
2007	9.9%
2009	7.4%
2011	8.6%
2013	8.2%
2016	7.5% (64/29)
2018	8.0% (63/30)
2019	7.66%
2020	7.22%*
2021	8.03% (65/27)
2022	9.04%
2023	8.76%

*Record low

Logistics Cost as a Percent of GDP



Why Are U.S. Logistics Costs Low?

- Major reason is geography:
 1. Many natural harbors on both coasts
 2. Long-distance navigable inland waterways
 3. Many 500+ mile hauls $\Rightarrow$ rail feasible
- Another factor is that the U.S. economy is more service-oriented than other countries [Ryan Andersen]
 - reduces the need for logistics

Is Driving on the Right Arbitrary?

- No:
 - Due to the widespread use of mule trains in the U.S. for freight transport
 - most mule train drivers were right-handed, so they sat on the left rear mule to free their right hand to control the mules
 - Prior to this, riding/driving was on the left
 - This freed the right hand to grip a sword
 - Swords were obsolete by the time the U.S. was settled



Who is this person?



- He is, arguably, one of the two or three people who have had the biggest impact on global trade since WWII
- He patented his innovation, and then immediately gave it away
- He was a trucker from Maxton, North Carolina





BORN: 1914, Maxton, NC
DIED: 2001, New York, NY

DID YOU KNOW?

As McLean's first container ship left Newark harbor, a man asked Freddy Fields, a top official of the International Longshoremen's Association, "What do you think of that new ship?" Fields replied, "I'd like to sink that sonofabitch." Longshoremen strikes ensued, but the cost of shipping dropped by a factor of a hundred.

Photos: (left) Time Life Pictures/Getty Images;
(right) Edward Burtynsky

Malcom McLean

Containerized Shipping

While his name is relatively unknown today, this North Carolina trucker invented container shipping, a method now indispensable to the modern world of global trade.

Start in Trucking

Malcom McLean was born into a North Carolina farming family in 1914. Struggling to assist his family during the [Great Depression](#), he started a small trucking company to transport farmers' goods and supplies. His resourcefulness enabled him to expand to thirty trucks by 1940, and he was eventually able to sell McLean Trucking, a \$12 million company with over 1700 trucks, by the mid-1950s.

Truck to Ship to Truck

His years in the transportation business showed McLean the need for an easier method of shipping goods. He had watched dock workers unloading goods from trucks and transferring them to ships, and marveled at the inefficiency of the process. "Wouldn't it be great," he asked himself, "if my trailer could simply be lifted up and placed on the ship?" In 1955, he gambled big on a container venture, buying two oil tankers and securing a bank loan to buy \$42 million worth of docking, shipbuilding, and repair facilities. He refitted the ships and designed trailers to stack below or on the decks. In April 1956, his first container ship, the *Ideal X*, departed Port Newark, New Jersey, headed for Houston.

Sea-Land

McLean named his new company Sea-Land, and rushed to expand it, exposing the business to financial instability. The venture required a lot of capital. His aggressive investment was rewarded by the [Port of New York Authority's](#) decision to develop a new container port in Elizabeth, New Jersey, anointing cargo shipping as the method of the future.

ISO Container



40 ft = 2 TEU

**BIC
Code**



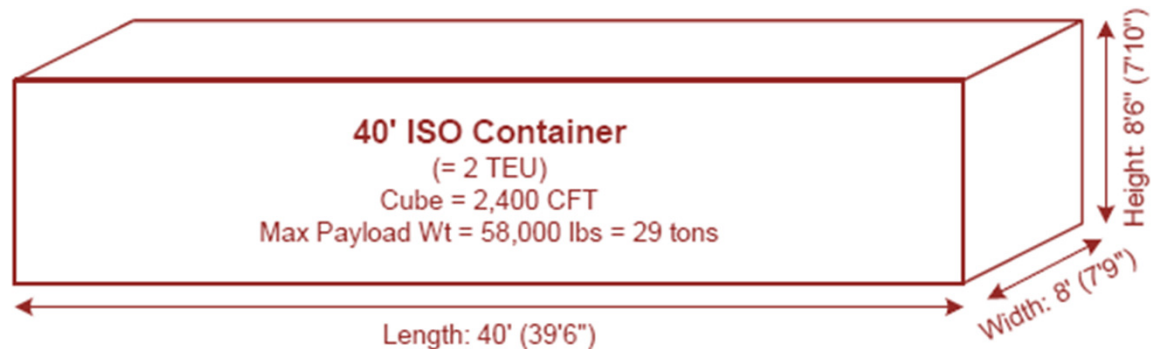
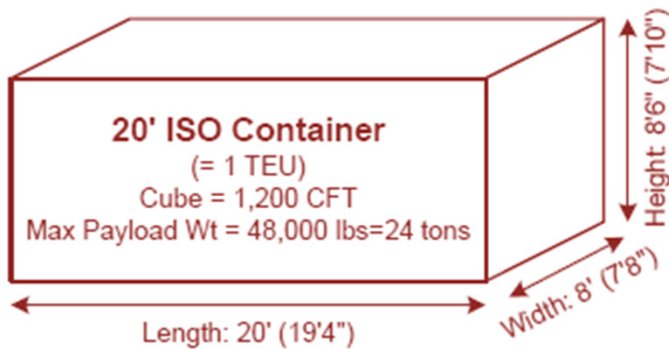
Photo: Dr. Jean-Paul Rodrigue



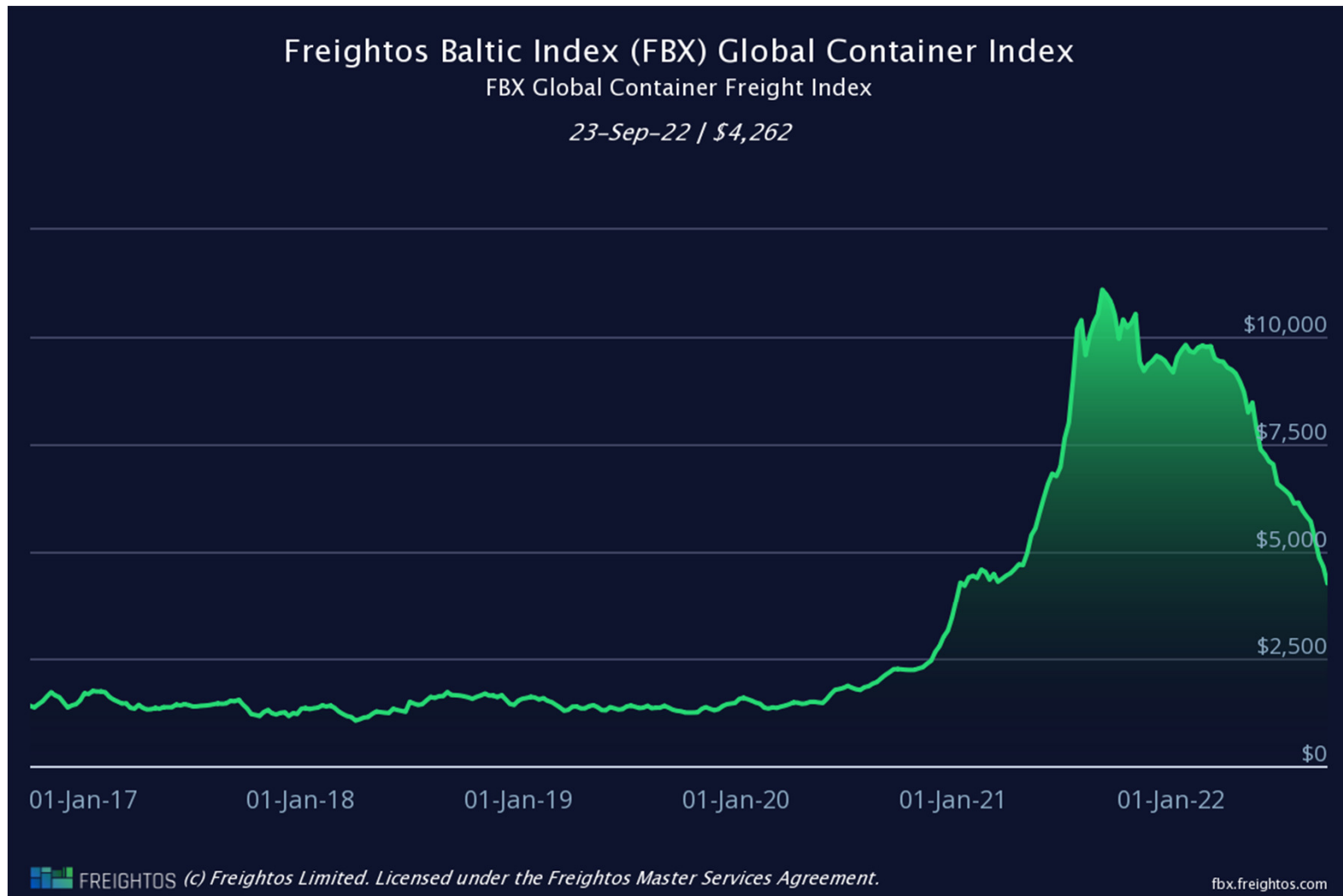
Owner Code (3 letters): UES
Product Group Code (1 letter): U
Registration Number (6 digits): 485812
Check Digit (1 digit): 5
Size & Type Code (4 digits/letters): LEG1

Operational Characteristics
Maximum weight: 34,000 kg
Container weight: 4,860 kg
Payload weight: 29,140 kg
Cubic capacity: 3,153 cubic feet

Used to transport 90% of international trade



Global Container Freight Index



FBX 2023-09-12: \$1,455

FBX 2024-09-24: \$4,701

Twistlock



Corner casting on a [shipping container](#).
The twistlock proper is done through a larger oval hole on the bottom.



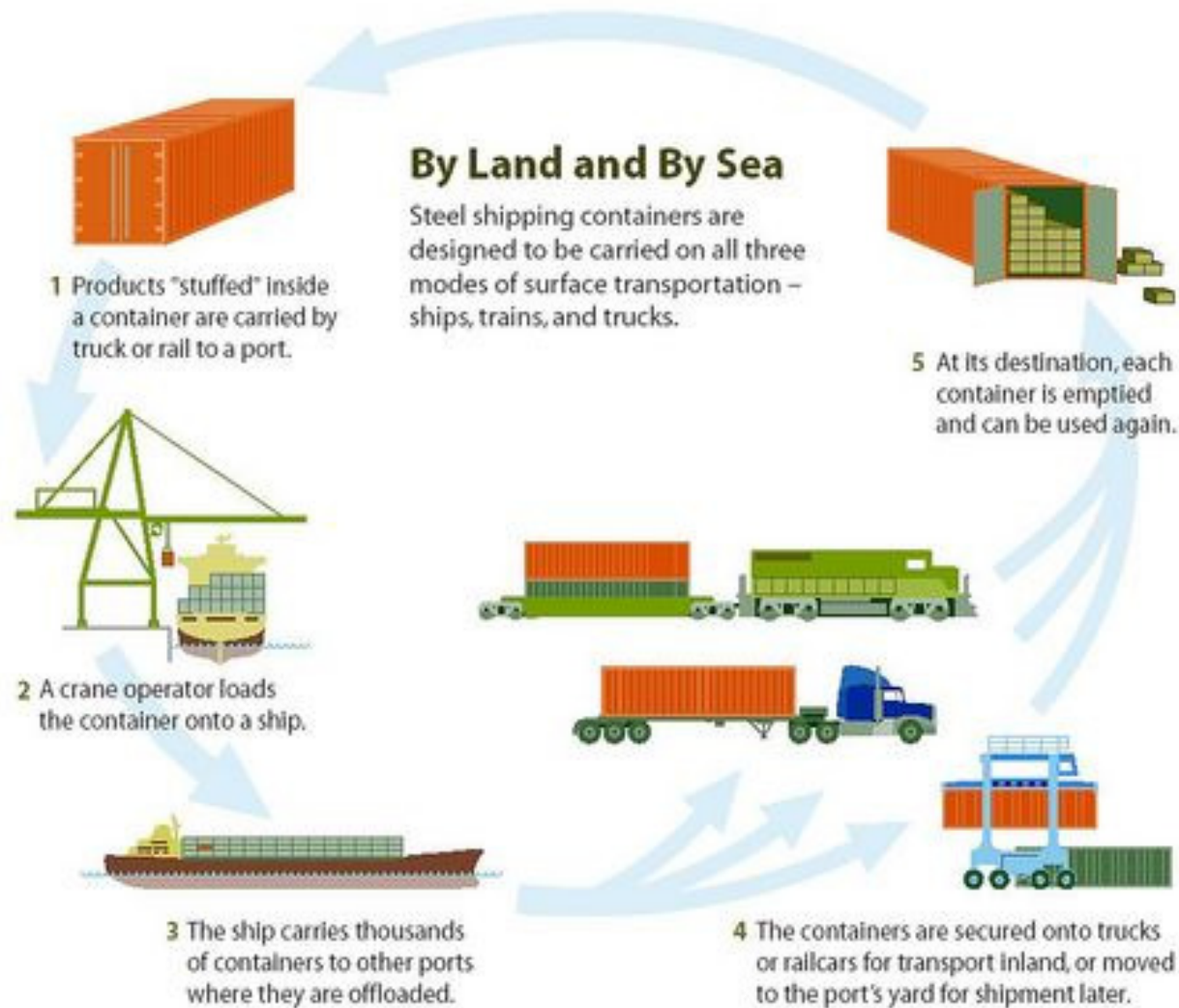
Twistlocks on the base of a container ship. Foreground: unlocked; background: locked. The [turnbuckles](#) are "lashing rods" used for additional stability



locked



Intermodal Transport



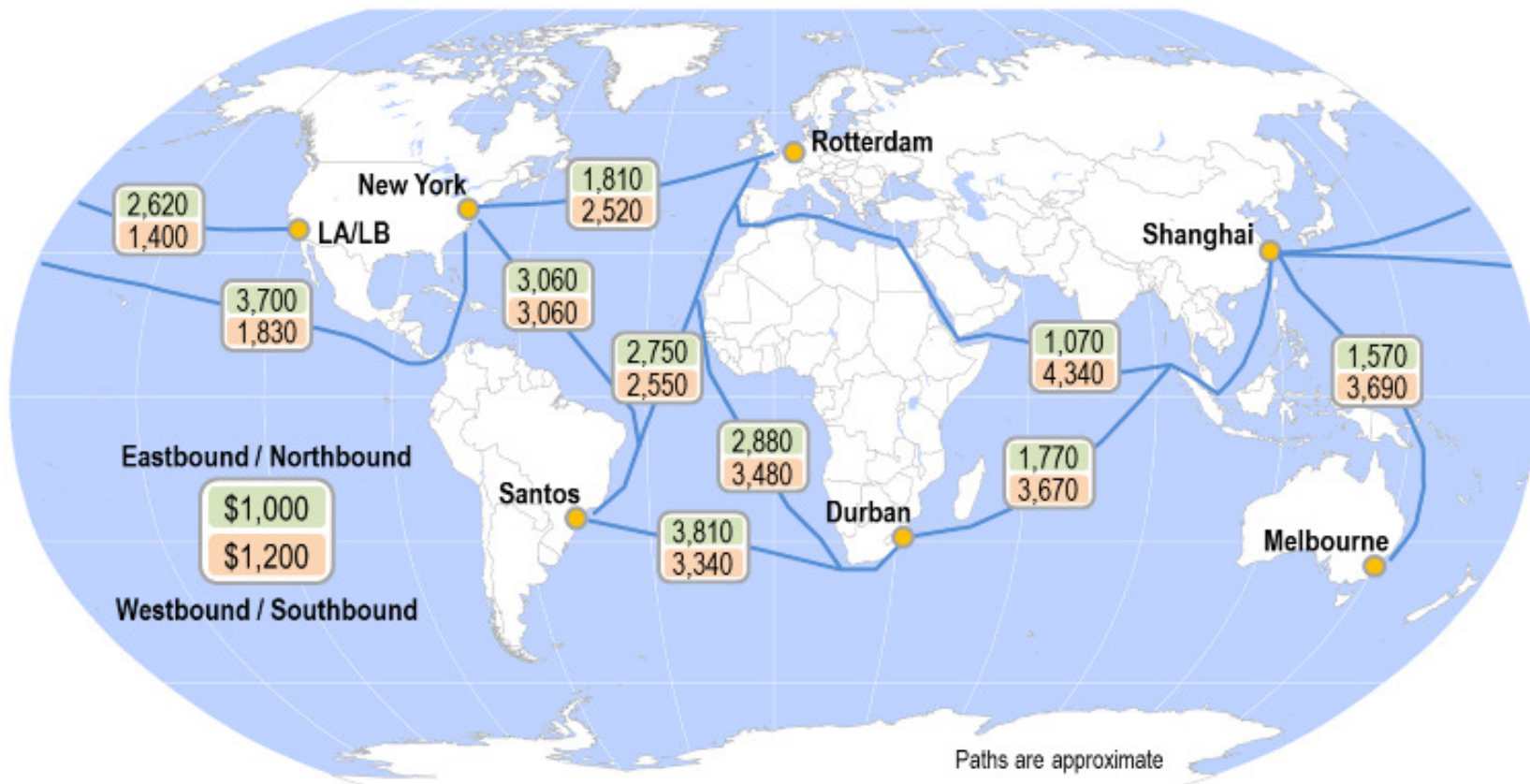
CenterPoint Intermodal Center, Chicago



www.urban-photos.com

© 2009 (BILL COBB)

Maritime Transportation Rates for a 40 Foot Container between Selected Ports, 2010

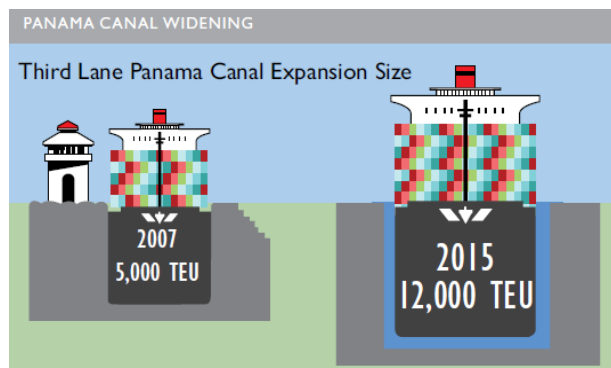
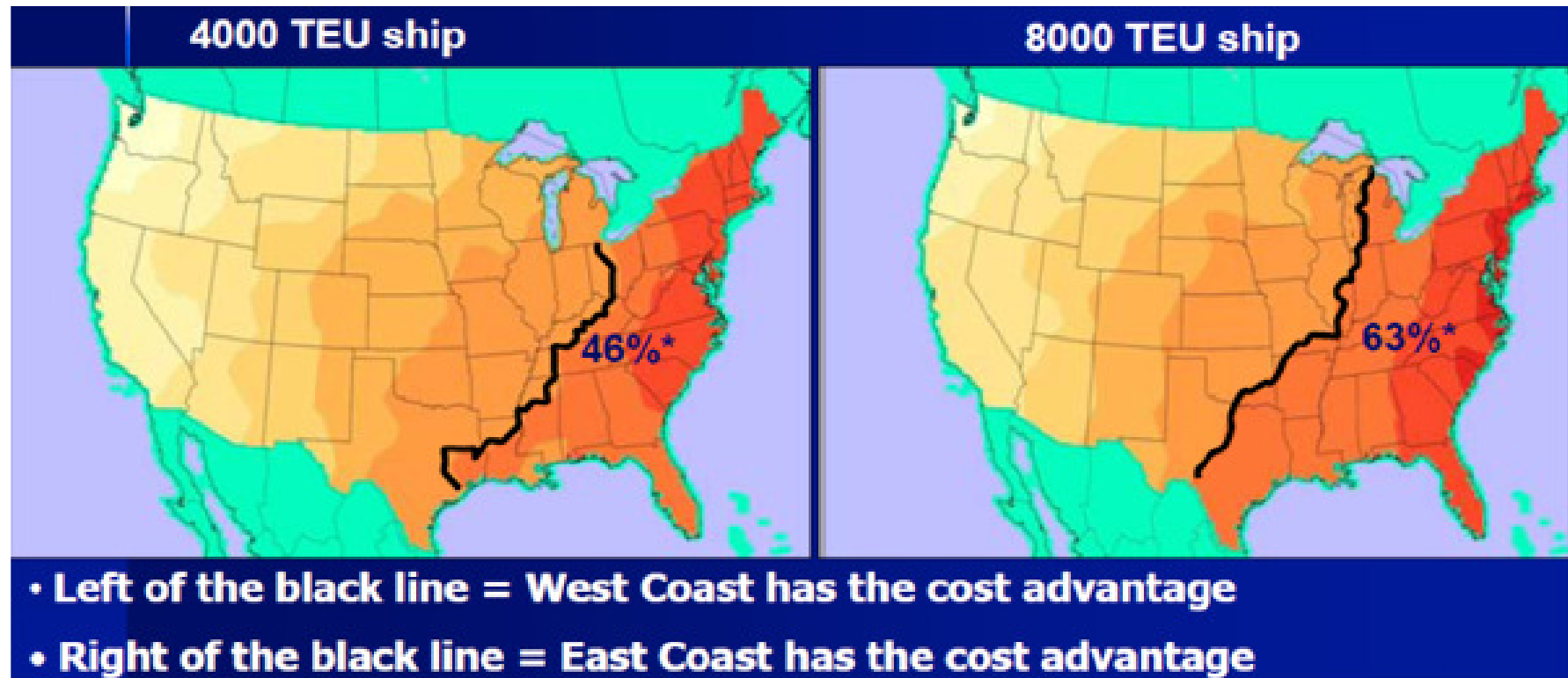


Source: Drewry Shipping Consultants. Note: Rates are for full container loads and include the base ocean shipping rate, port charges both at origin and at destination, fuel surcharges and all other surcharges.

Transit Times from Shanghai and North American Routing Options (in Days)

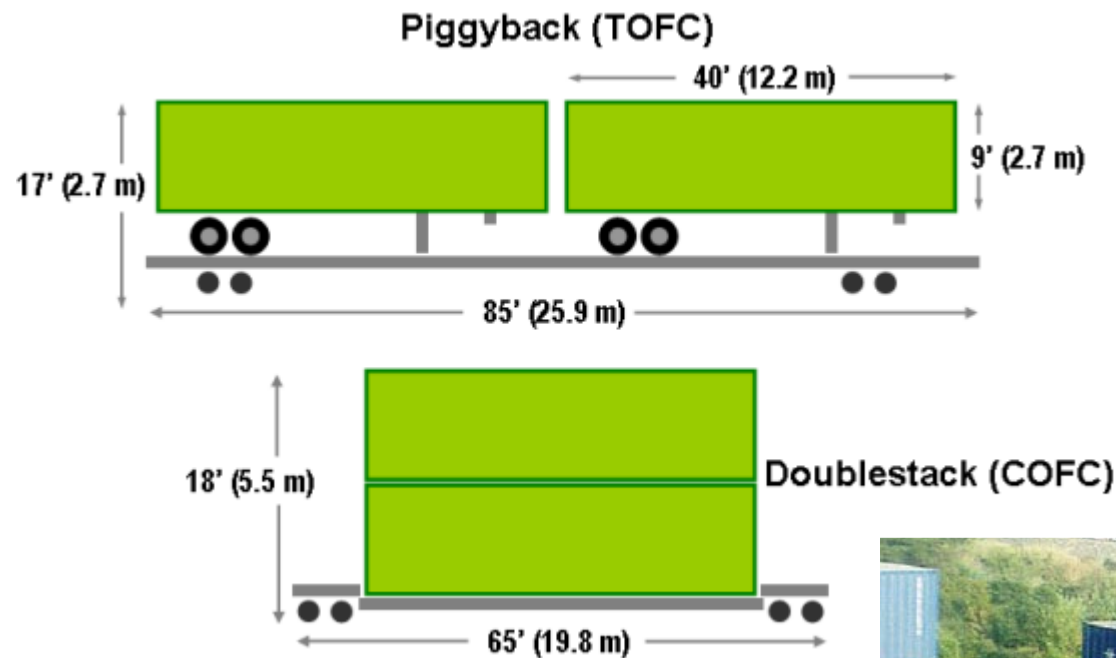


Far Reaching Effects of Canal Expansion

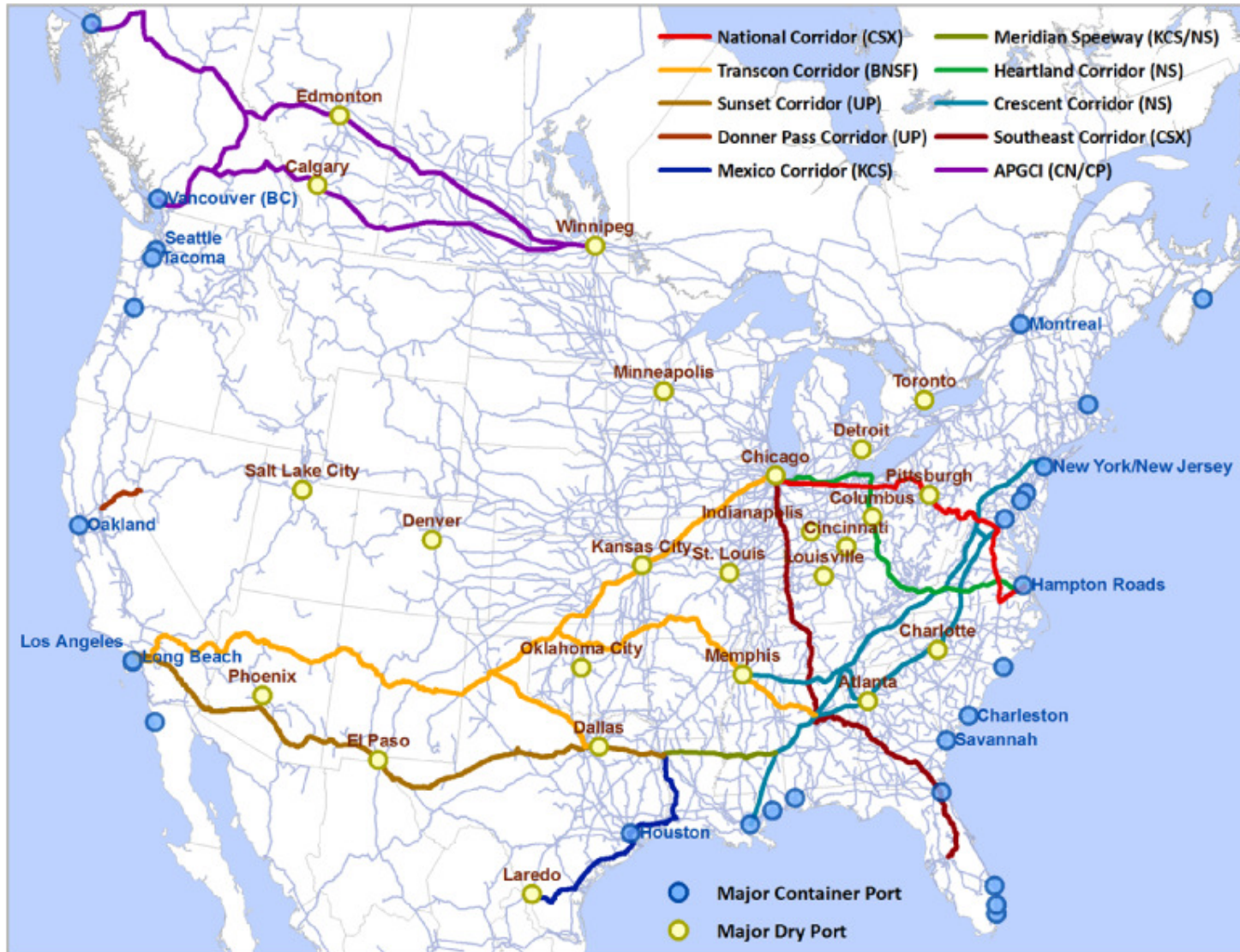


“Panamax” ship = 4000-5000 TEU Capacity
post-Panamax = too big to fit (Nimitz)
“New Panamax” = 12,000 TEU

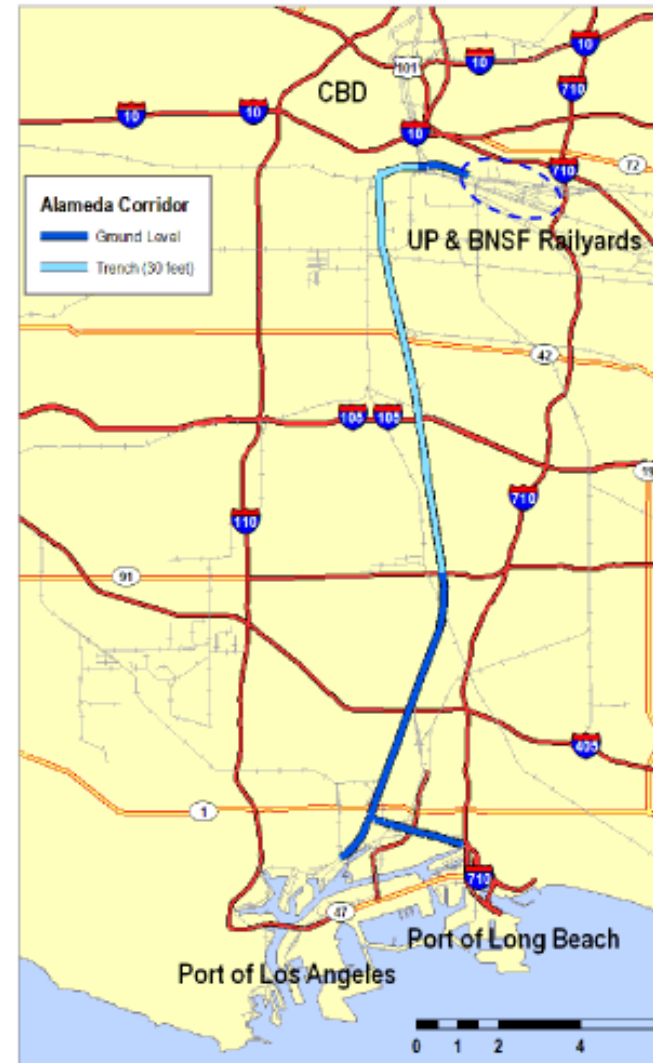
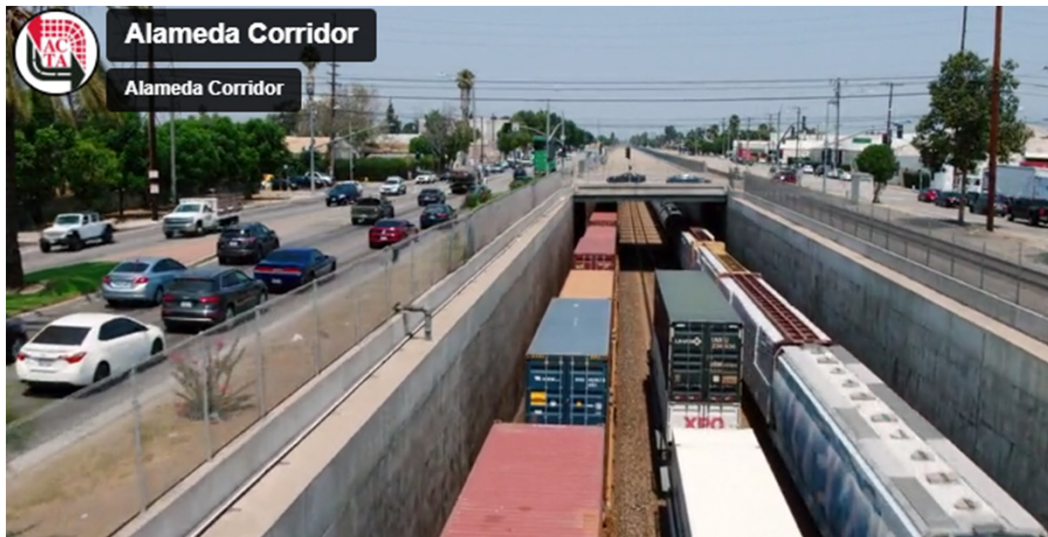
Piggyback and Doublestack Train Cars



Major North American Rail Corridors Improved since 2000

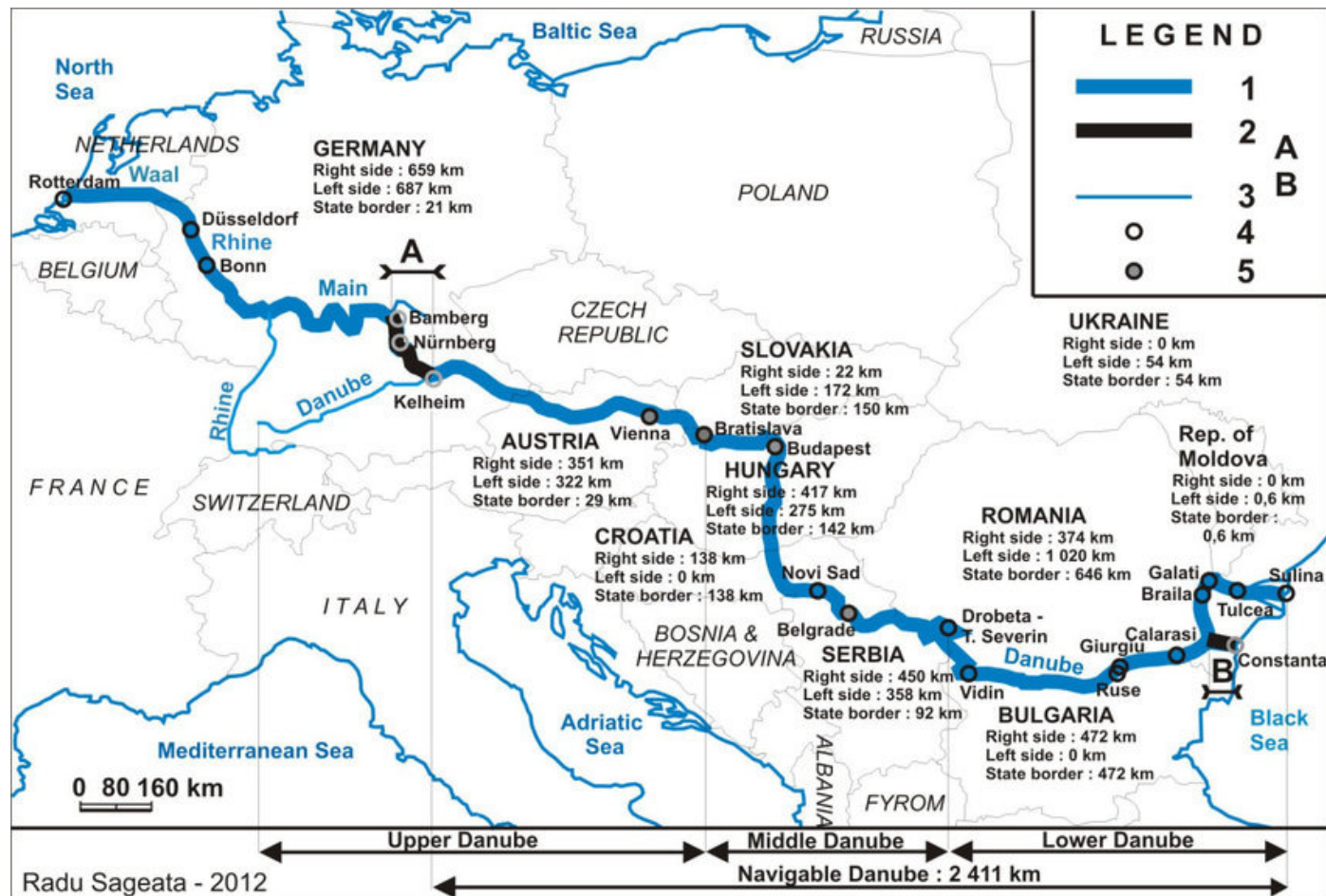


Alameda Rail Corridor



Rhine–Main–Danube Canal

- Completed in 1992. When was it started?
- Emperor Charlemagne ordered construction to start in 793



Auto ID

- Automatic identification (Auto-ID): real- time data collection and identification
- First *use case* that justified its development was all weather tracking of moving railcars
- Kartrak: colored bar code system developed mid 1960's
 - Tested in northern Norway
 - Abandoned late 70's due to stripe fading
 - Replaced by RFID (radio-frequency identification)
 - Lead to current UPC barcode

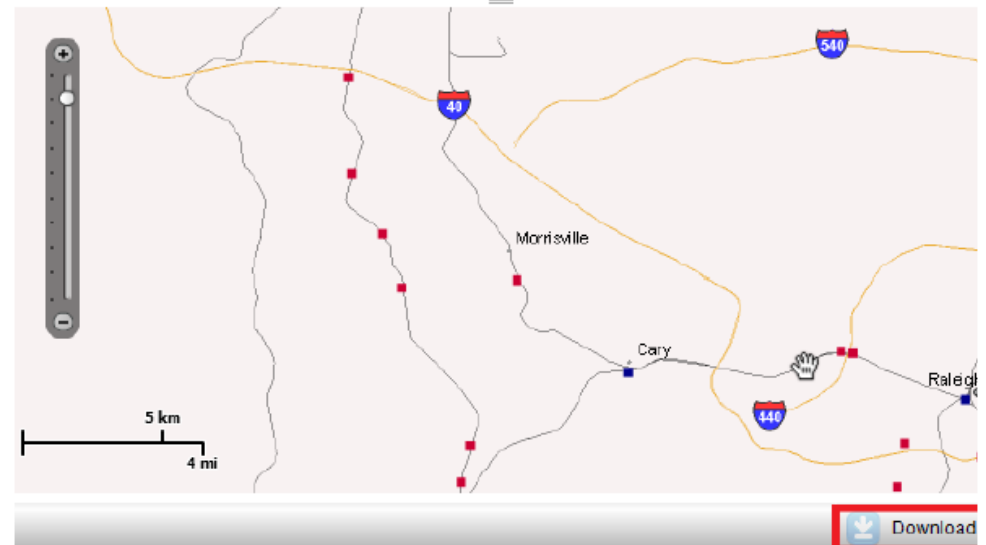


Railcar Tracking



7001 Weston Parkway, Suite 200
Cary, North Carolina 27513

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Station Detail	
Station Master Detail	OPSL Notes
SCAC	CSXT
FSAC	21603
Effective Date	08/12/1997
Expiration Date	12/31/9999
SPLC	411853000
Location Name	EAST DURHAM
Location Type	OR
Rule 260 Junc Abbrev	
Location County	DURHAM
Location State	NC
Latitude	+035.978772
Longitude	-078.876680
Zip/Postal Code	
Print Station OPSL Notes	EAST DURHAM


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LATEST NEWS

[CEPM Webinars Announced](#)

Aug. 22 - Railinc has announced the webinar schedule for CEPM Wheelsets.

[CEPM-Wheelsets On-Schedule](#)

Aug. 8 - The first phase of the CEPM project is on-track for launch in January 2012.

[Newsroom](#) ▶

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RAILINC SHORT LINE INDEX

July 2011 - 334,986

July 2010 - 328,102

Carloads Up Two Percent,
Metallic Ores, Nonmetallic Minerals,
& Lumber & Wood Products Lead
Gains

[See details](#) ▶

UMLER EQUIPMENT INDEX

2nd Qtr 2011 - 1,948,957

1st Qtr 2011 - 1,949,315

North American Fleet Size Remains
Steady During 2nd Quarter 2011

[See details](#) ▶

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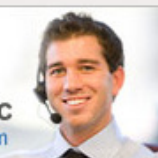
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1-877-RAILINC
csc@railinc.com

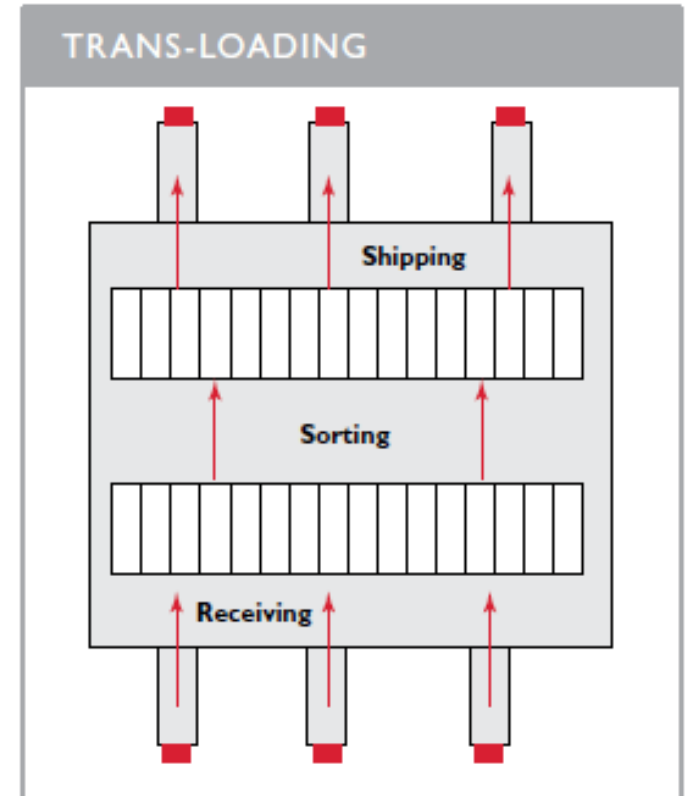


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Cary, NC 27513
(877) 724-5462

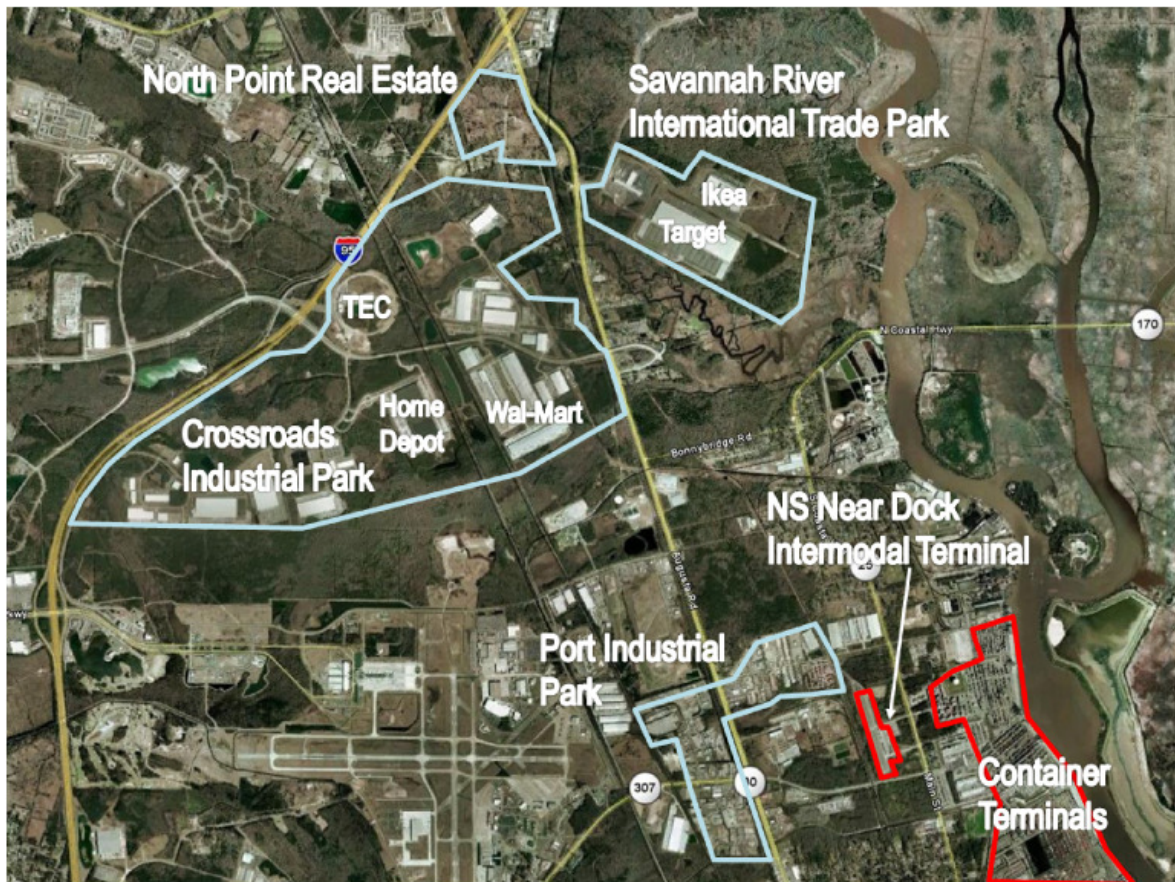
FREIGHT RAIL WORKS

Transloading

- Process of transferring a shipment from one transport vehicle to another
 - a.k.a. (or similar to) transshipping
- Advantages of transloading at a port prior to transport to inland distribution centers (DCs):
 - Contents of four 40-ft containers fit into three 53-ft domestic containers or semi-trailers
 - Empty 40-ft containers don't need to be returned from DC
 - Can re-sort and delay final assignment to DCs instead of shipping full contents to a single DC
- Disadvantage: Increased handling (cost and damage)



Savannah Logistics Cluster



Port of Savannah



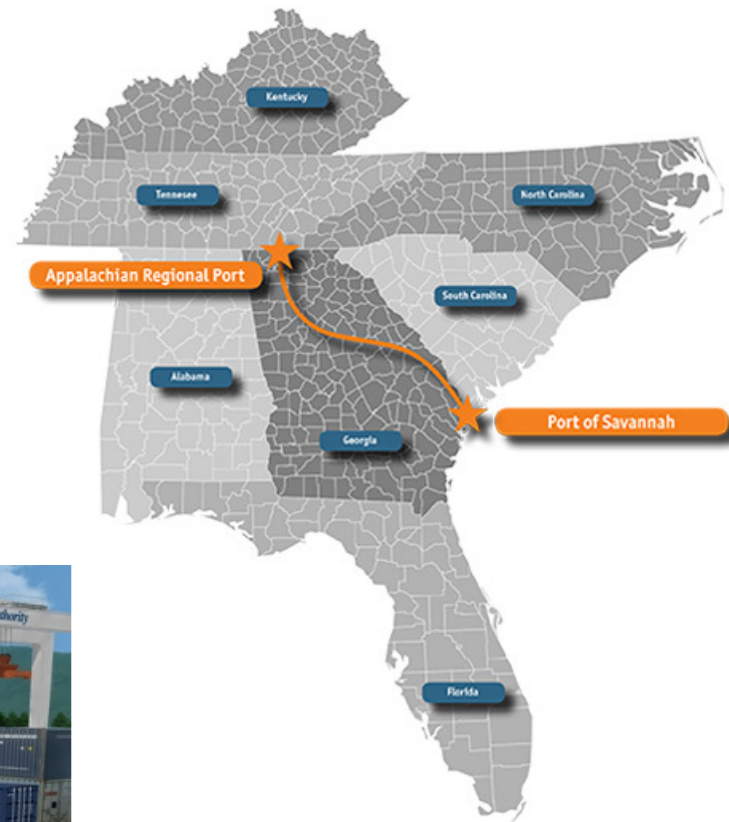
I-75 Commercial Vehicle Lanes

- Heavy truck traffic between just south of Atlanta and Port of Savannah
- Proposed project would consist of two barrier-separated commercial vehicle only lanes along I-75 median
- Would reduce
 - Congestion
 - Truck/car accidents
 - Maintenance cost of general purpose lanes
- Open to traffic in 2029
- Cost estimate is \$1.8 billion



Appalachian Regional Port

- Example of an *inland port*
- Provides direct 388-mile rail route to/from Port of Savannah
- Bypasses Atlanta congestion
- Reduces truck congestion at port
- Eliminates need for transloading
- Opened August 2018



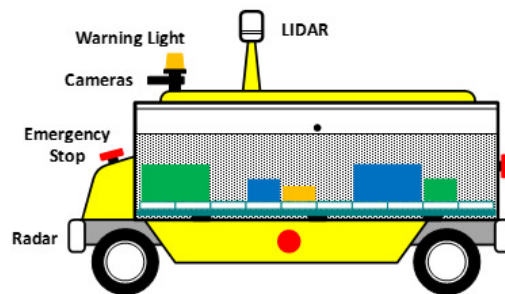
Vehicles for Home Delivery



(a) Delivery van (\$1.58/del)



(b) Nuro delivery vehicle (\$?/del)



(c) Autonomous vehicle (\$2.27/del)



(d) Starship delivery robot (\$1.89/del)



(e) Drone (\$0.80/del)

(f) Customer pickup at store (\$11.94/trip)

Last-Mile Logistics

Amazon Drone



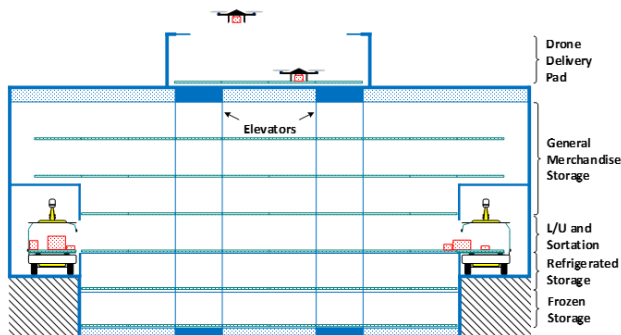
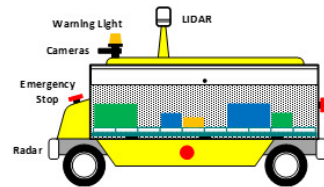
Starship Delivery Robot



Nuro Delivery Vehicle

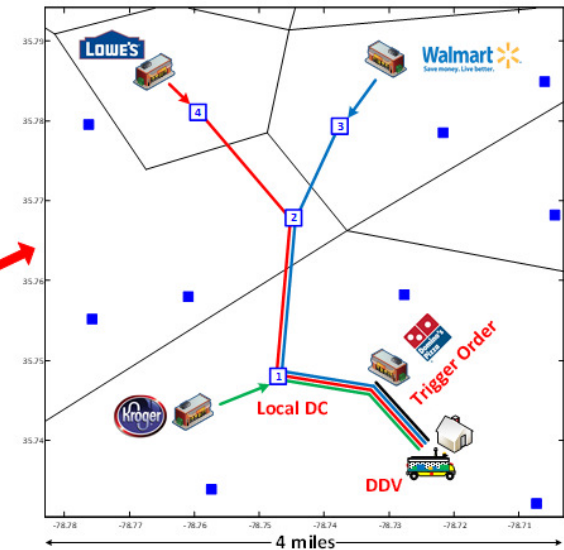
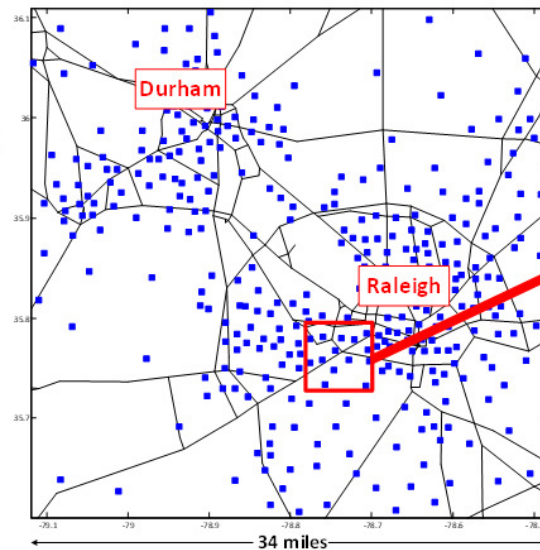


Generic Driverless Delivery Vehicle



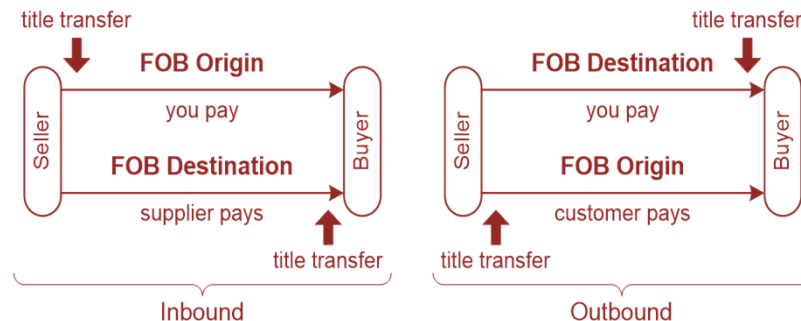
Home Delivery Alternatives

Unloading at Home	P2P On-Demand Delivery	Multistop Delivery Window
Customer Supervised	- High-value driver-based (pizza) - Driverless vehicle (manual unloading)	Bulk-item driver-based (furniture, appliances)
Unattended (packages/container)	Drone	- Low-value driver-based (UPS, USPS, FedEx) - Driverless vehicle (auto unloading)



Misc. Freight Terms

- **Demurrage**
- per-day fee to keep container/trailer
- **Drayage**
- short-distance transport (dray horse)
- **Dunnage**
- material to secure cargo in container (air bag, “popcorn”)
- **Bill of Lading** (blockchain)
- contract between carrier and shipper that serves as title for shipment
- **FOB (Free-on-Board)**
- indicates when seller transfers title to buyer



- **Truck vs. Tractor-Trailer**



- **Reefer**
- refrigerated container or trailer
- **Bobtail**



- **Common Carrier (vs Private Carrier)**
- carrier that serves general public
- **3PL (third-party logistics provider)**
- firm that specializes in providing warehousing and transportation services for hire

Misc. Freight Terms (cont)

- **Deadheading**
- truck travel without a load
- **Doubles**



- **Fifth Wheel (and Kingpin)**



- **Hours-of-Service (HOS) regulations**
- “Drivers may drive up to 11 hours in the 14-hour on-duty window after they come on duty following 10 or more consecutive hours off duty”
- **Sleeper, Driver Team**
- allows non-stop travel with one person driving while other sleeps
- **Tare Weight**
- Tare = Gross vehicle weight – Payload
- **Lumper**
- laborer hired by a trucker to unload freight at a warehouse