Intermodal Freight Transportation and Railroads

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AREMA®
American Railway Engineering and Maintenance-of-Way Association

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Definition

- **Intermodal shipment: a freight shipment that moves between origin and destination using two or more modes of transportation**
- **Types of intermodalism:**
  - unitized
  - bulk
- **Growth of unitized intermodal shipments has been a spectacular trend in transportation**

Intermodal Operations

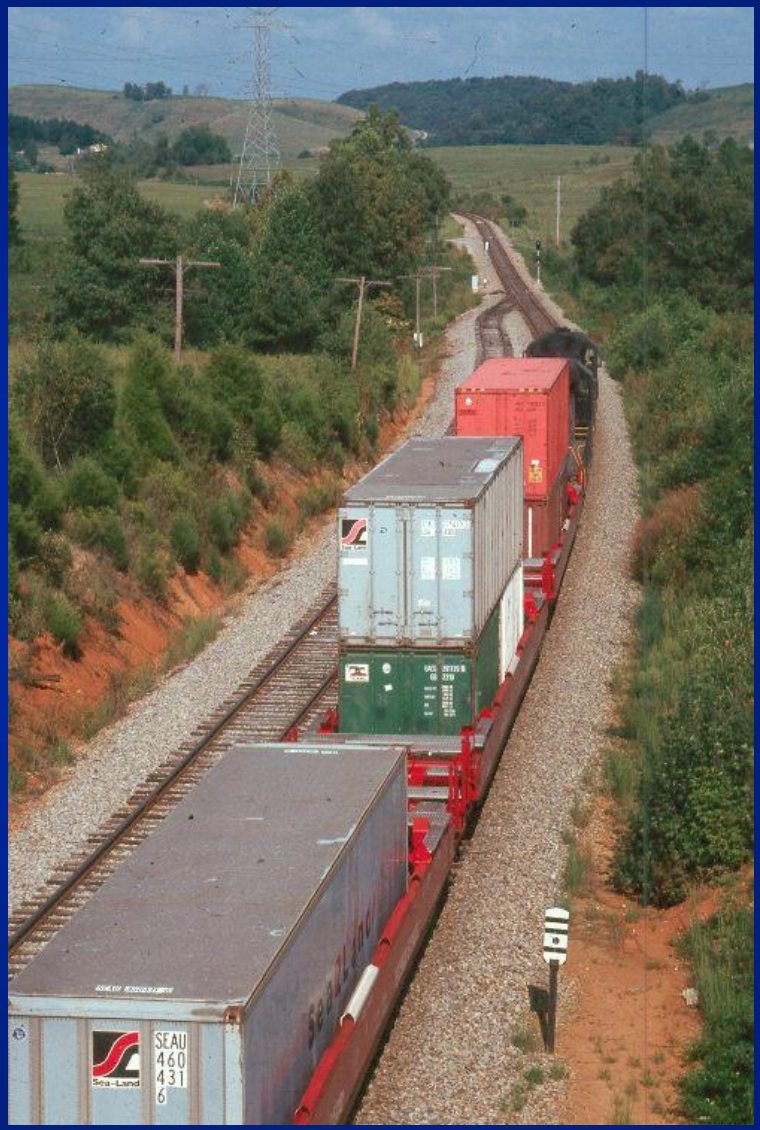
- **Service marketed by railroad, motor carrier, steamship line, or third party**
- **Roles of modes**
  - Motor carriers perform pick-up and delivery
  - Railroads perform land-side line-haul
  - Steamship lines perform intercontinental movement
- **Terminal facilities provided by port, steamship line, railroad, customer, or third party**

Types of Service

- **Railroad intermodal transportation is typically described as either:**
  - Trailer on flatcar (TOFC)
  - Container on flatcar (COFC)
- **These categories no longer cover all types of service (e.g., RoadRailer)**
- **Current intermodal rail cars don't necessarily resemble flatcars.**

(Above) TOFC Train, Union Pacific RR, Austin TX

(Right) Double stack COFC, Norfolk Southern Ry, Greeneville, TN

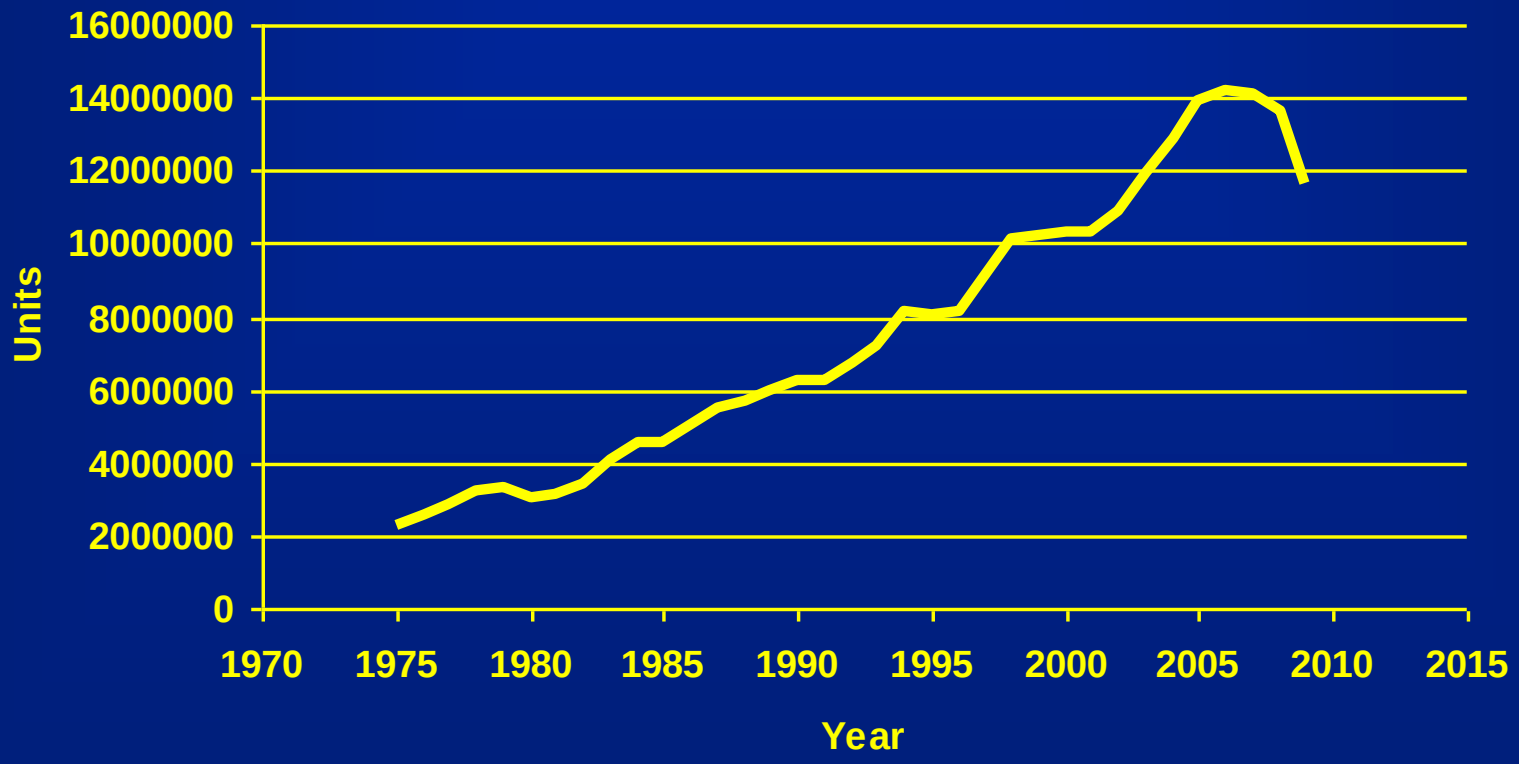


Rail Intermodal Traffic Growth

- **Railroads began offering TOFC service in the late 1950s**
  - many small, non-mechanized terminals
  - service in general freight trains
- **Trailer Train Corporation (now TTX) was formed to handle equipment pool**
- **COFC service paralleled the rise of marine containers**
- **Rise of global trade propelled COFC growth during 1980s**

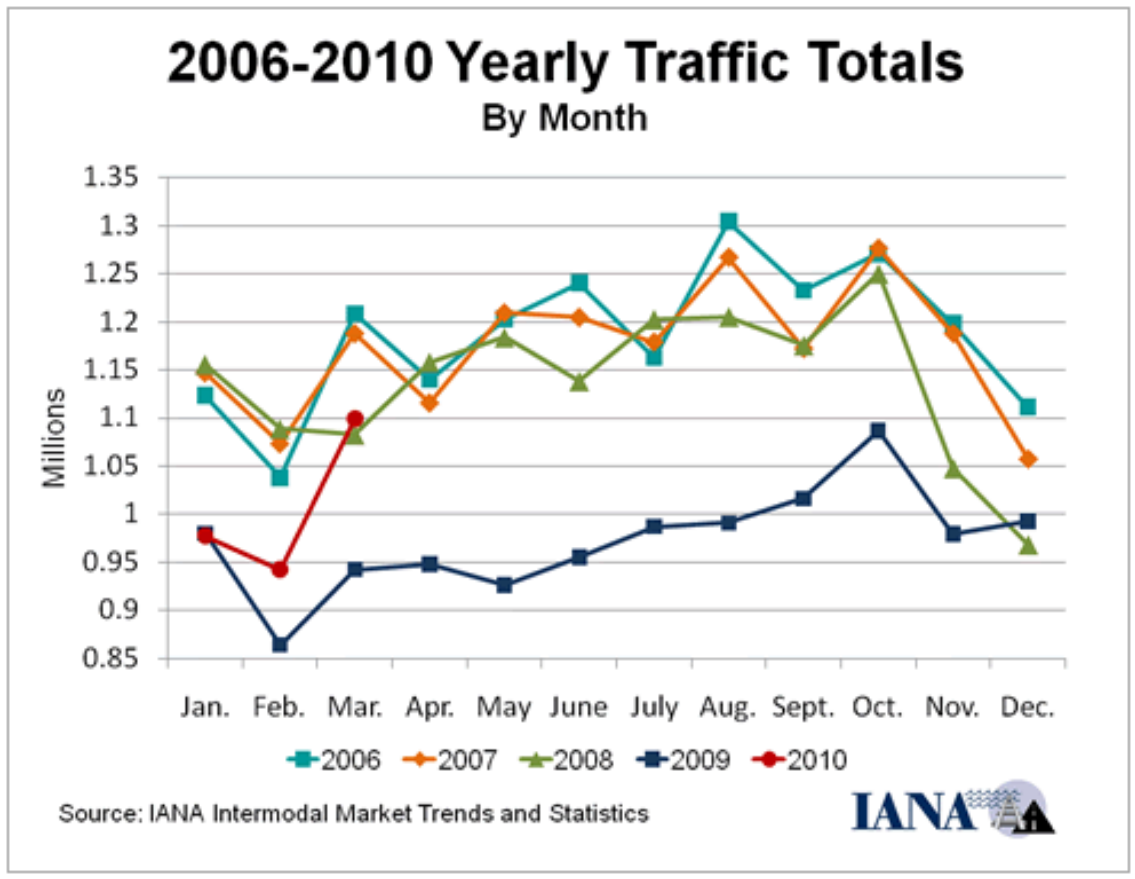
HISTORIC GROWTH

Annual Intermodal Volumes
(Sources: AAR & IANA)



The economic recession has affected recent intermodal trends, in common with all freight movement.

Recent Traffic Trends



Intermodal Truck/Rail Comparison

Source: BNSF Railway	Truck	Intermodal Train
Unit of Shipment	1 truckload	1 train (250 truckloads)
Labor (2000 mile trip)	1 person	26 people (1 train)
Frequency of Service	Daily / Hourly	Daily (if volume warrants) Often less than daily
Annual Volume Required for Daily Service	365	91,250
Transit	Mile/day: 500 Average MPH: 50 Operates: 10 hrs/day	Mile/day: 500 Average MPH: 21 Operates: 24 hrs/day
Route Infrastructure	Unlimited use of Federal and State road system	Use of privately owned rail network with limited use of alternate networks
Route Options	Virtually unlimited: many route options between origin and destination	Normally just one viable route between origin and destination

Relative Costs

DeBoer provided the following cost indices for a 1,000 mile haul:

89' railcar with TOFC	**0.55**
89' railcar with COFC	**0.53**
Double stack railcar	**0.41**
RoadRailer	**0.57**
Truck	**1.00**

Intermodal Containers

- **Allow unitized movement of goods**
- **Domestic and international versions**
- **Configurations include box, tank, flatbed**
- **Stackable**
- **Dimensions**
  - length
    - 20 ft, 40 ft, 45 ft for international use
    - 48 ft, 53 ft for domestic use
  - width = 96” international, 102” domestic
  - height = 4’, 8’, 8’–6”, 9–6”

40' x 9'6" Steel Dry Freight High Cube Refurbished

Sea Box, Inc. Container Types	Length		Height		Width		Door Opening	
	Exterior	Interior	Exterior	Interior	Exterior	Interior	Height	Width
40' DRY FREIGHT	40'0"	39'5 ½"	9'6"	8'9 7/8"	8'0"	7'8 ½"	8'5 5/8"	7'8 ½"

Sea Box, Inc. Container Types	Tare Weight in pounds	Payload in pounds	Gross Weight in pounds	Cubic Capacity in cubic feet
40' DRY FREIGHT	8,930	58,270	67,200	2,681

Chassis are normally used for movement of containers over the highway, although flatbed trailers can be used

40' Gooseneck Chassis

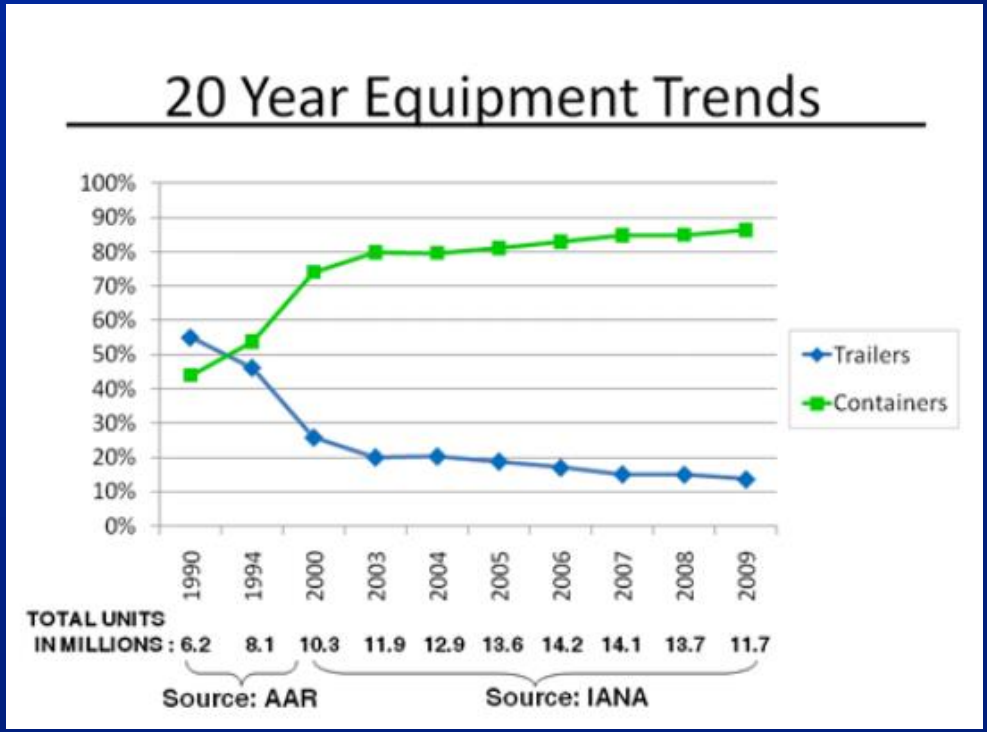
40' 6" LONG CHASSIS TRAILER DESIGNED TO CARRY ONE STANDARD 40' ISO CARGO CONTAINER	
48" Main frame height at rear based on 48" King Pin height.	
Tare Weight	6,600 LBS + 2%
Pay Load	67,200 LBS
Max Gross WT.	73,800 LBS

Intermodal Trailers

- **Common lengths are 28 ft, 48 ft, 53 ft; width is 102 in max.**
- **80,000 lb GVW with tractor**
- **Modified construction to withstand railroad service loads**
  - reinforced doors
  - lift rails
- **All configurations used; dry van and refrigerator most common**

Trailer and Container Use Trends

- **High volume of import/export trade drives container growth**
- **Domestic container traffic is small, but growing**
- **TOFC service focused on domestic market**
- **TOFC growth limited by**
  - availability of compatible trailers
  - need for long-haul (>750 miles); 88% of truck traffic is less than 500 miles



Source: IANA

MAXI-STACK IV

The Maxi-Stack IV car is the mainstay of the United States domestic double-stack car fleet because it provides the optimum balance between tare weight and capacity. It is a three-unit articulated double-stack car that can handle containers from 20' to 53' long in the well and containers from 40' to 57' in the top position. The Maxi-Stack IV utilizes 70-ton end trucks and 125-ton intermediate trucks. It has a capacity of 116,800 pounds per well.

53' All-Purpose Double-Stack Car

The 53' All-Purpose (AP53) double-stack well car is a single unit designed to maximize flexibility. It can carry either containers or trailers. The AP53 has a 53' well to accommodate containers from 20' to 53' long. It can handle containers from 40' to 53' long in the top position. The AP53 can also accommodate two 28' pup trailers or one long trailer up to 57' long. Each car is capable of carrying nose-mounted containers or trailer refrigeration units. The AP53 has 166,000 pounds of capacity per car to handle heavy loads. It can also be configured as a 3-unit drawbar car.

Mechanized Loading Technology

- **Gantry crane**
  - transfer only
  - rail or rubber tired
  - 25–50 ton lift capacity
  - span 32–76 ft
  - 5–8 container lift height
- **Straddle loader**
  - transfer/storage
  - rubber tired
  - 50 ton capacity
  - span 15–20 feet
  - turning radius 35 ft outside
  - 2–5 container lift height
- **Side loader**
  - transfer/storage
  - rubber tired
  - 22–45 ton lift capacity
  - turning radius 20 ft to 52ft requires aisles 30ft min to 75ft ideal
  - 2–3 container lift height
- **Reach loader**
  - transfer/storage
  - rubber tired
  - 50 ton lift capacity
  - 5–8 container lift height

Marine Gantry Cranes

Rubber Tired Straddle Loader

Side Loader

Reach Loader

Image from Mi-Jack Products, Inc.

Lift Spreader Assembly

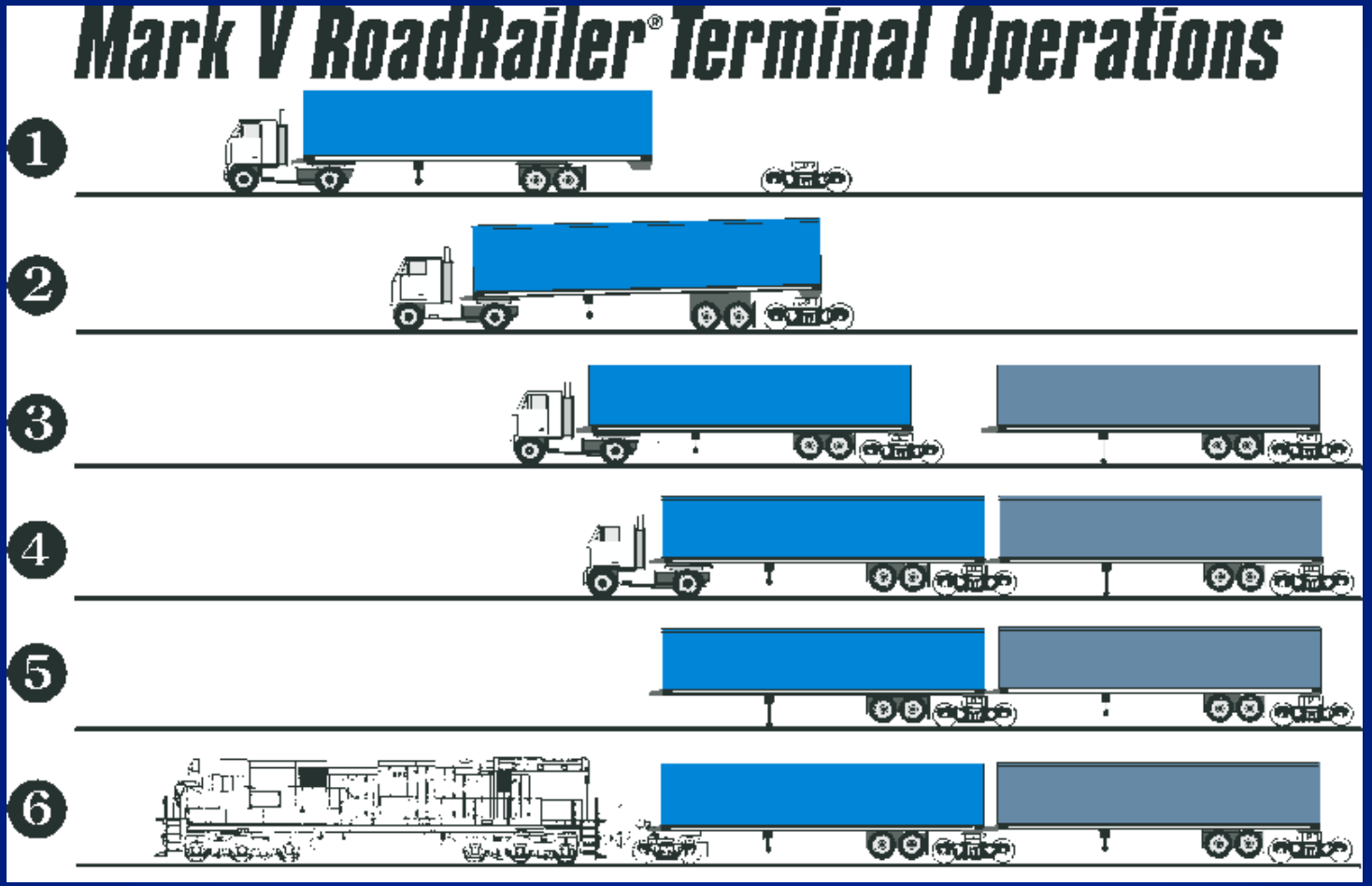
Carless Technologies

The RoadRailer® may be handled over the highway like any conventional semitrailer

Or coupled in trains of up to 125 units

Coupler Mate

Bogie



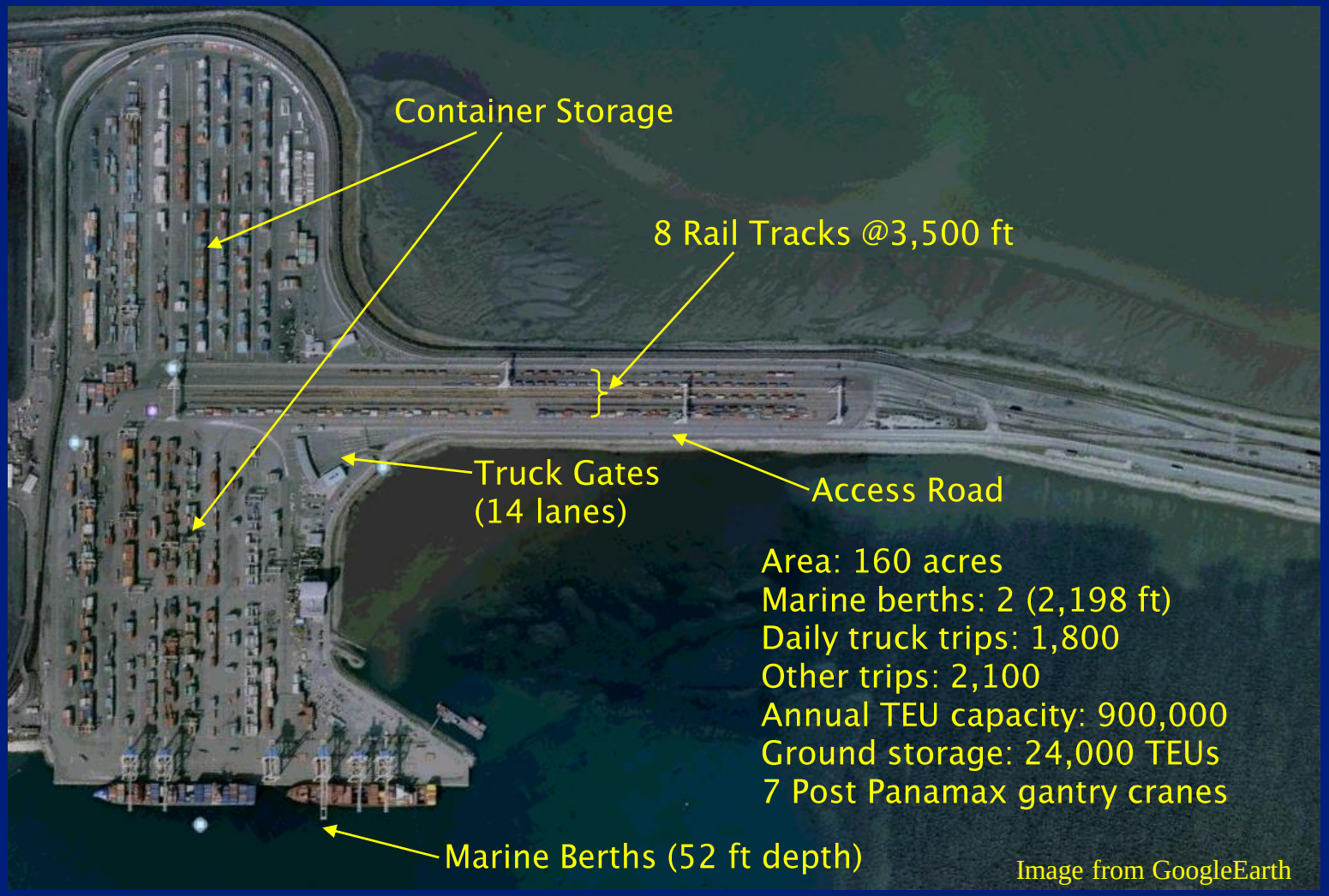
1. Hostler trailer positions trailer.
2. Trailer air suspension lifts rear of trailer, tractor backs trailer onto rail bogie.
3. Trailer air suspension is vented. Steel coil springs lift tires clear of rail.
4. Tractor backs trailer to coupling with balance of train.
5. Tractor leaves leading trailer on landing gear. Air lines are connected and landing gear is raised on second trailer.
6. Rail locomotive backs CouplerMate® to trailer. Air lines are connected and landing gear is raised on all trailers.

Source: Wabash National Corporation

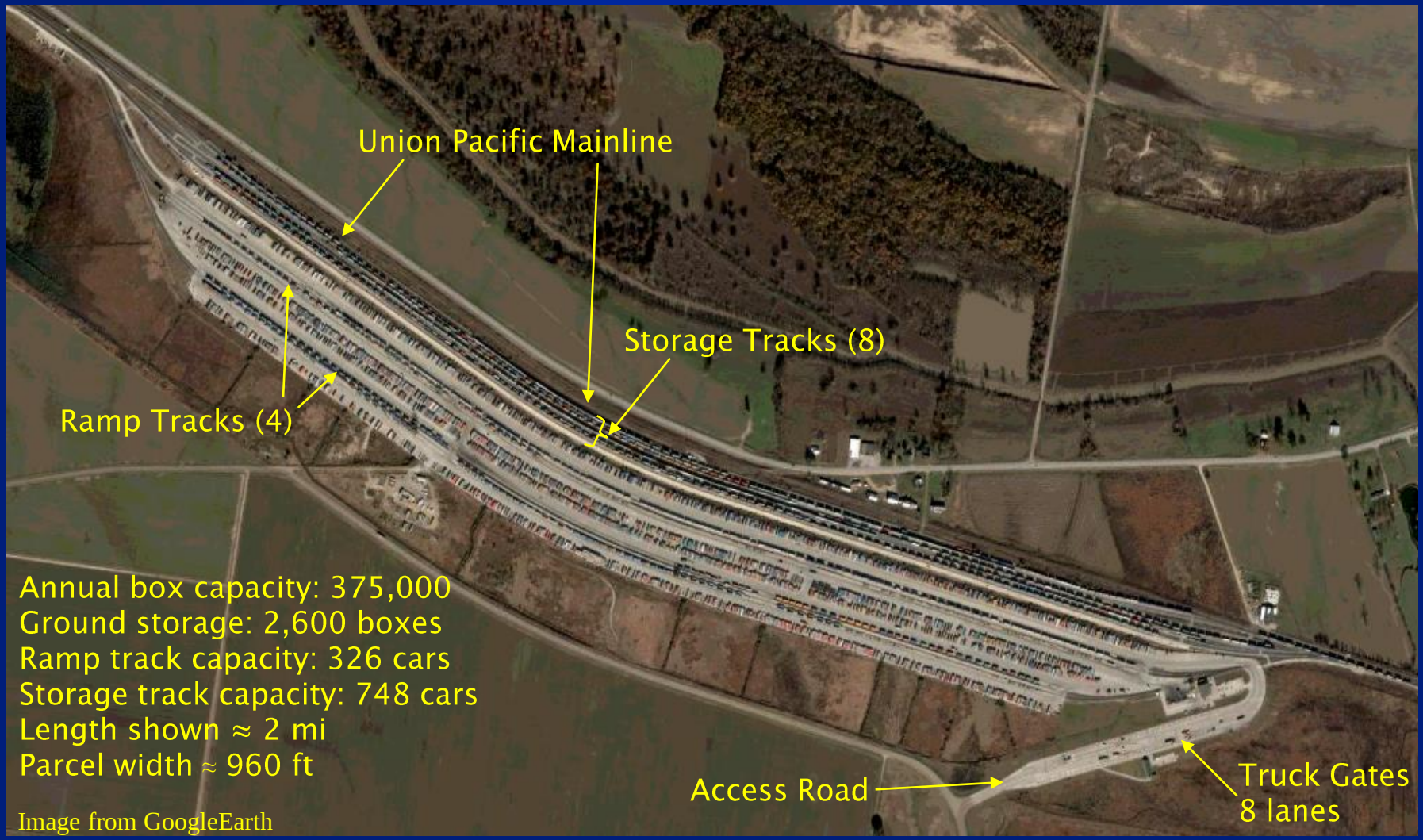
Intermodal Terminal Elements

- Provision for loading/unloading railcars
- Box storage (long term or temporary)
- Vehicle storage (railcars/trailers/chassis)
- Check-in/check-out control
- Vehicle and box servicing/repair
- Security and lighting
- Office and administration
- Information systems
- Vehicle scales

Roberts Bank, BC Marine Terminal



Marion, AR Intermodal Terminal



Factors in Terminal Location

- Access to railroad and highway system
- Area, configuration, and topography of site
- Cost to acquire site and provide infrastructure
- Adjacent land uses
- Proximity to customer base
- Ability to accommodate future growth
- Local support

Terminal Design

- **Low volume (<100,000 annual lifts)**
  - side loader operation
  - rail loading tracks of 500–1000 ft length
  - 110 feet separation between tracks
  - separate parking areas for road vehicles
  - one way highway traffic circulation
- **Medium volume (100,000-500,000 annual lifts)**
  - rail loading tracks 1,000–3,000 ft stubbed or flow–through
  - side loader or straddle loader operation
- **High volume (>500,000 annual lifts)**
  - rail unloading tracks 3,000 to 8,000 ft, flow through preferred
  - straddle loader or gantry operation
- **In all cases, a linear design is preferable**

Future Issues for Intermodalism

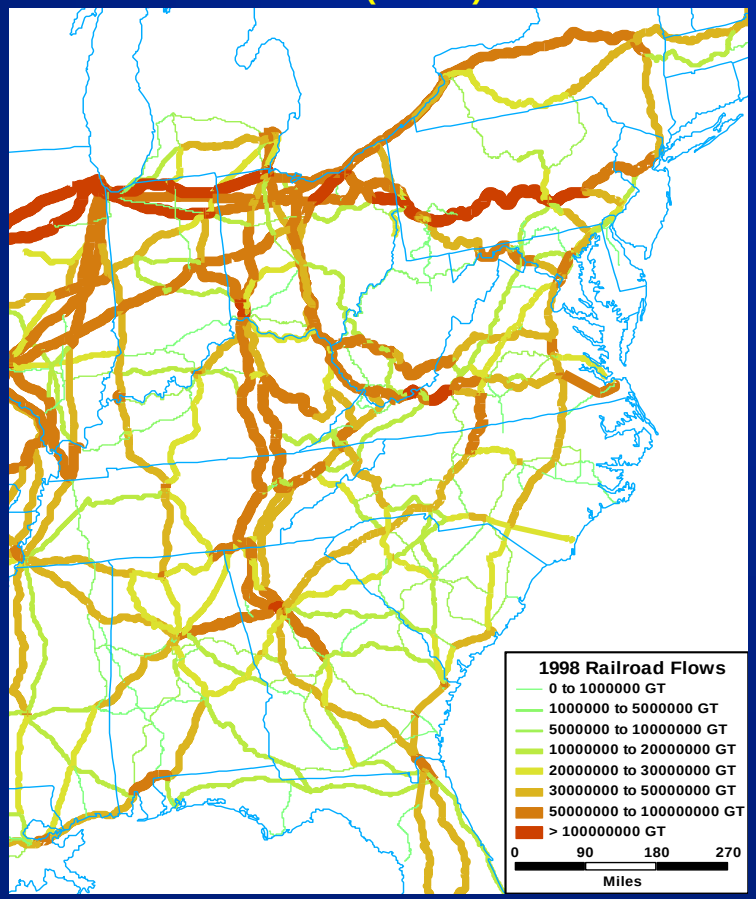
- **Improving the railroad system**
  - adding capacity to handle more business
  - matching truck service characteristics
  - increasing efficiency of intermodal equipment
- **Funding needed improvements**
  - private sector
  - public sector
  - public–private partnerships
- **Developing a short-haul intermodal system**
  - currently, intermodal is competitive for shipments >750 mi
  - 88% of truck trips are 500 mi or less

Intermodal Trains and Railway Infrastructure

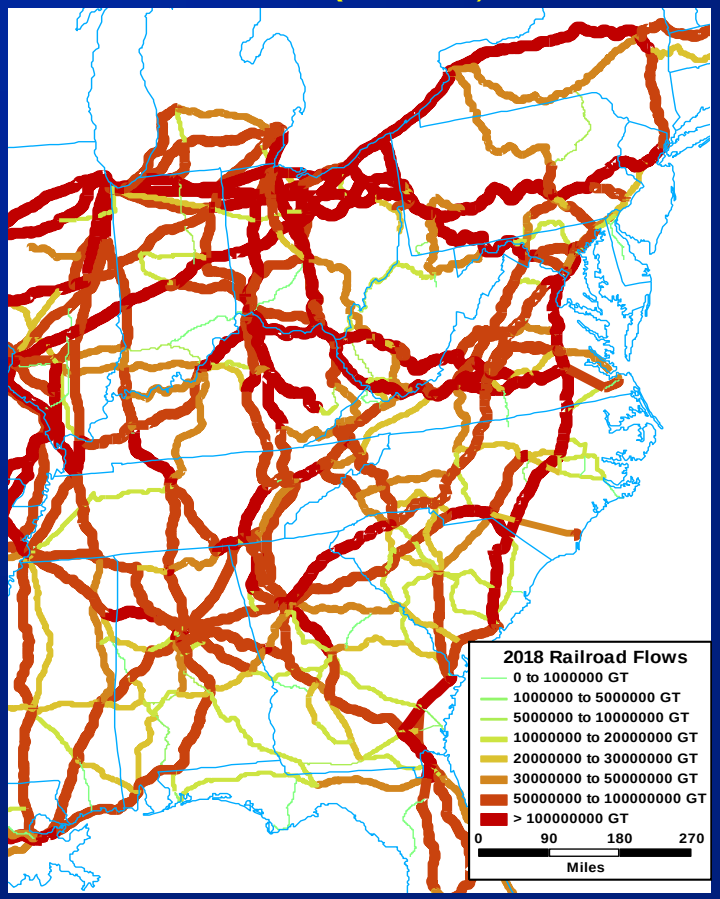
- **Intermodal trains must be service competitive with trucks**
  - maximum speeds of 50–70 mph typical; such speeds
    - consume track capacity
    - require appropriate control system
    - require high train power/weight ratio
    - require higher track and alignment standards
  - schedule requirements provide operating challenge
- **Train lengths to 7,500 ft routine; may reach 10,000 ft if conditions permit**
  - adequate passing siding length needed on single track lines
  - multiple main track provides better capacity and operational flexibility, at higher cost
  - careful terminal design needed to avoid conflict with mainline operations
- **Double stack trains need adequate clearances (20’ 3” min)**

The Railroad Capacity Issue

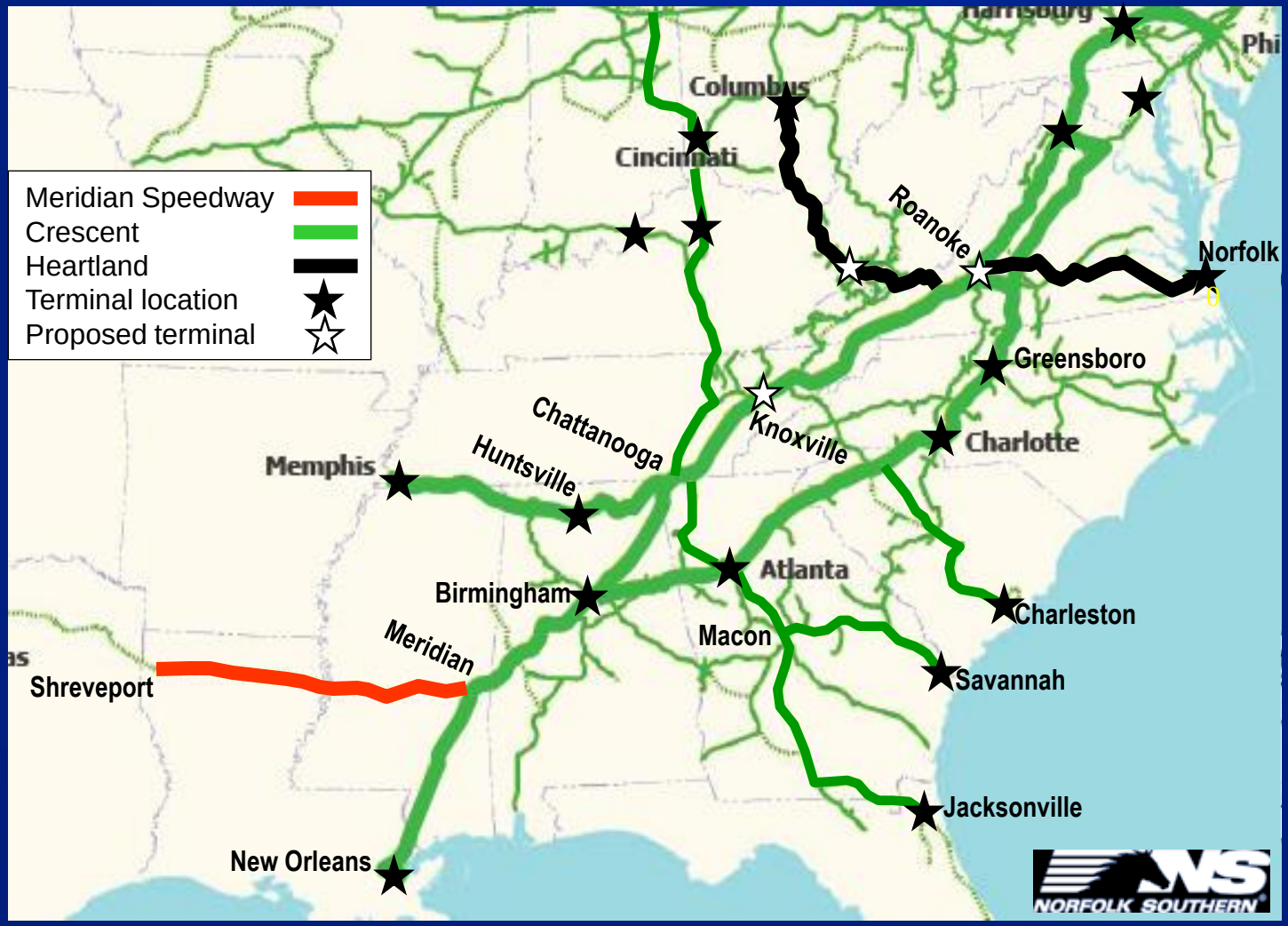
1998 (Actual)



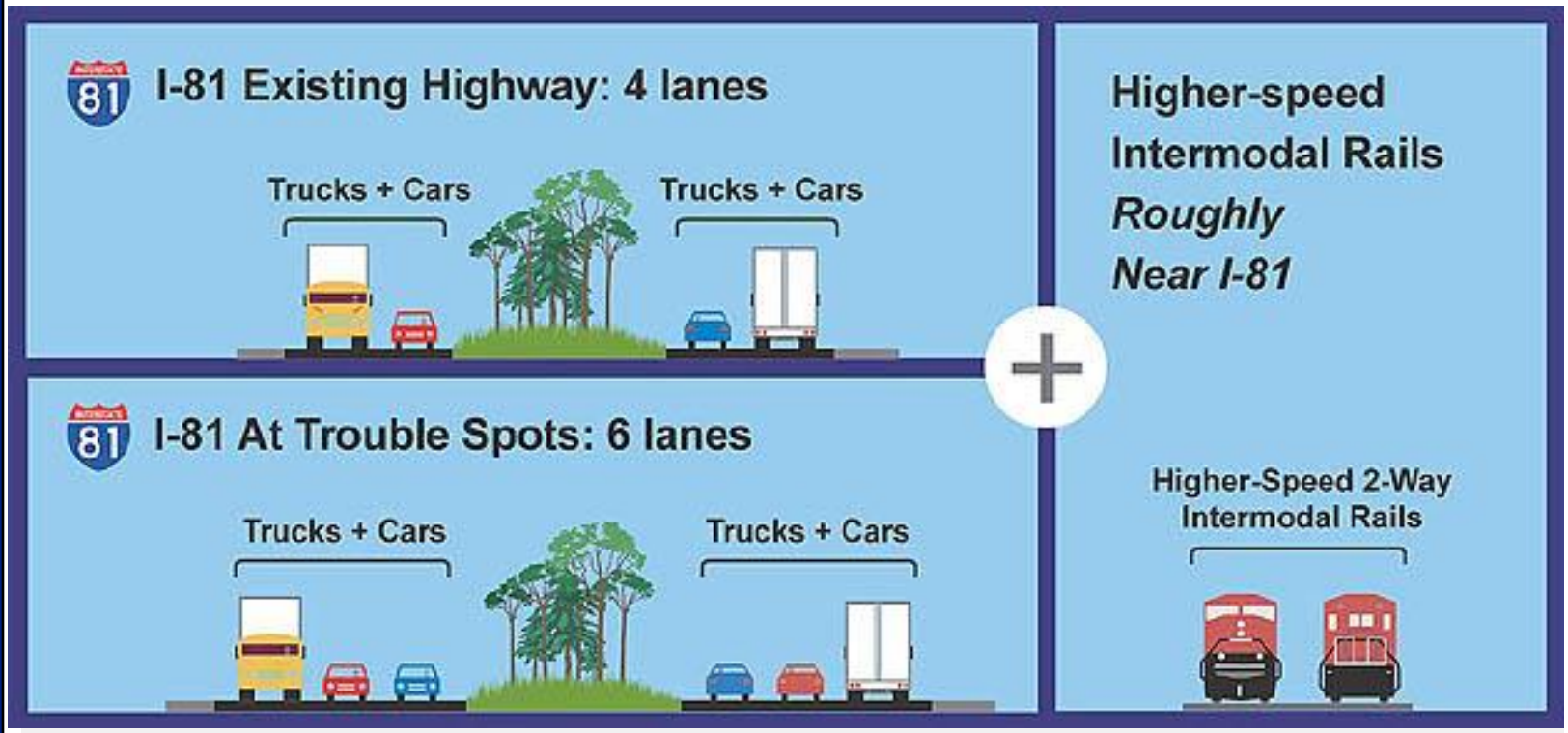
2018 (Forecast)



Intermodal Corridors



RAIL SOLUTION : *At a Glance*



- **Rail and spot highway infrastructure upgrades**
- **Traffic management and enforcement options for quick-fix safety improvements**

RAIL – *SAFER, FASTER, CHEAPER, CLEANER*

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