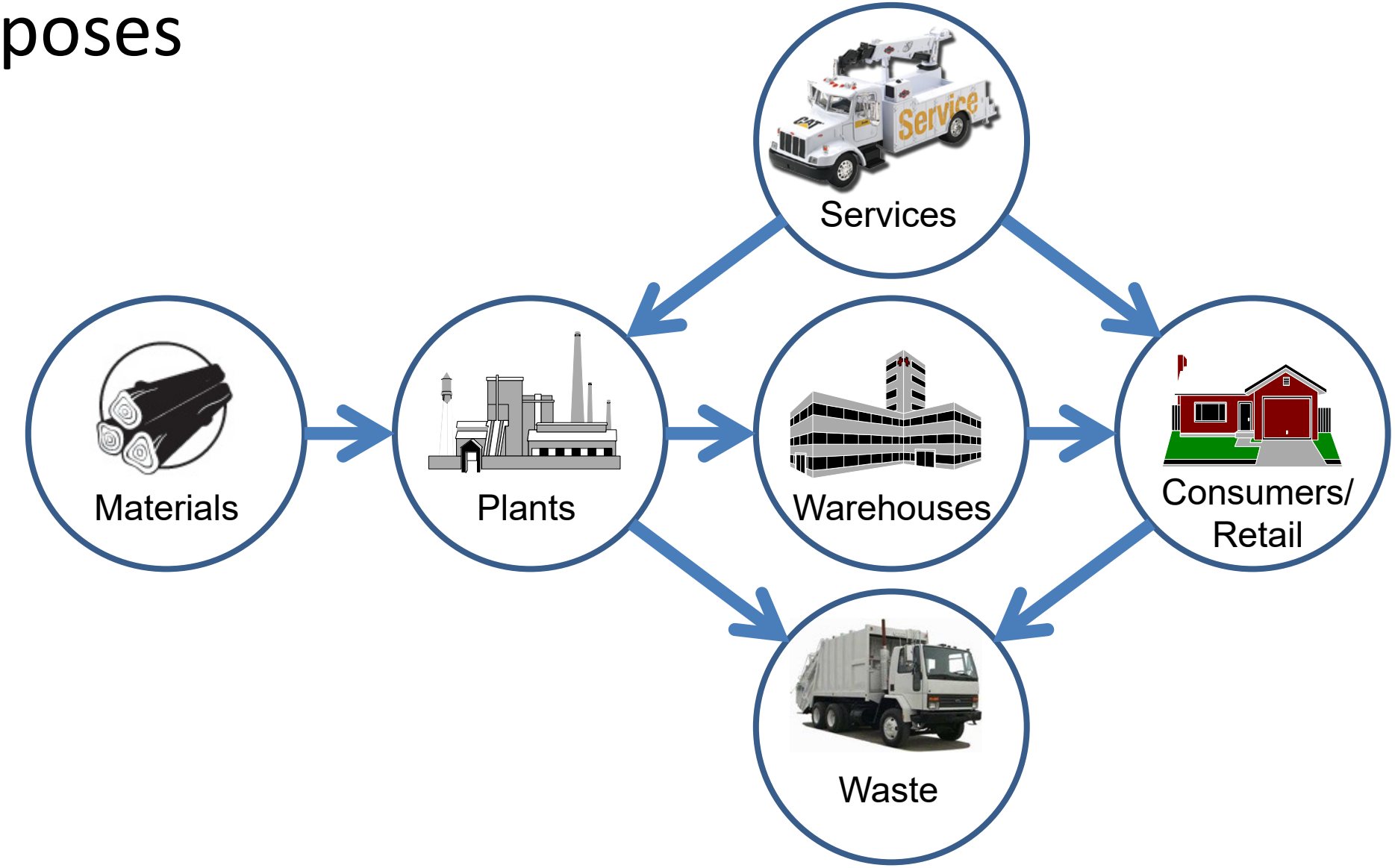
Freight System

CIVE 461: Urban Transportation Planning
Supplemental Notes

Freight transport – why should we care?

- Nation's economic strength currently rests on **efficient**, **safe**, and **secure** freight transportation
- **Efficiency** and **reliability** of freight transportation: one of the most important reasons for North America's prosperity and competitive advantage
- Freight transportation is an important element in:
  - Siting and conduct of commerce
  - Location of cities and towns
- Virtually every product we consume requires transportation

Freight transportation is needed for many purposes



What influences freight movement?

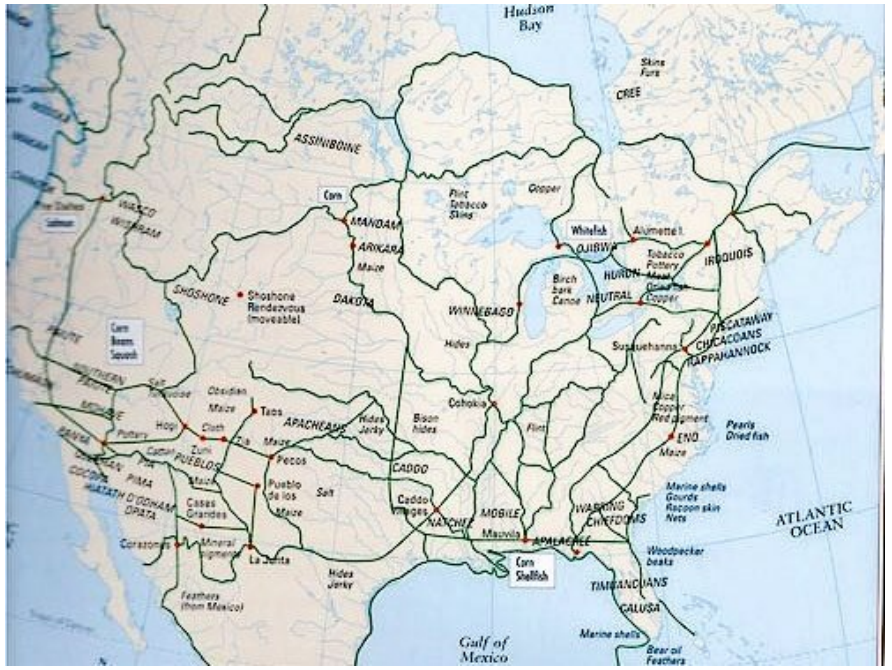
- A function of many factors:
  - Economic health of the nation and the world
  - Fortunes of particular economic sectors
  - Business process innovations
  - Technological changes
  - Trade agreements
  - Government policies, programs and regulations

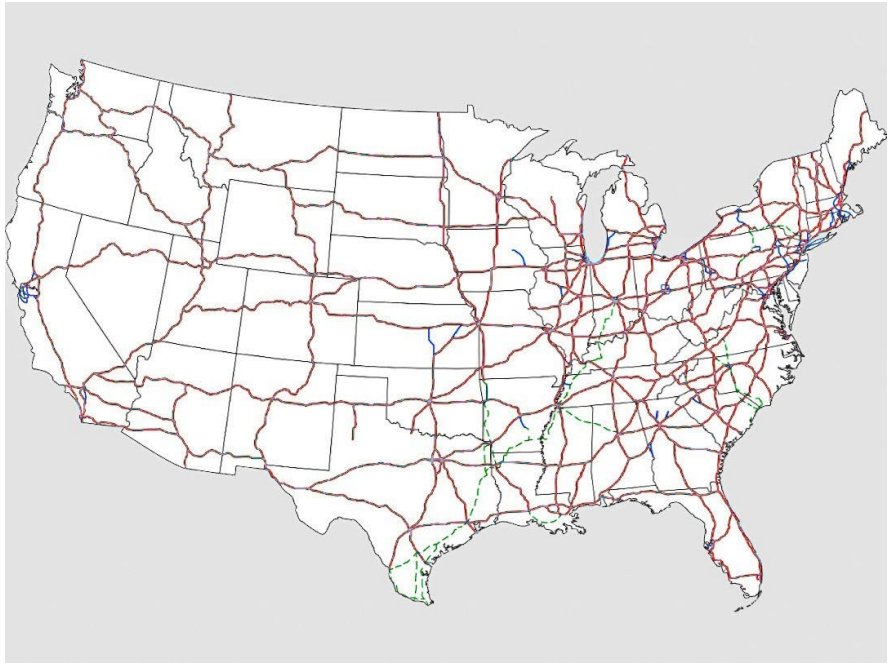
Freight Impacts

- Congestion
- Noise
- Pollution / Greenhouse gas emissions
- Pavement Damage
- Road Fatalities, serious collisions
- Risks associated with hazardous materials movement
- Security Issues

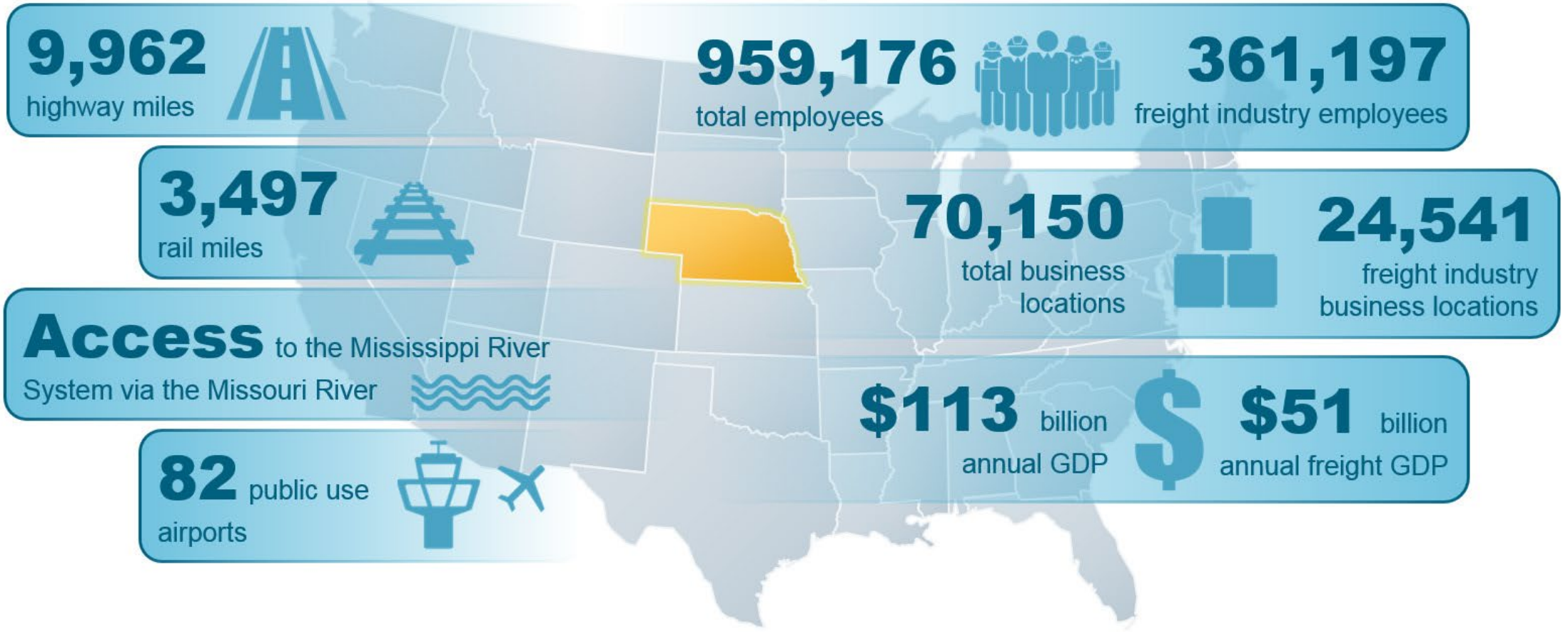
Freight in Nebraska

- Continental trade routes have existed for centuries
- Missouri River to the Rocky Mountains route via Oregon Trail along the Platte River valley

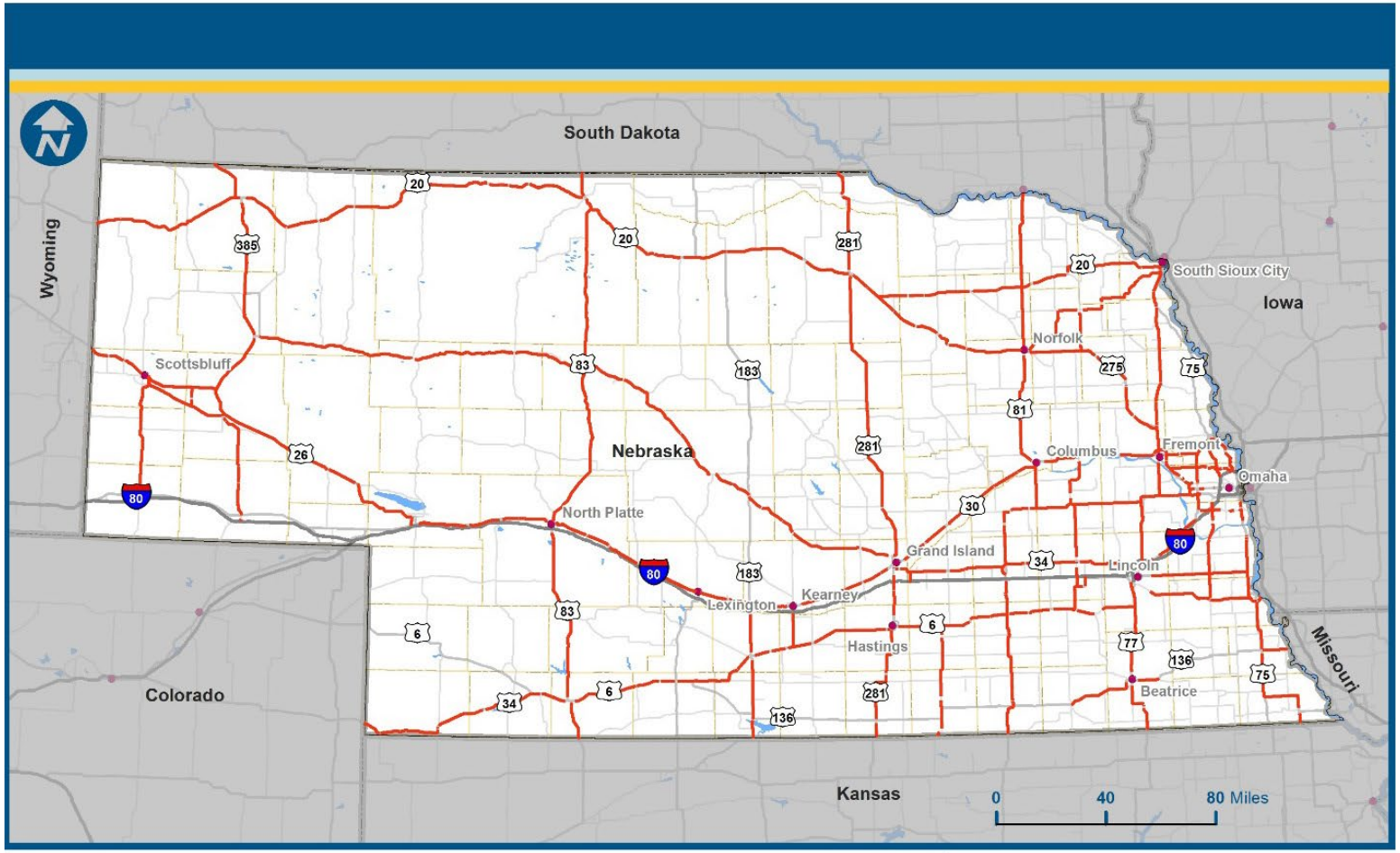




Nebraska Freight Today

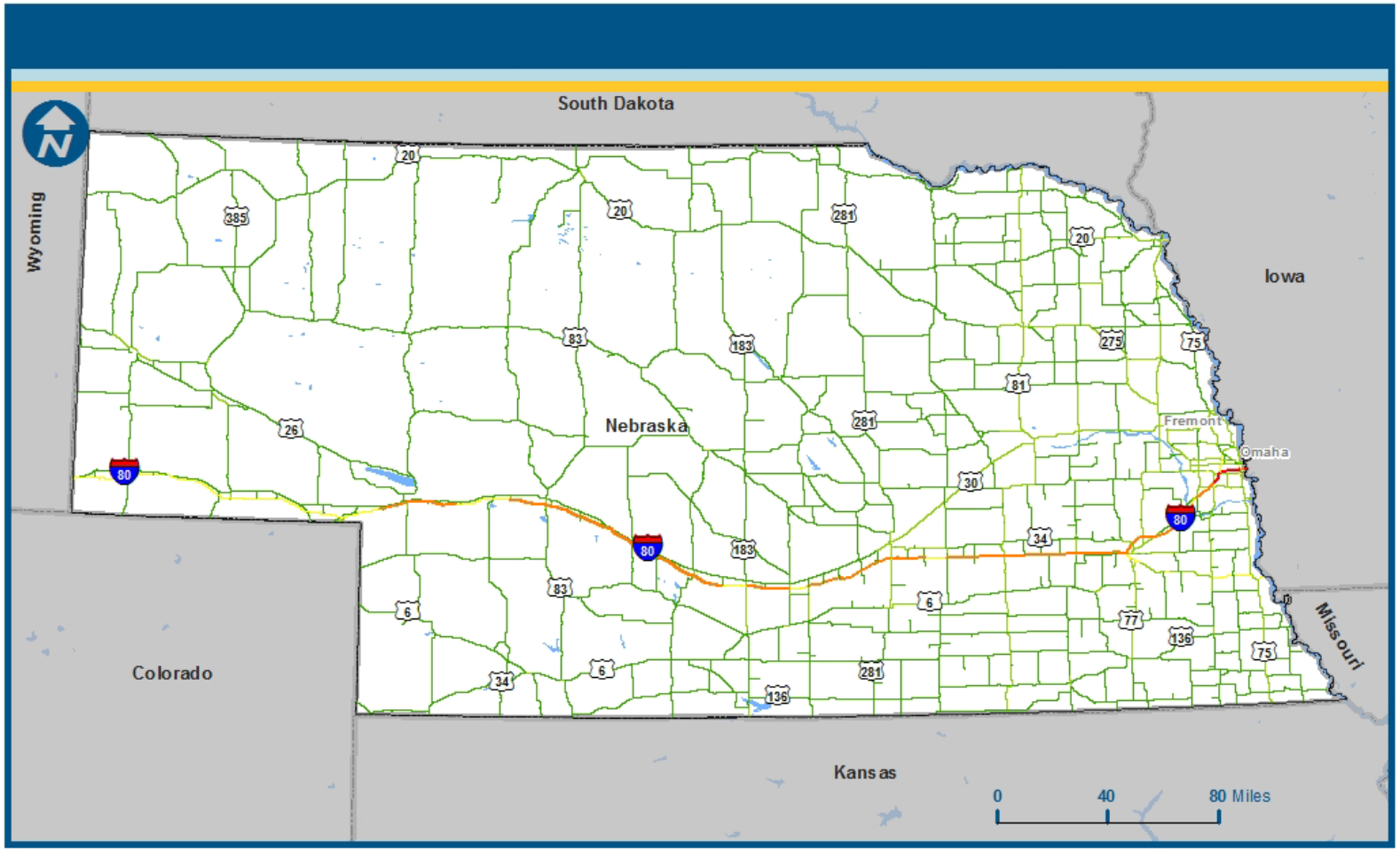


Nebraska Freight Today



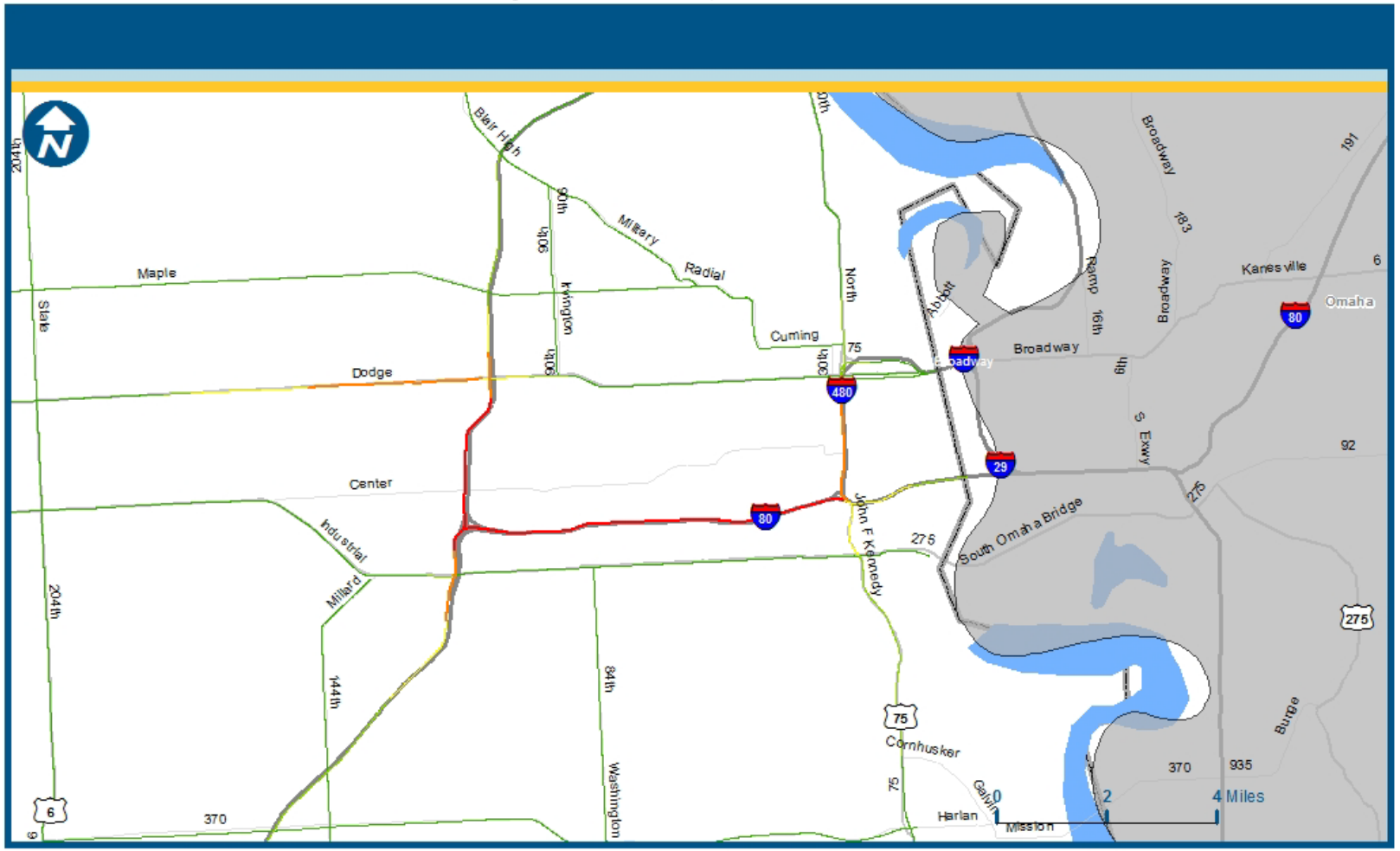
NEBRASKA
Good Life. Great Opportunity.

AADTT on Nebraska Highways - 2014



NEBRASKA
Good Life. Great Opportunity.

AADT on Omaha Highways - 2014



Legend

AADT

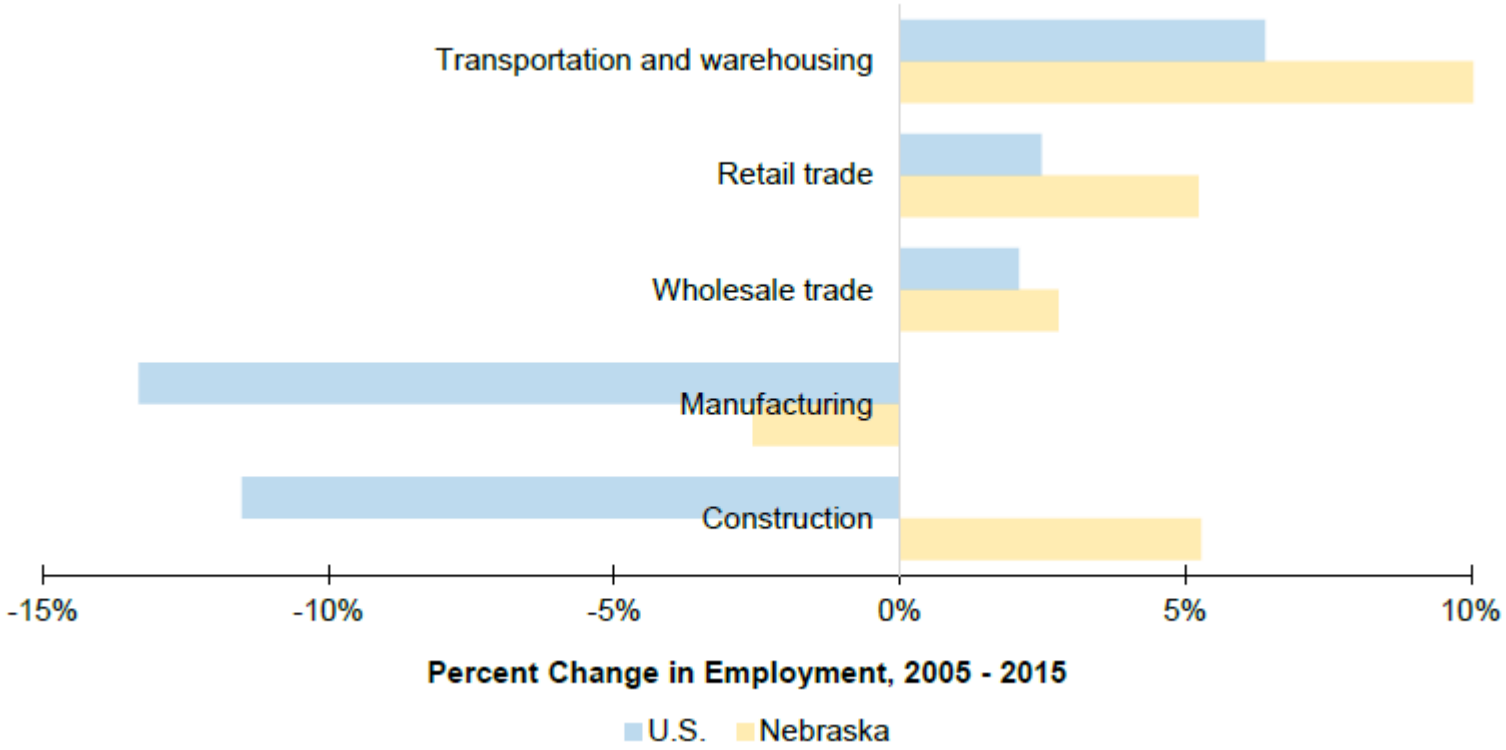
- < 50,001
- 50,001 - 75,000
- 75,001 - 100,000
- 100,001 - 125,000
- > 125,000

NEBRASKA
Good Life. Great Opportunity.

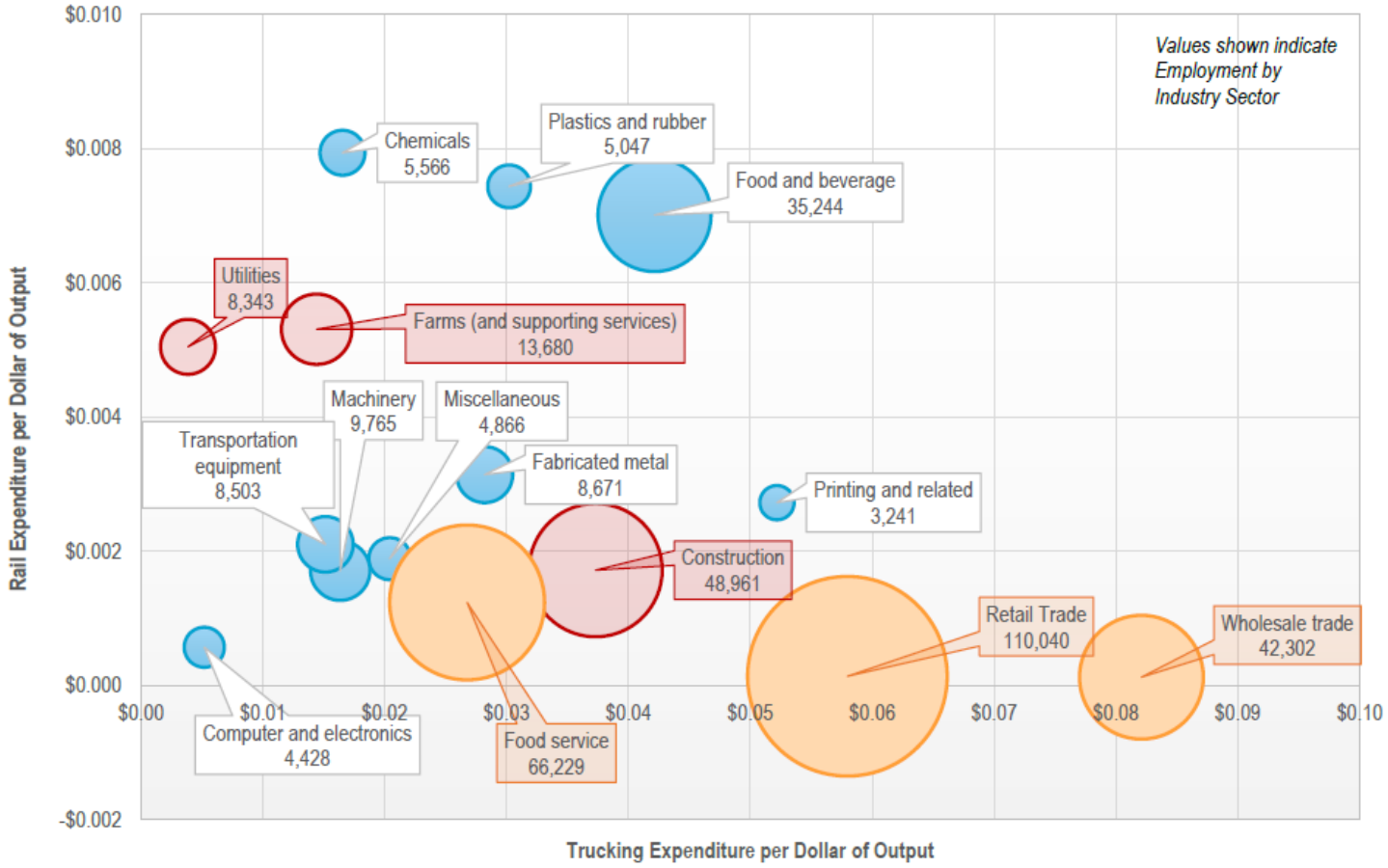
Rail in Nebraska

- Economical long-distance transport mode for agriculture and manufacturing sectors
- **Union Pacific (UP)** headquartered in Omaha
- BNSF & UP own 47% & 31% of track, respectively
  - **Question:** What impact do you think this ownership structure has on passenger rail in the US?

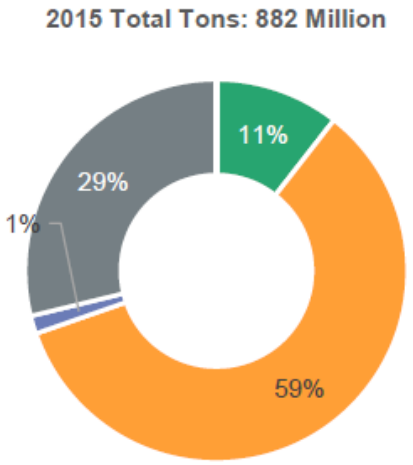
Employment Trends in Freight-Dependent Sectors

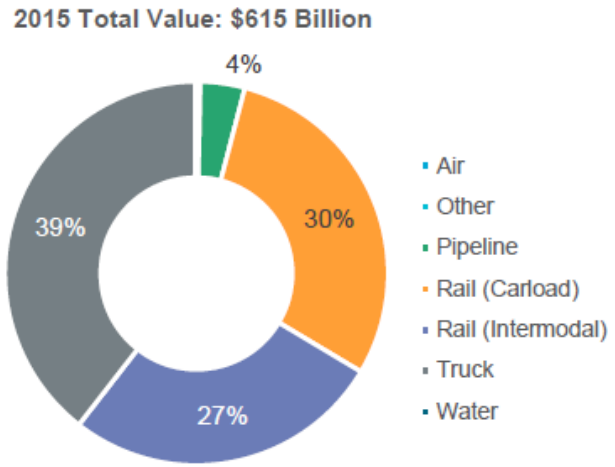


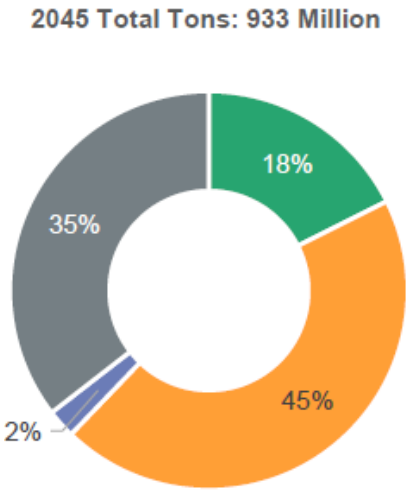
Transportation Expenditure Requirements for One Dollar of Output for Goods Sector Industries and Employment by Sector

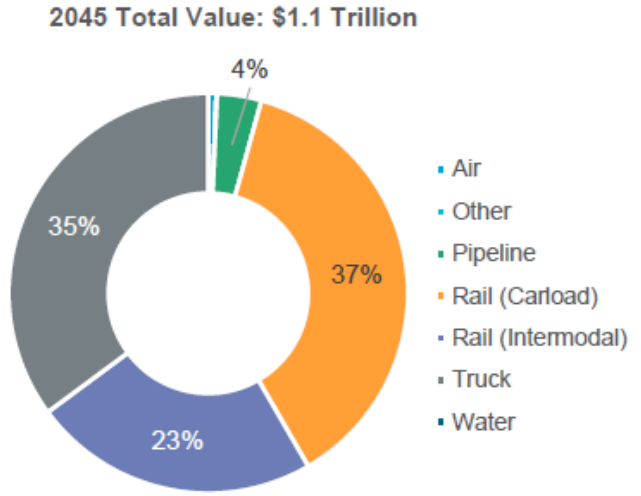


Current & Anticipated Nebraska Tons & Values by Mode



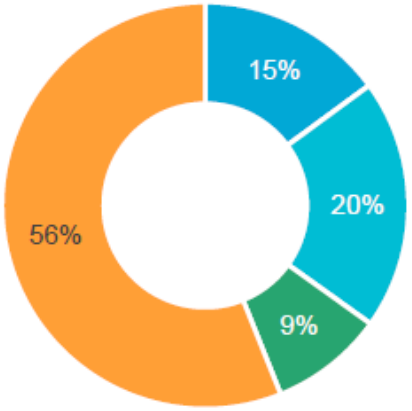




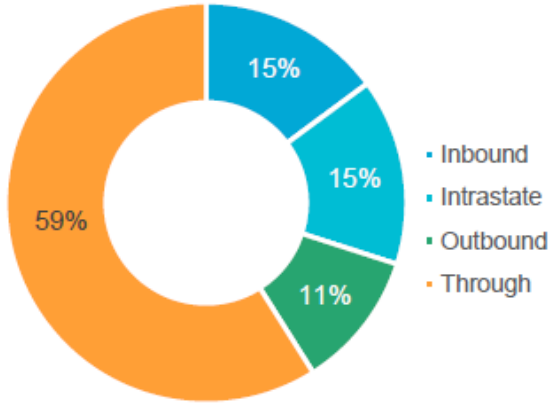


Current & Anticipated Nebraska Goods Movements by Weight & Value

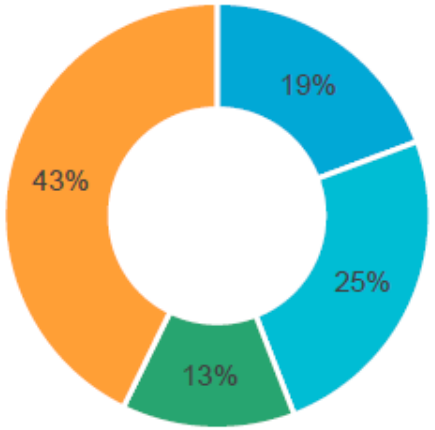
2015 Total Tons: 882 Million



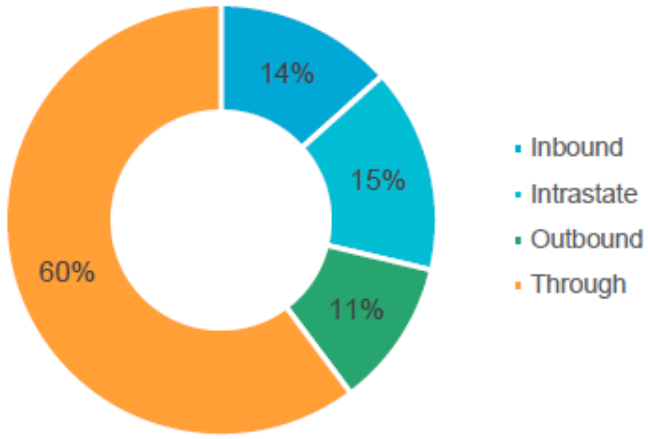
2015 Total Value: $615 Billion



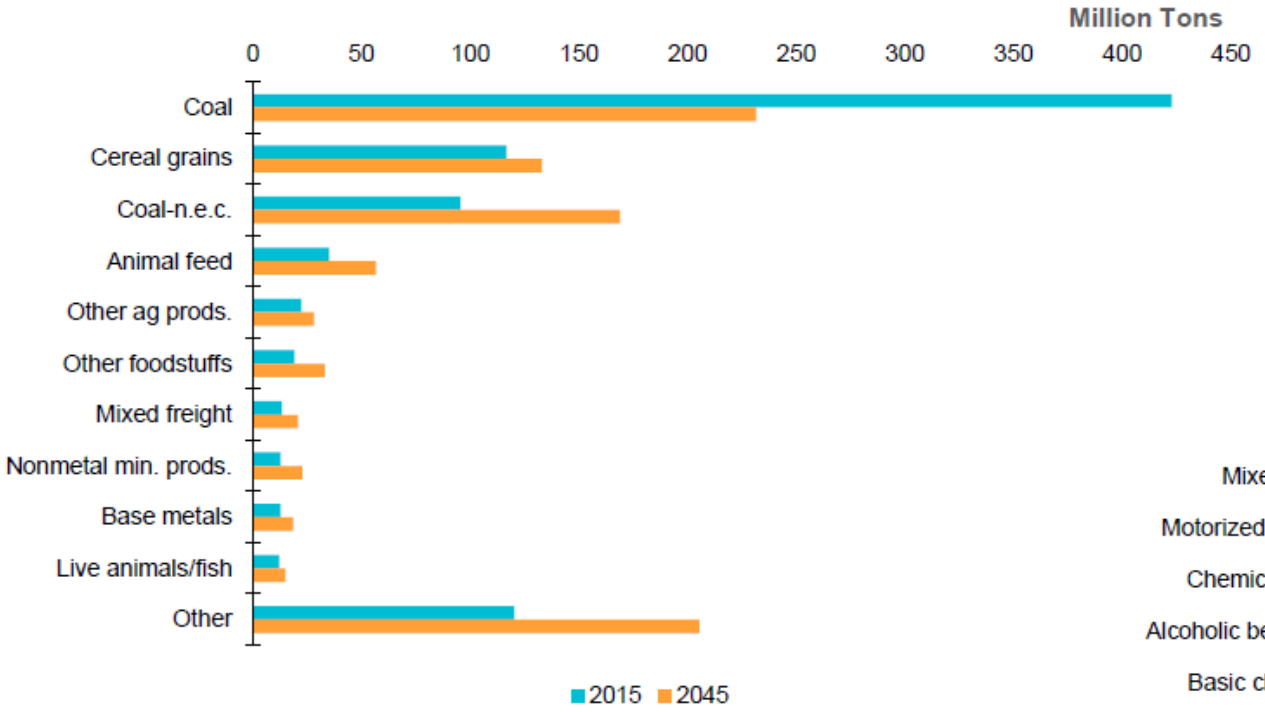
2045 Total Tons: 933 Million

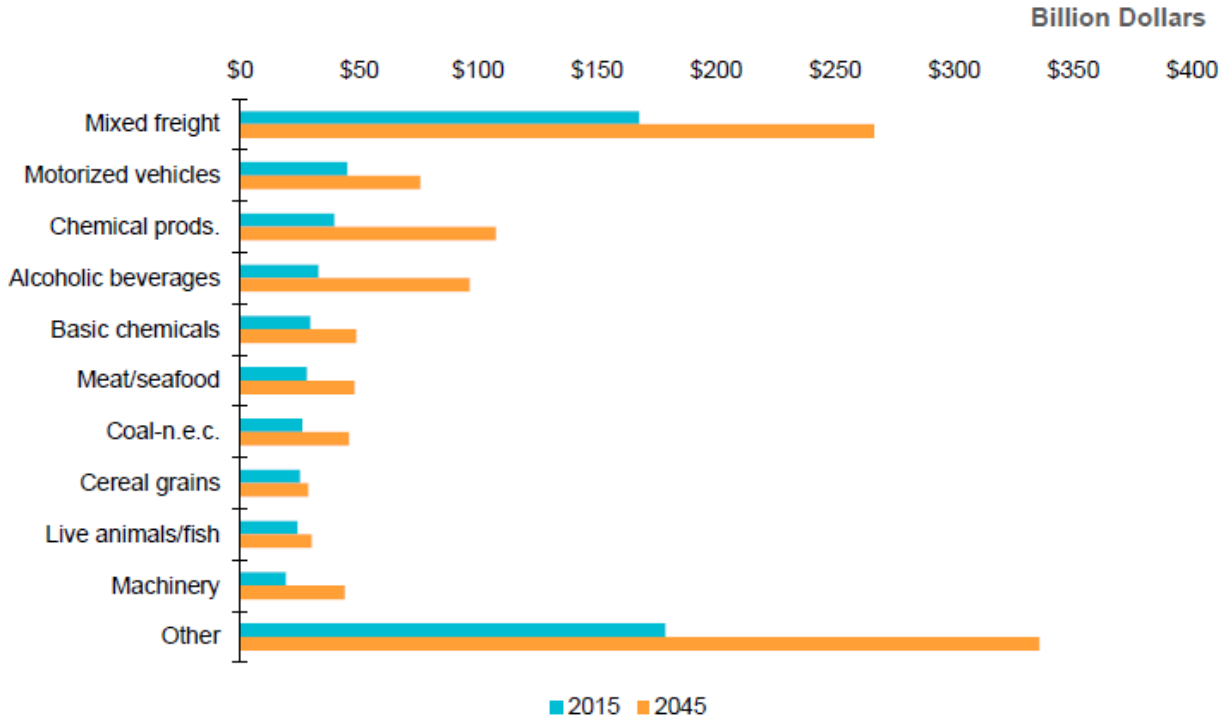


2045 Total Value: $1.1 Trillion



Nebraska Commodities by Weight & Value





Service Provision – Market Definition

Major Players

- **Shippers/receivers:** demand freight services
- **Carriers:** provide transportation services with owned or leased fleet
- **Freight forwarders:** traditionally, arrange shipments & process paperwork; now broader
- **Third-party logistics providers (3PLs):** wider range of services including warehousing, pre-planning, post-delivery support

For-Hire Trucking

- For-hire trucking firms offer either truckload (TL) or less-than-truckload (LTL) services, or a mix of two.

Private Trucking

- Provided by company that is transporting **own goods**
- Many **retail distributors** operate private fleets:
  - Consumer goods distributors
  - Chemical product producers
  - Pulp & paper companies
  - Beverage distributors
  - Wholesale distributors of agricultural products
- Private fleet can be used, not only for firm's own products, but also to haul goods for other firms

Truck Owner-Operators

- Owner-operators are small independent operators who own or lease their own truck & haul trailers or other equipment for a carrier
- Owner-operators can work for one or more carriers
- Some owner-operators are under long-term contracts to carriers
- Also provide carriers with additional operational flexibility, allowing them to respond to demand peaks

Courier Services

- Courier services include delivery of all letters, envelopes, paks (plastic pouches designed to accommodate large documents and small parcels), boxes, & cartons
- As of 2022, there were approximately 415,856 courier companies in the United States

Rail Mode

- Rail has been **losing market share** to truck/highway transport

- To remain competitive, rail has been discounting service on marginal lines & focusing on trunk lines

- **Intermodal freight** benefits from
  - Truck driver shortages
  - Increased fuel prices
  - Increased trucking prices

- Intermodal sector increasing
  - BNSF operates an 18-acre facility in South Omaha with 18 rail spots and 1,100 vehicle bays
  - UP operates the **Bailey Yard** in North Platte, reported to be the largest railroad classification yard in world with 17 receiving and 16 departure tracks & handling 14,000 rail cars daily

Economic Benefits of Freight

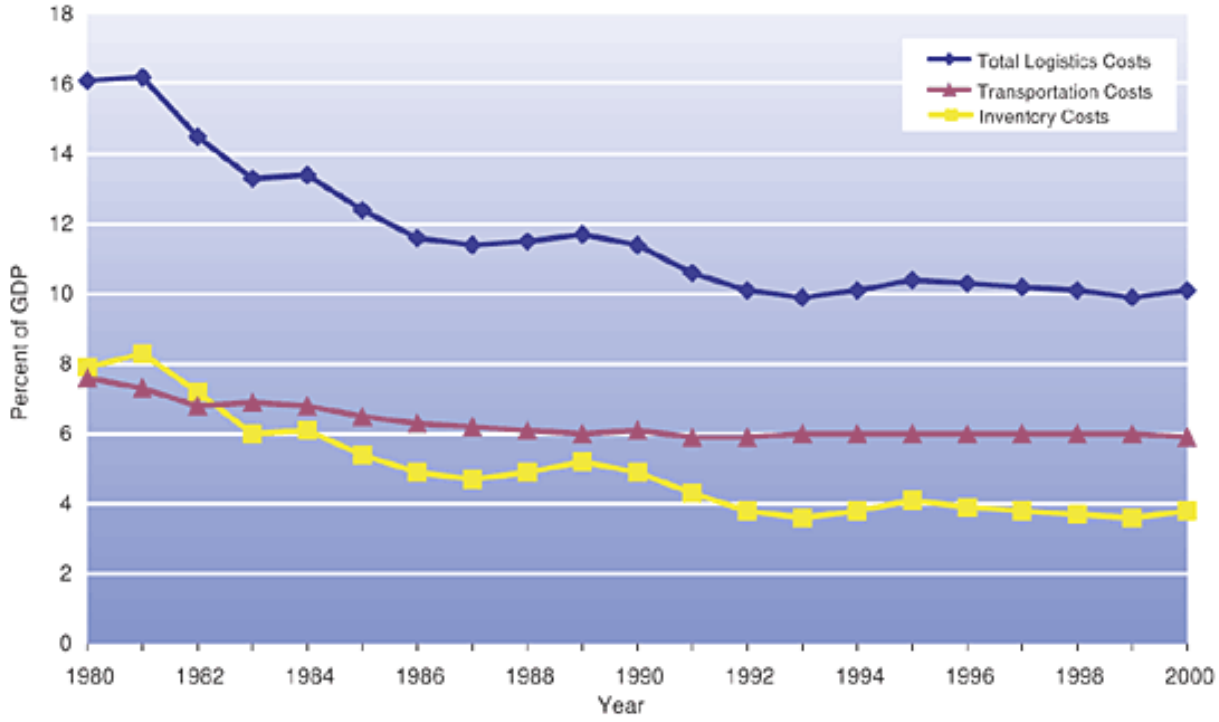
- Increase value of goods - by moving them to locations where they are worth more
- Encourage competition & production - by extending the spatial boundaries of commodity and labor markets
- Stimulate demand for goods & services
- Employ millions of people (5.4% of US GDP is transportation & warehousing)

Freight & Economy - Efficiency

- Efficiency & reliability of freight transportation – directly related to productivity
- Productivity is one of most important reasons for North America's competitive advantage
- Cost of moving freight dropped from about 16.1% of GDP in 1980 to 8.5% in 2011

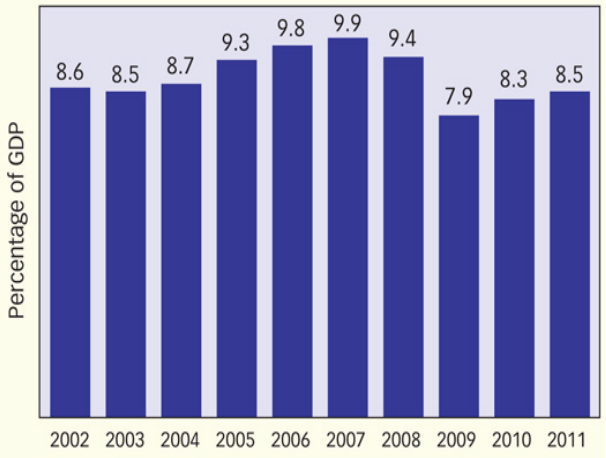
Freight & Economy - Efficiency

Figure 1. Business Logistics Expenditures as a Percent of U.S. Gross Domestic Product (GDP)



Source: Prologis and Cass Information, Inc., *12th Annual State of Logistics Report*, June 4, 2001.

[FIGURE 1] U.S. LOGISTICS AS PERCENTAGE OF GDP



[SOURCE: 23RD ANNUAL "STATE OF LOGISTICS REPORT," 2012]

Freight & Economy - Reliability

- Need **reliable travel times** in economies where many goods are expensive with tightly scheduled manufacturing/ distribution systems
- Late arrivals can have **significant costs** for factories waiting for parts to assemble, and for carriers who miss guaranteed delivery times
- **Poor reliability** -> **Increase in required inventory**
- Shippers and carriers assign a value to travel time, ranging from **$25 to almost $200 per hour**, (depending on the product carried)
- Value of reliability (i.e., cost of unexpected delay) for trucks is another **50% to 250% higher**

Freight Transportation in a Changing Business Environment

- Shift from manufacturing to services
- Customers demand more **flexible, reliable, on-time service**
- Traffic growth is greatest for smaller shipments
- Demand for traditional, high-volume transportation services will account for a smaller portion of the industry's revenues and volume

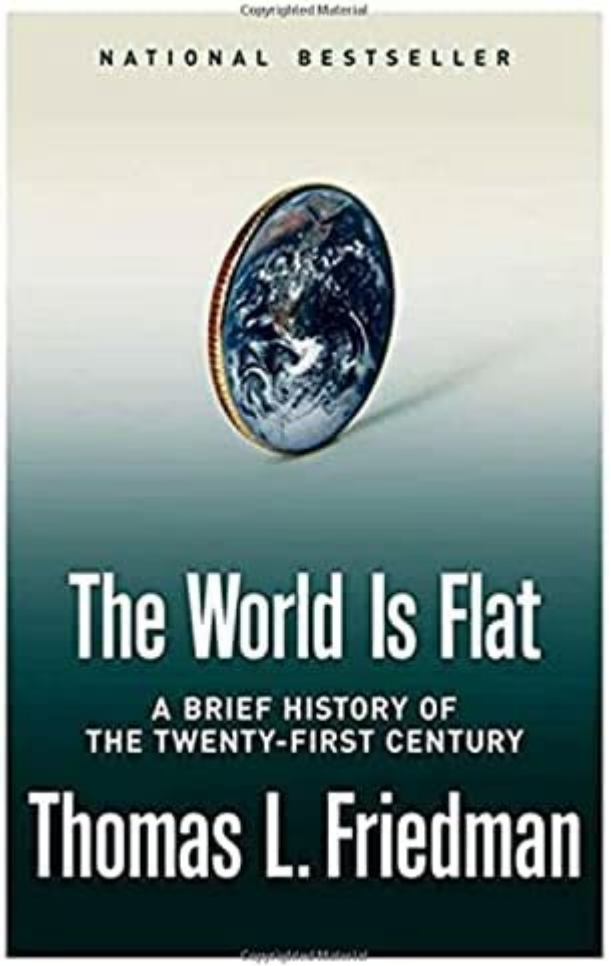
Shift from Push to Pull Logistics

- Shift from "**manufacture-to-supply**" or inventory-based logistics ("push" logistics) to "**manufacture-to-order**" or replenishment-based logistics ("pull" logistics)
- **Pull logistics** relies less on expensive inventory and more on accurate information and timely transportation
- Move to coordinated logistics (i.e., careful scheduling of container pickups at intermodal terminals to prevent extra handling for storage)

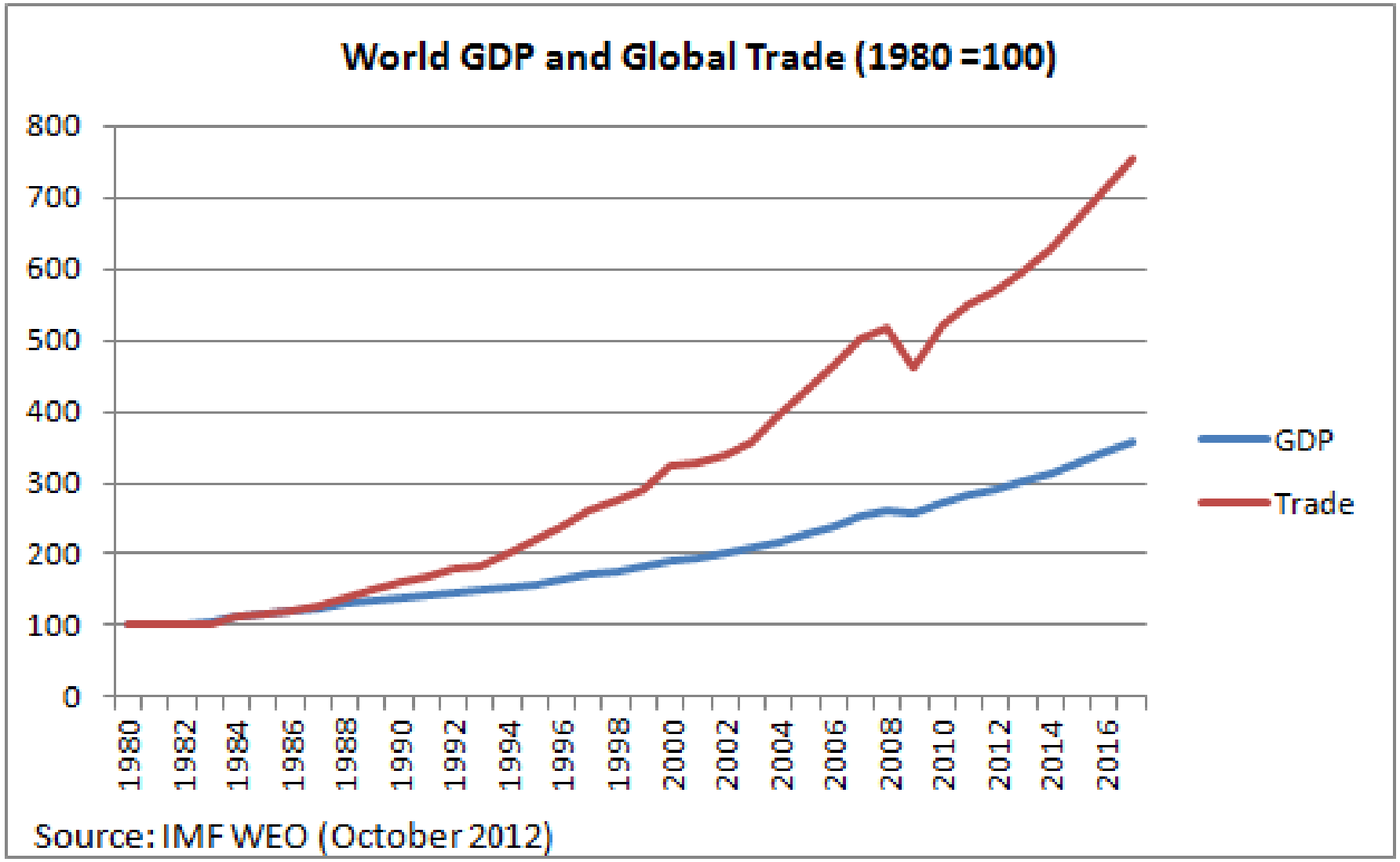
Globalization

- Increasing reliance on **international trade** to satisfy demand for goods and services

- Due to:
  - Liberalization of trade policies such as North American Free Trade Agreement (NAFTA, 1994), (USMCA, 2020)
  - Internationalization of supply chains
  - Transport & information technologies that make global organization of production and consumption possible

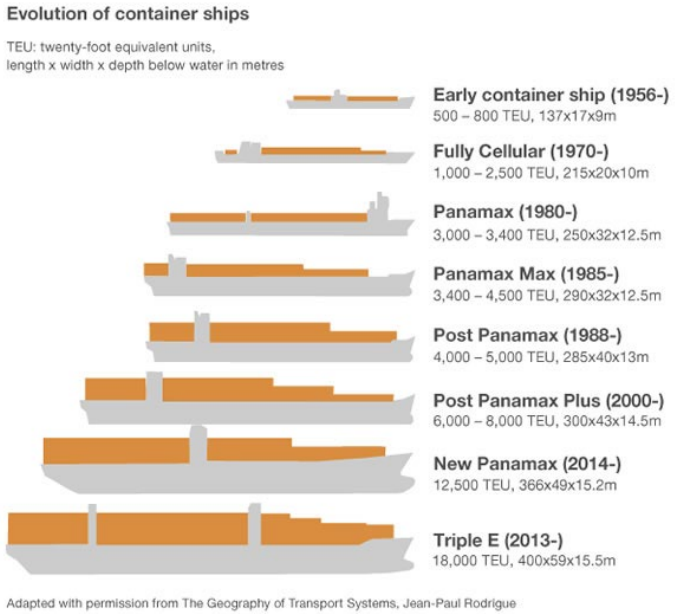


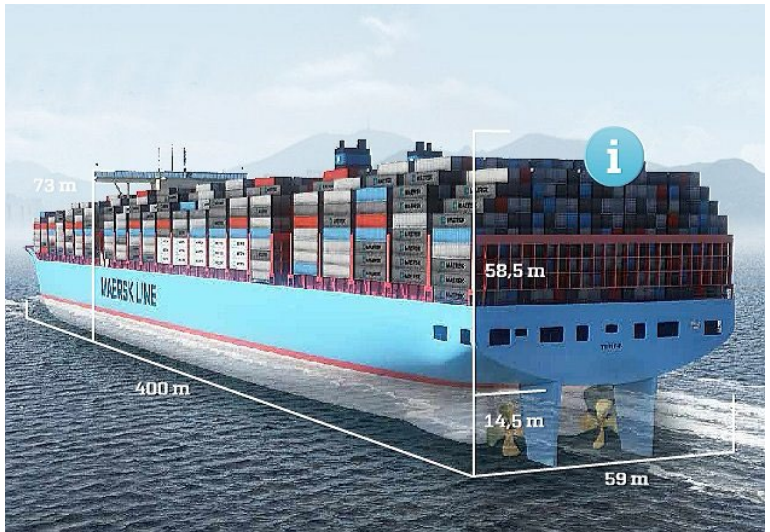
Globalization



Globalization

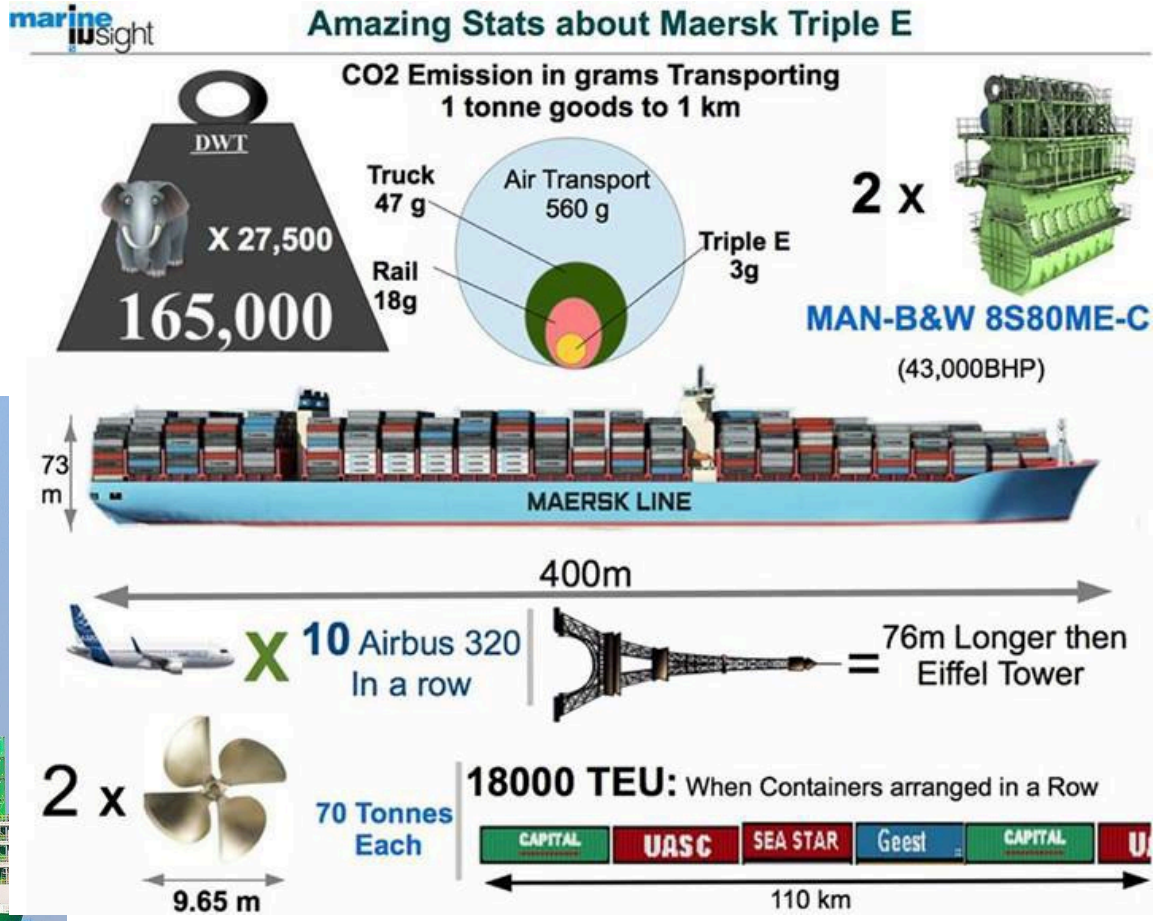
- Growth in international trade has influenced location and development of:
  - Air and marine cargo facilities
  - Land border crossings
  - Intermodal connectors





- Increasing reliance on **containerized transport** has created demand for:
  - Larger, more specialized container facilities & ships
  - More intermodal capacity to handle increased landside traffic

Massive Container Ships



Transportation Challenges

Congestion and Capacity

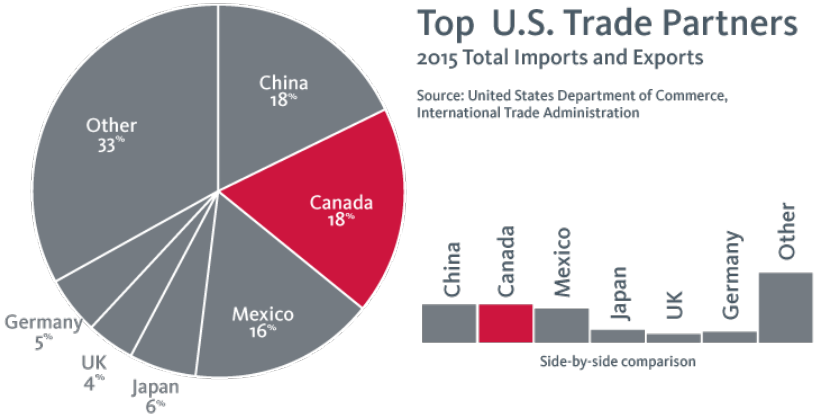
- **Increases in the volume of freight**:
  - Freight volumes growing faster than passenger
  - Strained the transportation network in some locations
  - Exacerbated conflicts between the traveling public and freight carriers

- **Growth in international trade**:
  - Greater pressure on gateways, ports, airports, intermodal facilities, & border crossings

Creation of NAFTA

- Fostered **north-south traffic**
- Increased demands on domestic freight transportation system
- Since NAFTA went into effect in 1994:
  - U.S. trade with Canada & Mexico has **increased by about 90%**
  - Strains on nation's highway and rail networks (configured for traditional E-W trade)
  - Strains at border crossings

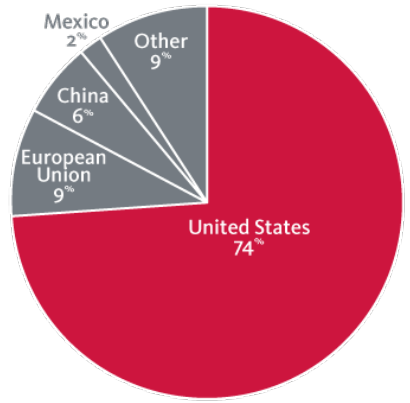
Border Congestion



Top U.S. Trade Partners

2015 Total Imports and Exports

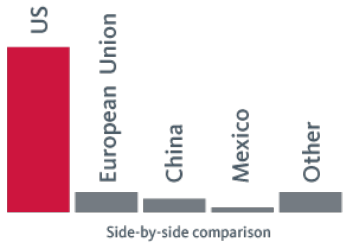
Source: United States Department of Commerce, International Trade Administration



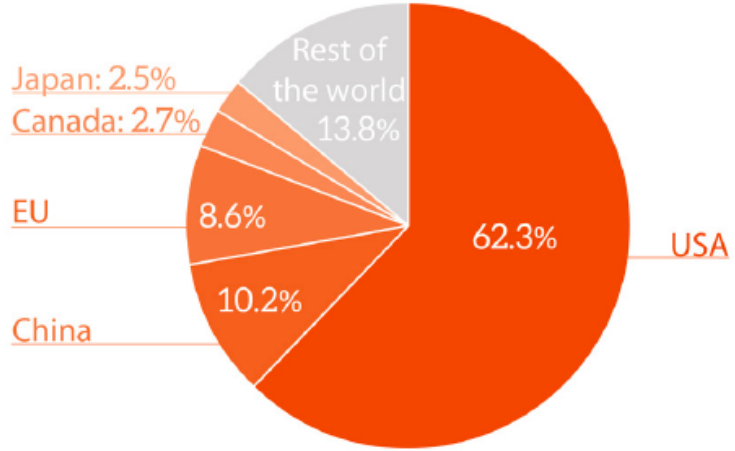
Top Canada Trade Partners

2015 Total Imports and Exports

Source: Statistics Canada



Top Mexico Trade Partners



Source: The IMF.

Total Containers Moving Across Borders

2021	
Total U.S.-Mexican border	**6,959,384**
Total top 5 gateways	**5,308,024**
Laredo, TX	2,554,608
Otay Mesa, CA	967,909
Hidalgo, TX	683,756
Ysleta, TX	667,047
Calexico East, CA	434,704

2021	
Total U.S.-Canadian border	**5,655,125**
Total top 5 gateways	**3,869,013**
Detroit, MI	1,394,304
Buffalo-Niagara Falls, NY	910,225
Port Huron, MI	859,257
Blaine, WA	394,051
Champlain-Rouses Point, NY	311,176

Improving System Operations

- Moving goods from a shipper to a receiver, logistics (or supply chain) management

- In North America, **private sector** is responsible for most freight operations

- Pressure on carriers to improve operations:
  - Demand for **smaller more frequent shipments**
  - Increased importance of **reliability**
  - Increased use of **intelligent transportation system** (ITS) technologies
  - Potential for **vehicle automation** to transform the industry
  - **Sustainability**

Intermodal Freight Operations

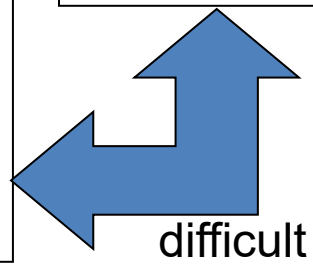
- Numerous **stakeholders** with different priorities

- Lack of **shared information** about
  - Shipment location
  - Vehicle & equipment availability,
  - Gate queues
- Result in **cost increases**, reliability & productivity losses

Planning & Financing Freight Project

Publicly Funded Improvements:
- structured process
- lengthy time lines,
- many stakeholders, including
  - different levels of government,
  - transit authorities,
  - the public

Private Sector Planning
- based on market trends
- requires timely response



difficult to develop private/public partnerships

Environment

- Environmental affected by various aspects of freight systems:
  - Facility location
  - Demand for goods movement
  - Vehicle performance (engine technology)

National Security

- Top priority is general cargo in **international commerce**

- Crucial need:
  - Information about **ownership & location** of containers as they move from origin to destination
  - System of **tracking containers** & **identifying custodians** of the cargo

Freight Modeling (In Brief)