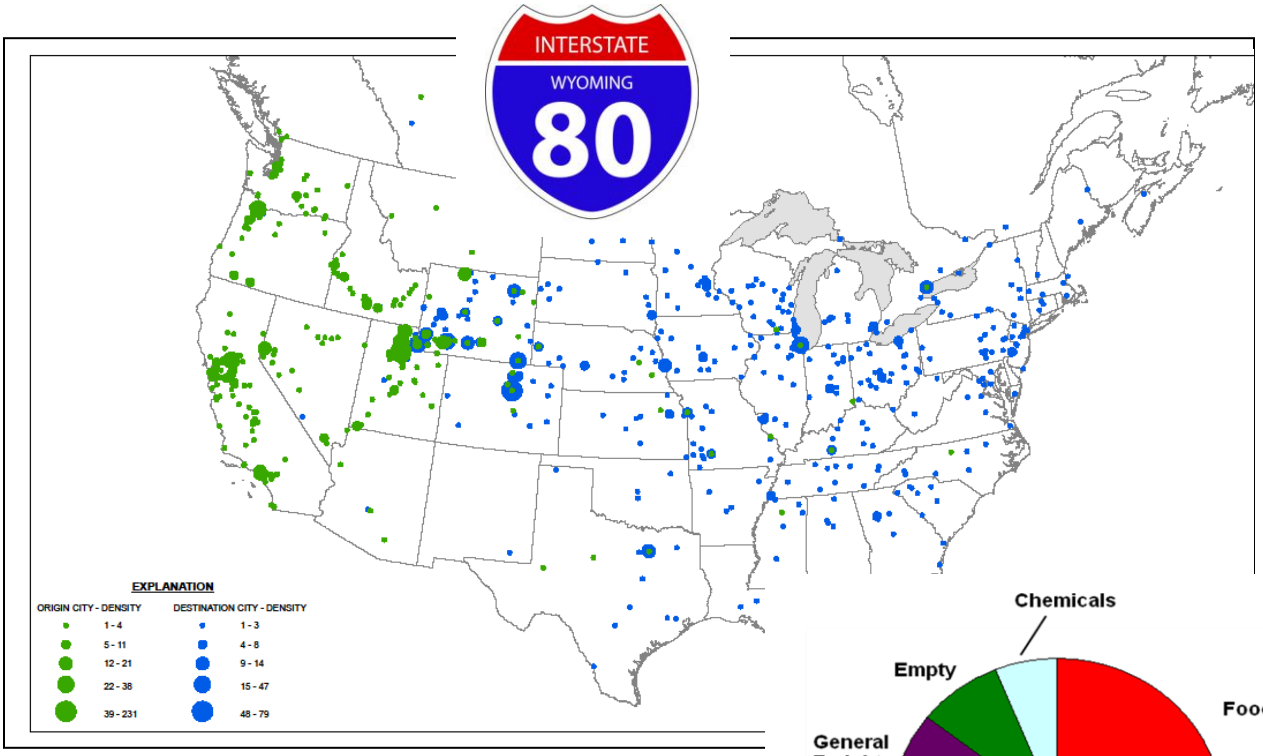
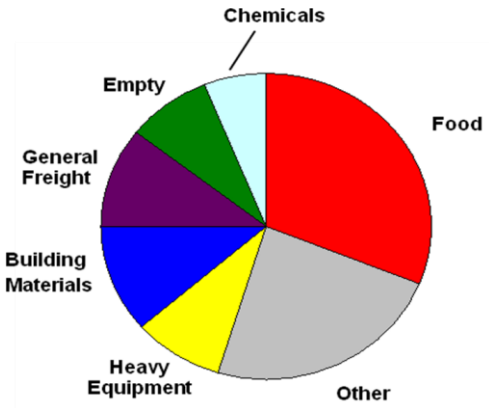
FINAL REPORT
FHWA-WY- 09/09F

Interstate 80 Freight Corridor Analysis

Current Freight Traffic, Trends and Projections for WYDOT Policy-makers, Planning, Engineering, Highway Safety and Enforcement





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Federal Highway Administration

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Department of Transportation

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Abstract:
This report is the result of a two-part study intended to provide input to WYDOT's long-term planning process for the I-80 facility. The first phase of the study involved an on-the-ground freight survey of over 2,000 truckers traveling eastbound and westbound on Interstate 80. The second phase involved analysis of macro-trends that will influence future freight volumes along the I-80 corridor through Wyoming. The study uses a scenario analysis framework to combine data and insight from these two phases to yield useful input and a potential freight planning framework for WYDOT planners and decision makers.

Key Words Wyoming, Research Program, Interstate 80, freight, freight growth forecast, scenario analysis, trucker driver survey, intermodal, Union Pacific, Burlington Northern			Distribution Statement Unlimited
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SI* (Modern Metric) Conversion Factors

Approximate Conversions from SI Units

Symbol	When You Know	Multiply By	To Find	Symbol
Length				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Area				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
ml	milliliters	0.034	fluid ounces	fl oz
l	liters	0.264	gallons	gal
m^3	cubic meters	35.71	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg	megagrams	1.103	short tons (2000 lbs)	T
Temperature (exact)				
°C	Centigrade temperature	1.8 C + 32	Fahrenheit temperature	°F
Illumination				
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
Force and Pressure or Stress				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	pound-force per square inch	psi

Approximate Conversions to SI Units

Symbol	When You Know	Multiply By	To Find	Symbol
Length				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
Area				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
Volume				
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	l
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
Mass				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lbs)	0.907	megagrams	Mg
Temperature (exact)				
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celsius temperature	°C
Illumination				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
Force and Pressure or Stress				
lbf	pound-force	4.45	newtons	N
psi	pound-force per square inch	6.89	kilopascals	kPa

Acknowledgements

R&S Consulting would like to acknowledge the support of the Wyoming Department of Transportation's Research Program and the Research Advisory Committee as well as Planning for sponsoring this study. R&S would like to acknowledge the contribution provided by the Wyoming Highway Patrol, Cheyenne and Evanston Port of Entry personnel for providing support for the trucker survey. R&S Consulting would also like to thank those individuals in WYDOT statistics and other state transportation organizations that provided data and information for this study. Finally R&S would like to thank the many organizations for providing valuable data, information and insights on domestic and international freight movements for this study.

Forward

This report is the result of a two-part study intended to provide input into WYDOT's long-term planning process for the I-80 facility. The first phase of the study involved an on-the-ground freight survey of over 2,000 truckers traveling eastbound and westbound on Interstate 80. The second phase involved analysis of macro-trends that will influence future freight volumes along the I-80 corridor through Wyoming. The study uses a scenario analysis framework to combine data and insight from these two phases to yield useful input and provide a potential freight planning framework for WYDOT planners and decision makers.

An accurate long-term prediction of the percent growth of freight volumes along the I-80 corridor was not the intent of this study. And it is not realistic to believe that one could make confident predictions of average long-term growth of truck vehicle miles traveled (VMT) on I-80 given the complex and changing network of transportation patterns, modal shifts, the dynamics of trade, domestic industry, consumption, across the diversity of goods in transport. The purpose of this study was to further characterize freight on I-80 and to develop growth scenarios beyond linear extrapolation of historic freight volumes and the USDOT Freight Analysis Framework (FAF).

WYDOT uses various inputs to estimate traffic growth. For a project with a 10-year design life, WYDOT uses 10 years of historic traffic data and projects 10 years into the future. Other factors such as economic development and growth are also taken into consideration.

The study has quantitative as well as qualitative components to better characterize I-80 freight movements (i.e. volume and characteristics), changes in volume and characteristics with respect to time (i.e. growth rate) and changes in the growth rate (i.e. the second derivative of freight volume and characteristics with respect to time). Readers of this report must judge whether the survey population, survey techniques and location limitations are statistically significant and provide a representative sample of I-80 freight from which some of the study's conclusions are drawn. However in either case, a framework emerged for WYDOT to better understand and perhaps provide another input into WYDOT projections of I-80 freight growth rates.

The authors of this study have extensive knowledge of the I-80 corridor having authored a previous study *Feasibility of a Next-Generation Intermodal Rail-Truck Transport System for the Western I-80 Corridor*. During that study, a simulation model was developed to estimate the long-term costs to maintain I-80 given various truck traffic growth parameters. This model was one of the quantifiable elements of the analysis framework used to explore various truck traffic growth rates and ultimately to estimate WYDOT's future reconstruction and maintenance costs associated with various freight volume scenarios. However, only a limited number of scenarios were simulated for this study. For example, the analysis of the impact of truck VMT on the cost to maintain I-80 at its current level of service assumes WYDOT maintains the current mix of asphalt and concrete lane miles. The fiscal impact of inflation was included in simulating the impact of increases in freight volumes on future reconstruction costs.

Even with a limited set of scenarios the results of this study should provide insight into factors driving freight volume. WYDOT should monitor these factors and consider them in forecasting freight volumes for long-range planning for the I-80 corridor. This study presents a comprehensive and coherent set of indicators which when taken collectively define the freight growth scenarios. Should the indicators point towards the high growth scenario over the next five years, the study recommends that WYDOT consider strategic solutions to manage I-80 to deal with the significantly higher freight volumes that that particular scenario is pointing to.

This study was performed independently of other studies commissioned by WYDOT, such as the recent study to evaluate the feasibility of tolling Interstate 80.

Arguments stated, concepts presented, conclusions drawn, and recommendations made are solely those of the authors of this report and do not necessarily represent those of WYDOT or the FHWA.

Executive Summary

The first phase of the study involved interviewing approximately 2,000 truck drivers over a 180-day period between September 2007 and March 2008 using a roadside intercept survey. Survey locations were the Cheyenne Port of Entry for westbound traffic and the Evanston Port of Entry for eastbound traffic. The survey identified the business entity, driver demographics, origin and destination, type of load, type of rig and other information. In general, drivers were satisfied with the condition of the I-80 facility but did identify several deficiencies. Over 30% of eastbound and westbound trucks were carrying food products. The Salt Lake City/Ogden area emerged as a major inland western freight hub. The highest number of origin-destination pairs was between Chicago and Salt Lake City/Ogden. Approximately 25% of respondents were under some type of time penalty arrangement which was most commonly associated with hauling food products. Over 2,000 origin-destination pairs by product category were loaded into a GIS database and analyzed. Maps showing these freight patterns are presented in Chapter 4. Results from this analysis were used in building freight growth scenarios in the second phase of the study.

The second phase of the study examined numerous factors influencing future truck traffic volumes across Wyoming. These factors were distilled into three themes or scenario dimensions:

- Mega changes in the transportation network.
- Changes in supply and demand or origin/destination for products transported via I-80.
- Changes in intermodal penetration relative to I-80 freight.

Each scenario dimension has two possible outcomes. The impact of these outcomes (and their respective likelihoods) on future I-80 freight volumes are driven by 1st order factors such as the expansion of Mexican ports and the Panama Canal. These constructs were the foundation for building and analyzing eight freight growth scenarios illustrated on page 67.

- Of the eight scenarios developed and analyzed only two have a growth rate higher than the most recent 10-year average annual growth rate of 4.4%. The scenario with the

highest likelihood forecasts an annual growth rate between 1.3% and 2.4%. This forecast is based on the expectations of a significant shift in freight flows from east-west to north-south and other macro-economic factors. This scenario and six of the eight scenarios developed and analyzed are well below recent forecasts from USDOT's Freight Analysis Framework. Given the dynamics identified in this report, continuation of I-80's 10-year historic growth rate of 4.4%, while possible, is also forecast as unlikely since 4.4% growth is within the range of only two Scenarios which are a low probability.

Each scenario has a likelihood and an estimated 30-year reconstruction cost generated from a previously developed I-80 simulation model. Indicators were identified that can be monitored by WYDOT to determine which scenario is materializing.

The study served to identify key factors (both direct and indirect) that will influence future I-80 freight volumes and provide an additional forecasting tool to help WYDOT position and plan for the most likely required level of investment in I-80 and by consequence other routes and transportation assets within the State.

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List of Acronyms and Abbreviations

BNSF – Burlington Northern Santa Fe Railroad

CAGR – compounded annual growth rate

JIT – just-in-time (logistics practices that streamline manufacturing processes)

LTL – less-than-truckload

TEU – trailer equivalent unit (volume of freight equal to a 40-foot trailer)

TL – truckload

UPRR – Union Pacific Railroad

VMT – vehicle miles traveled

Chapter 1 – Introduction

Background

During the past twenty years the United States' political and economic push towards global trade and the resultant economic growth as well as domestic economic growth has not been supported by well-coordinated national freight policies and programs. The result is an increasing inability of states on major Interstate freight corridors, such as Wyoming, to absorb the costs of maintaining the transportation infrastructure to accommodate the increase in freight movement. Wyoming, as with many other less populous western and mid-western states, has limited funding from gas taxes and a relatively small population base from which to raise additional revenue by other means to fund roads. In the State budget, funding for roads competes with education, health care and other societal needs. States such as Nebraska, Wyoming and Nevada must maintain their portion of Interstate 80 at an acceptable level of service without adversely compromising their ability to invest in other routes on their networks. Maintaining I-80 for the primary benefit of interstate commerce often comes at the expense of other roads in Wyoming and in other I-80 corridor states.

Several previous studies provided a basis for this proposed research project. The first is a 1997 publication entitled *Western Transportation Trade Network (WTTN).* The WTTN study was sponsored by 14 states and served as a baseline of data on surface freight movement for all major trade routes in the western U.S. The WTTN also identified transportation infrastructure deficiencies adversely affecting trade and freight transportation.

Another important starting point was the WYDOT sponsored study *Wyoming Freight Movement and Wind Vulnerability* authored by researchers at the University of Wyoming. This report reviewed sample Vehicle Inventory Use Survey and traffic data from WYDOT. The report developed an equation for the "cost" of delay; the equation is predicated on a weighting factor for the value/importance of the goods being transported.

Another supportive research effort was the recently completed WYDOT-sponsored study, *Feasibility of a Next-Generation Intermodal Rail-Truck Transport System for the Western I-80 Corridor*. This study focused on the long-term costs (reconstruction and maintenance, crashes

and fatalities, energy use and emissions) of increasing truck traffic on I-80. The study analyzed several freight growth projections and found significant differences in I-80 freight volume projections provided by the USDOT (even within the USDOT forecasts) versus the historic annual growth rates based on actual Wyoming traffic data. The study also examined the savings in long-term I-80 reconstruction costs to I-80 corridor states if a moderate amount of I-80 highway freight could be diverted to rail. The study identified the barriers to diversion and presented an innovative intermodal concept to address these barriers. The study also provided policy recommendations for FHWA, State transportation departments, Union Pacific (UPRR) and other entities such as the Port of Oakland.

All three of these studies cited the need for more granular information on freight movements and a more coordinated approach to managing the freight movement along the I-80 corridor. This study will provide the former, presumably in support of the latter.

Purpose of Study

A significant percentage of WYDOT funding is devoted to Interstate 80. According to WYDOT's Budget Office the estimated average annual expenditure for a ten-year period (2000 – 2009) to maintain I-80 is over a quarter of a billion dollars (WYDOT). In 2006, average annual daily truck traffic (AADTT) was approximately 6,000. At the current average growth rate of over 4.4%, I-80 truck traffic is expected to double over the next 15 years. This could more than double the funds required to maintain I-80 at its current level of service. Given this volume of freight, assumptions in I-80 truck traffic growth over the next 10-20 years may drive key asset management strategies and related investment decisions. These investment decisions will be in the order of several billion dollars. Therefore, it is critical that assumptions in truck traffic growth be further refined and qualified with respect to the dynamics that will influence I-80 freight growth and WYDOT's asset management decisions over a long-term planning horizon.

R&S Consulting proposed this study to provide WYDOT with data and analysis of current freight movements, trends and insight into future freight movement along I-80. The results of this study will support future WYDOT planning and policy analysis and decisions in asset management, revenue management, highway safety and enforcement.

This study supports recommendations in the *Guidebook for Freight Policy, Planning, and Programming* published by the Transportation Research Board which describes basic and advanced approaches to freight planning. The *Guidebook* distinguishes between basic and advanced approaches to freight planning by: 1) the breadth and depth of stakeholder involvement and 2) the amount of freight data captured and analyzed. The *Guidebook* recommends the advanced approach where freight traffic is significant and that planning organizations develop a comprehensive regional freight profile as this represents a foundation for subsequent freight planning efforts (NCHRP, 2007).

During this study two thousand truckers were surveyed to collect data on driver profiles, freight movements, type of goods, ownership, time sensitivity, satisfaction with the I-80 facility, etc. Based on review of previous studies, input from WYDOT officials, and the authors' knowledge this survey was a first-of-its kind detailed data collection and analysis of freight characteristics and freight movement on the western I-80 corridor. The trucker survey followed through on a recommendation that WYDOT gain better understanding of freight volume and freight values (Young, 2004). Since truck drivers account for approximately 50% of I-80 users, the study provided a vehicle for WYDOT to solicit input from this key constituency.

The study synthesized information from the survey with broader analysis of U.S freight patterns and how this relates to changes in I-80 freight volumes by analyzing data, trends and other sources of information. This resulted in formulation of eight future freight growth scenarios that encompass a spectrum of 20-year annual growth rates ranging from 2% to almost 6% annual growth in truck vehicle miles traveled (VMT). These scenarios assume a constant growth rate, even though it is likely to fluctuate based on "noise" variables such as periods of slow and negative economic growth. It is even possible, indeed probable, that over a 20-year time horizon one scenario could play out during the first 5-10 years followed by changes in freight patterns related to a different scenario. Although a four percent range in growth rates may seem wide, over a 20-year time horizon this range and these bounds appeared reasonable.

There is significant sensitivity in 20-year freight volumes resulting from this range in growth rate projections. Compounding average annual growth rates differing by only two percent will, over 20 years, significantly underestimate or overestimate truck VMT. WYDOT's strategy and investment alternatives for operating and maintaining the I-80 facility could be considerably

different assuming a two percent versus a six percent annual growth rate in truck VMT. Yet using the 10-year average of 4.4% may be suboptimal – leading planners down a path of incremental investment strategies as opposed to more fundamental changes in asset management and investment strategies. In other words, a planning assumption based on "splitting the difference" may not provide the basis for optimal long-term strategic decisions. Since pavement consumption, i.e. useful pavement life, is proportional to truck VMT and the useful life of asphalt is significantly less than concrete, under a 6% forecasted annual growth rate in truck VMT it may be more advantageous for WYDOT to transition more of I-80 from asphalt to concrete – this is a multi-billion dollar decision. Conversely, if the growth in I-80 freight volume decreases by half (from 4% to 2%) over the next 20 years as a result of changing freight patterns or diversion, WYDOT may have funds to invest in upgrading other routes due to fewer lane miles of I-80 needing reconstruction.

Due to the sensitivity of this key planning assumption and the complexity inherent in forecasting freight pattern growth, a dynamic analysis framework was developed that can be adapted over time. This framework will be presented in Chapter 5.

To be useful to WYDOT planners, attributes of each scenario were defined along with a method to assess the likelihood of each scenario. A set of scenario indicators was identified, evaluated and baselined. These indicators are intended to be combined with WYDOT's traffic count data and current regression models to help determine which scenario and related freight growth rate is being realized over time. It is recommended that WYDOT planners review these scenario indicators periodically for forecasting truck VMT growth rates to support asset management, planning and revenue projection decisions.

Project Scope and Work Plan

The project consisted of six tasks. Tasks 1 focused on a review of previous I-80 studies and freight analysis models. Task 2 involved developing and administering the trucker survey and entering the data into a database for statistical and geospatial analysis. Task 3 included the compilation and analysis of the trucker survey data. Task 3 also included geospatial analysis of the data and development of freight movement maps and graphs. Task 4 focused on gathering data and additional information on freight patterns (origins, destinations, type of freight, routes, modes, etc.) from and how these patterns are changing in relation to I-80; sources included information obtained from large shippers and publicly available data and analysis. Task 5 centered on developing a framework to construct freight growth scenarios and analyze these scenarios. Task 6 encompassed drafting the formal report and presentation material for use in conferences and other speaking opportunities.

Originally this study was to include a brief analysis of the impact from increasing truck weight limits in Wyoming. During a subsequent coordination meeting it was decided not to include this analysis. Therefore this was not included as a factor in the analysis of I-80 freight volume growth rates on freight flows and reconstruction costs.

Chapter 2 – Literature and Review Data

Literature and Data Review

The first phase of this study involved reviewing relevant literature and data. Several sources of freight growth projections for the I-80 corridor through Wyoming have been published over the past ten years. These sources include:

- USDOT, *Freight Analysis Framework.*
- Tomasini and Young, *Study of Freight Vehicles along Interstate 80 Corridor.*
- R&S Consulting, *Feasibility of a Next-Generation Intermodal Rail-Truck Transport System for the Western I-80 Corridor*.

Since the study authored by Tomasini and Young was a subset of the study authored by R&S Consulting these two studies will be reviewed collectively. This section will conclude by summarizing previous freight projections and a comparative analysis of these projections.

Truck Traffic Projections – Freight Analysis Framework

The United States Department of Transportation (USDOT) developed a model that derives a dataset of forecasted freight volume by route. The model is called the *FREIGHT ANALYSIS FRAMEWORK* (FAF). According to information from the USDOT website and interviews with USDOT officials (Tianjia Tang, 2007), the FAF forecasts the movement of freight throughout the country in future years. It was developed by Federal Highway Administration to understand and forecast commodity movements in the U.S. The FAF combines origin-destination commodity flow data, and assigns flow to the modal networks. The model has the ability to analyze changes in flows or networks and includes multi modes, i.e. trucks, railroads, water and air. At its core the FAF model forecasts the tons of commodities produced and where they are consumed; this is converted to number of trucks required on different routes of the highway network to support this movement.

The FAF incorporates data from multiple state and federal sources to estimate commodity flows and related freight transportation movement among states, regions, and major international gateways across the entire nation. Data sources include:

- BTS/Census Bureau Commodity Flow Survey (All Modes).
- BTS Transborder Freight Statistics (Truck, Rail, Pipeline).
- Surface Transportation Board/Federal Railroad Authority Rail Waybill Sample (Rail).
- MarAd and US Army Corps data (Water).
- BTS/FAA (Airport).
- Reebie (Truck).
- Census Bureau 5-year Census and Annual Survey of Manufacturers (Truck, Water, Air).
- Private Port Directories (Water).
- DRI Industrial Production Indices (Truck, water, air).
- Trade Association Production & Shipment Reports (Truck, water, air).
- US Geological Survey Mineral Industry Reports (Truck, water).
- Reebie Associates Freight Locater/InfoUSA Street-Address Industrial Employment & Activity (Truck).
- County Population Data (Truck).
- Inter-Industry Trade Patterns (Input/Output Table) (Truck, Air).
- Motor Carrier Industry Financial & Operating Statistics (Truck).
- Railroad Industry Proprietary Rebill Factors (Truck).

According to the USDOT, the FAF estimates commodity movements by truck and the volume of long distance trucks over specific highways. Flows are estimated at the county-to-county level by mode and commodity. Models are used to disaggregate interregional flows from the Commodity Origin-Destination Database into flows among individual counties and assign the detailed flows to individual highways. National and regional forecasts are applied to these flows. These models are based on geographic distributions of economic activity rather than a detailed understanding of local conditions. While the FAF provides reasonable estimates for national and multi-state corridor analyses, USDOT states that FAF estimates are not a substitute for local data to support local planning and project development. Figures 1 and 2 illustrate data derived from the FAF showing projected freight volumes on I-80 across Wyoming in 2000 and 2020, respectively.

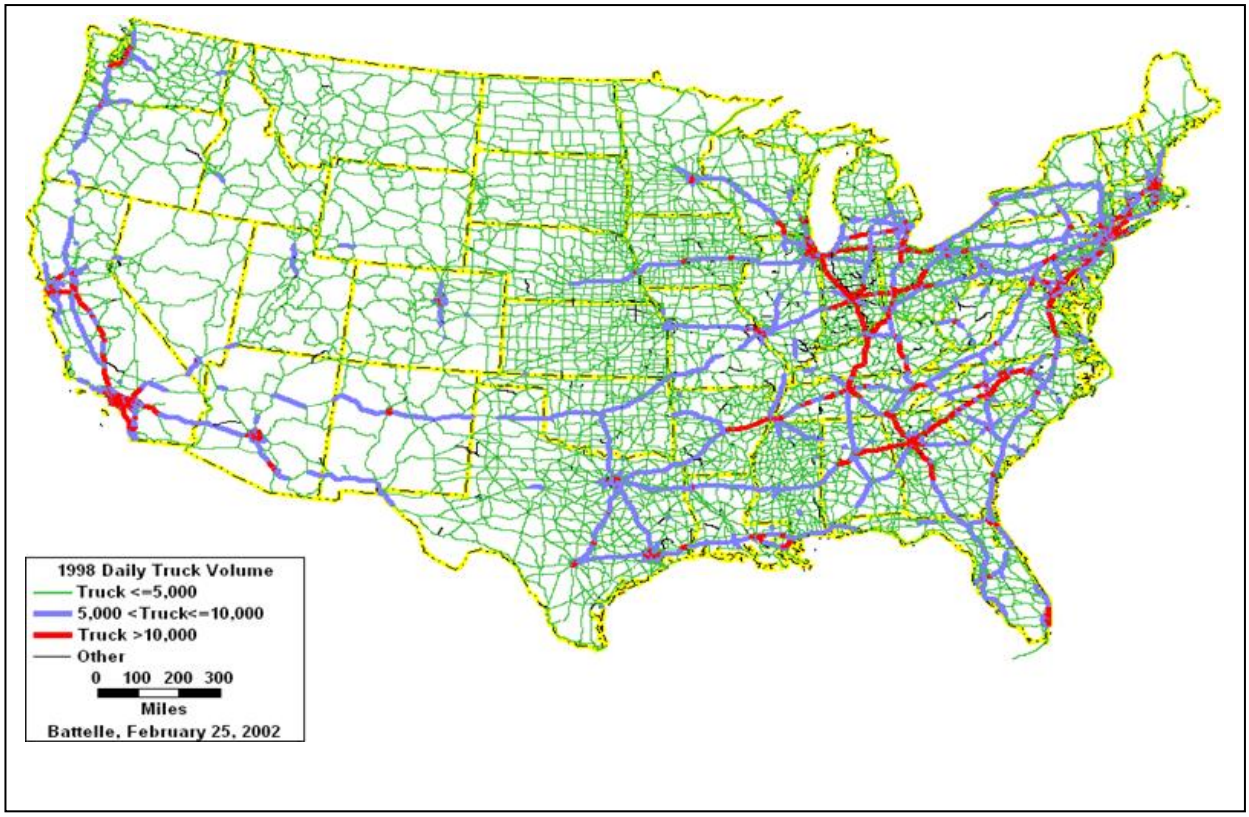


Figure 1. 2000 Truck Volume Projections Derived from the USDOT FAF.

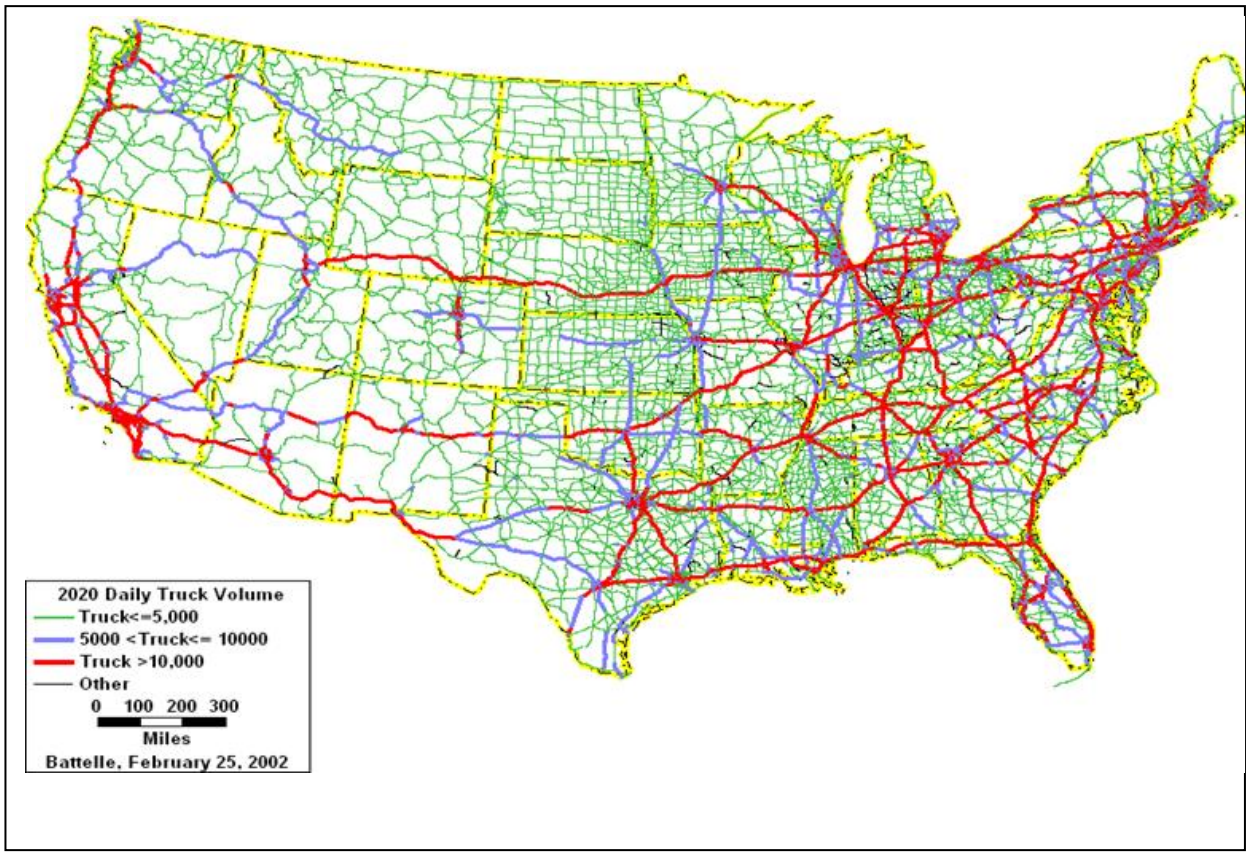


Figure 2. 2020 Truck Volume Projections Derived from the USDOT FAF.

The FAF has the capability to forecast based on the type of freight. Figures 3 and 4 show other FAF outputs. Figure 3 shows truck freight flows for all commodities with freight density in tons. Figure 4 shows truck freight flows for high-value, time-sensitive products.

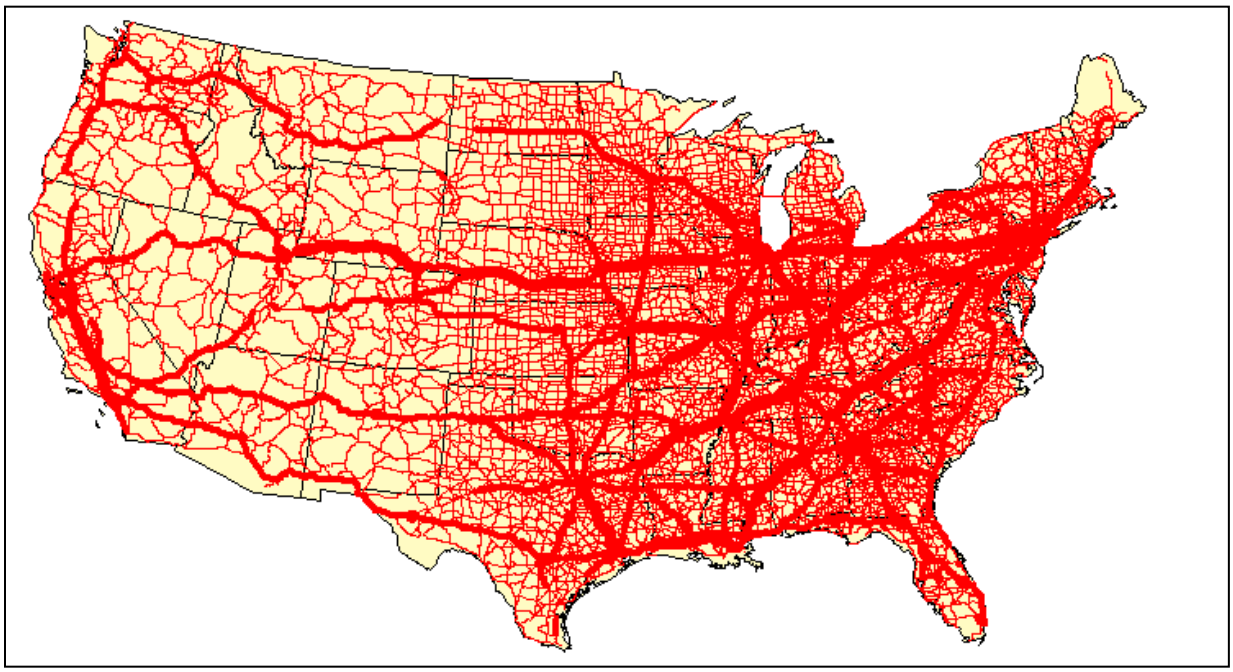


Figure 3. Sample FAF Output of Freight Flow Density for All Commodities.

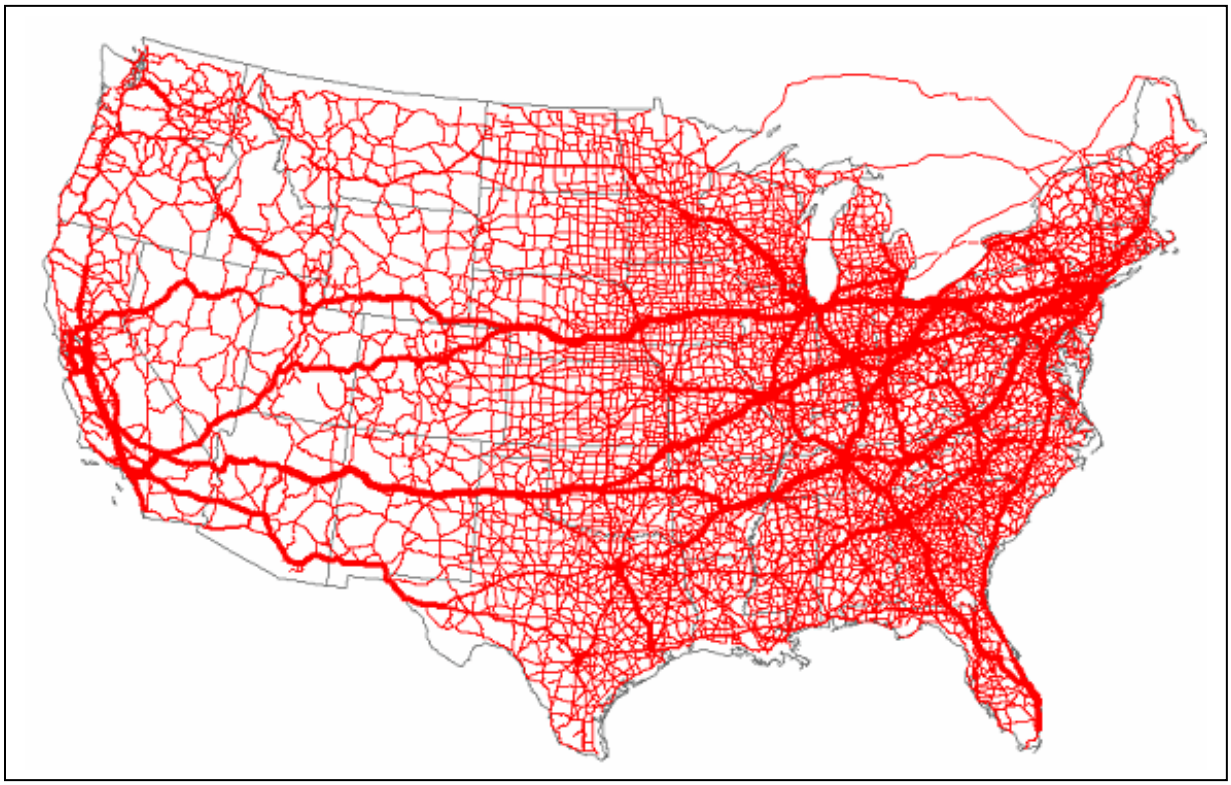


Figure 4. Sample FAF Output of Freight Flow Density for High-value, Time-sensitive Products.

The FAF provides data and information specific to Wyoming. Table 1 presents information on freight shipments that have either an origin or a destination in Wyoming. As shown in the table, rail moved the largest percentage of tonnage and the second largest percentage by value. Trucks moved the largest percentage of the value and the second largest percentage by tonnage.

Table 1. Freight Shipments To, From, and Within Wyoming 1998, 2010, and 2020 (Source: FAF).

	Tons (millions)			Value (billions $)		
	1998	**2010**	**2020**	**1998**	**2010**	**2020**
State Total	377	475	534	50	98	164
By Mode						
Air	<1	<1	<1	<1	2	3
Highway	65	101	135	39	79	135
Other [a]	<1	<1	<1	<1	<1	<1
Rail	312	374	399	10	18	26
Water	0	0	0	0	0	0
By Destination/Market						
Domestic	376	473	531	49	97	161
International	1	2	3	<1	2	3

Note: Modal numbers may not add to totals due to rounding.
[a] The "Other" category includes international shipments that moved via pipeline or by an unspecified mode.

According to the FAF model truck traffic is expected to grow throughout Wyoming over the next 20 years. Figure 5 shows how the FAF attempts to link origin and destination data to provide a network view of the predominant “feeder” routes and “fantail” routes for I-80 truck traffic. Figure 6 illustrates multi-modal aspects of the FAF, by depicting rail freight flows across Wyoming. Figure 6 is approximately ten years old so it may not accurately reflect the tremendous increase in coal shipments from the Powder River Basin or the increased amount of freight traffic on UPRR’s Central Corridor. As illustrated in Figures 7 and 8, much of the growth will occur on the Interstate highway system. Truck traffic, moving to and from Wyoming, accounted for 14% of the average annual daily truck traffic on the FAF road network. Approximately 6% of truck traffic involved instate shipments, and nearly 71% involved trucks traveling across the state to other markets. About 9% of the AADTT were not identified with a route-specific origin or destination.

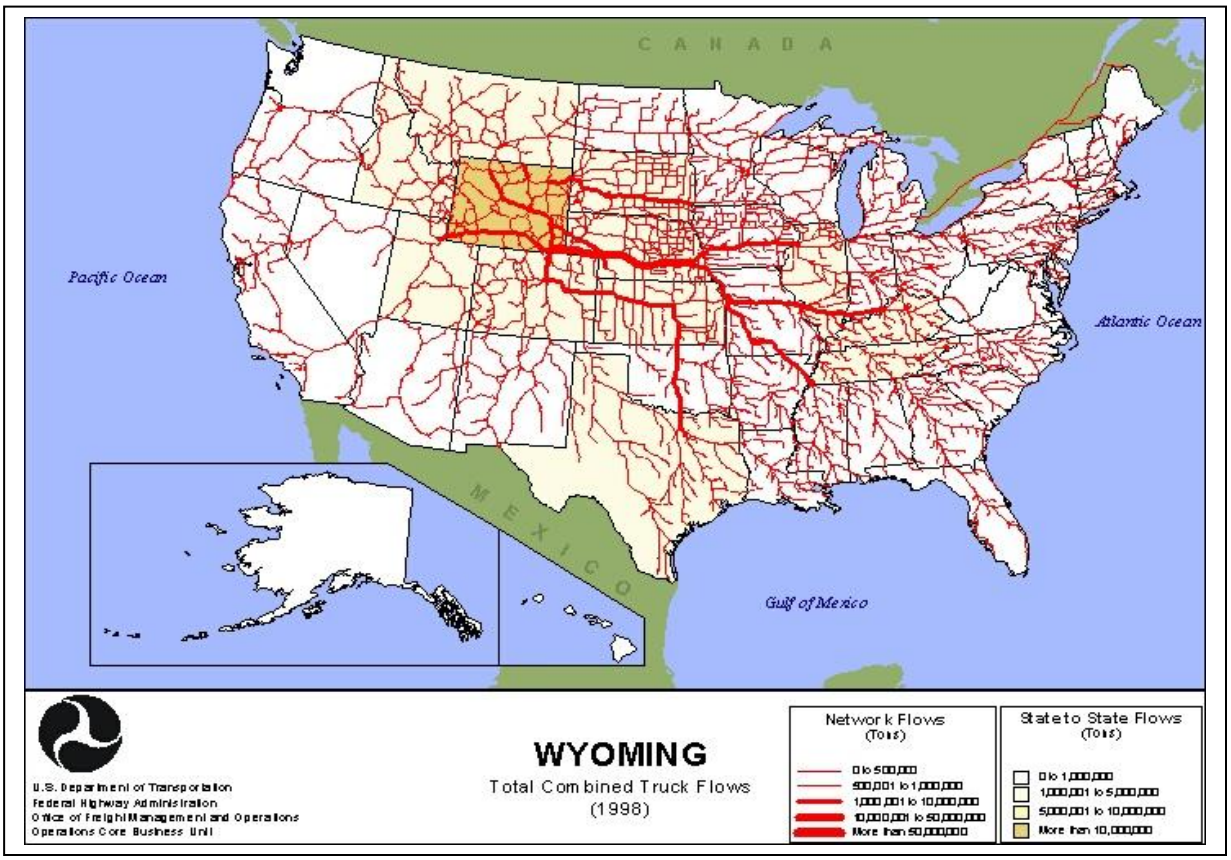


Figure 5. 1998 FAF Map of Total Combined Truck Flows across Wyoming.

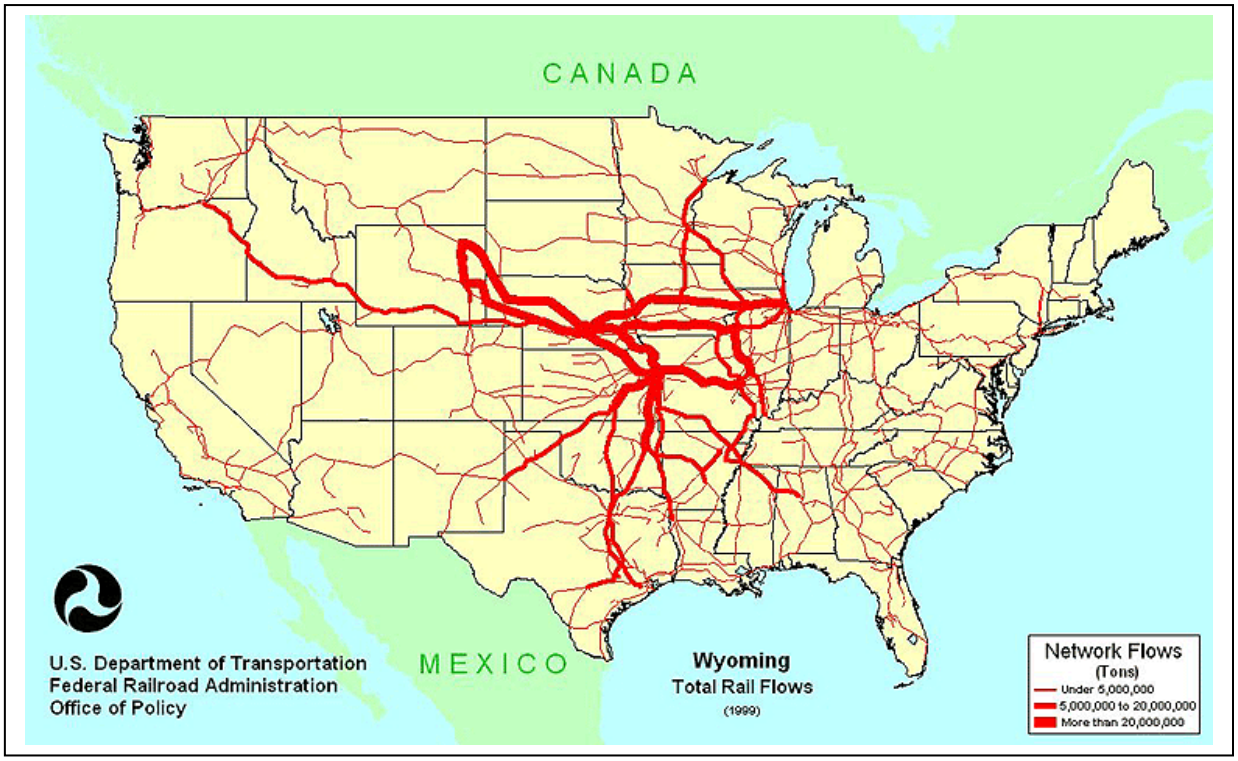


Figure 6. 1999 FAF Map of Rail Flows across Wyoming.

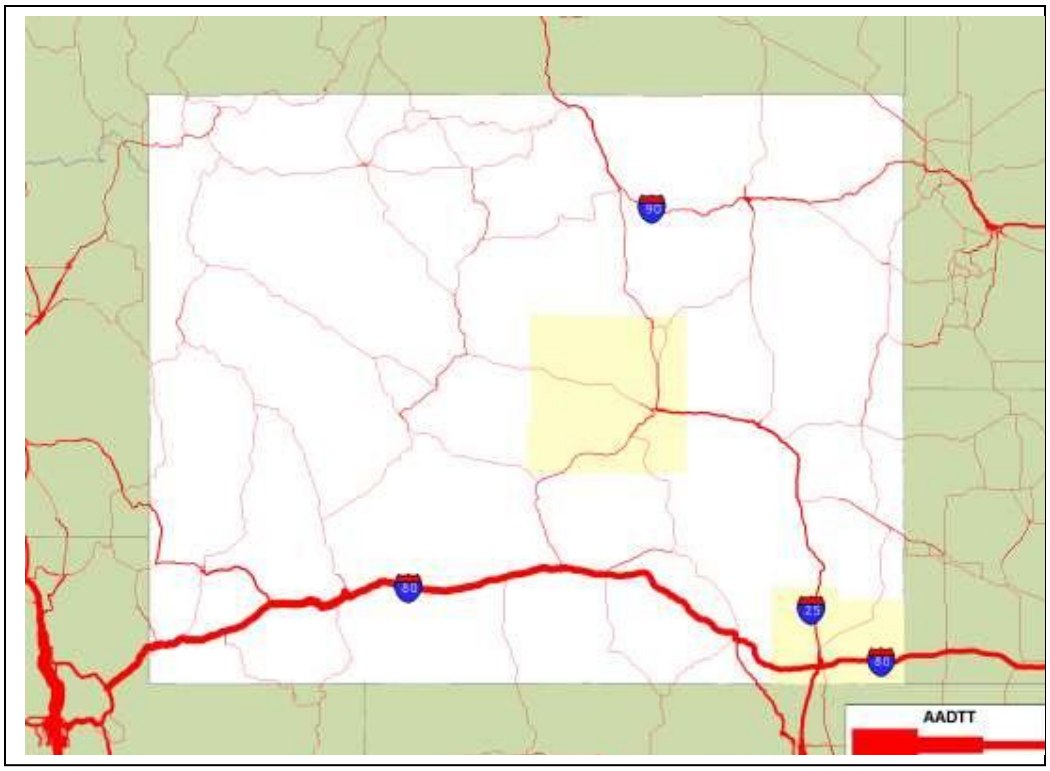


Figure 7. 2010 FAF Projections of Wyoming Freight Flows for Commodities Transported by Truck (Source: USDOT).

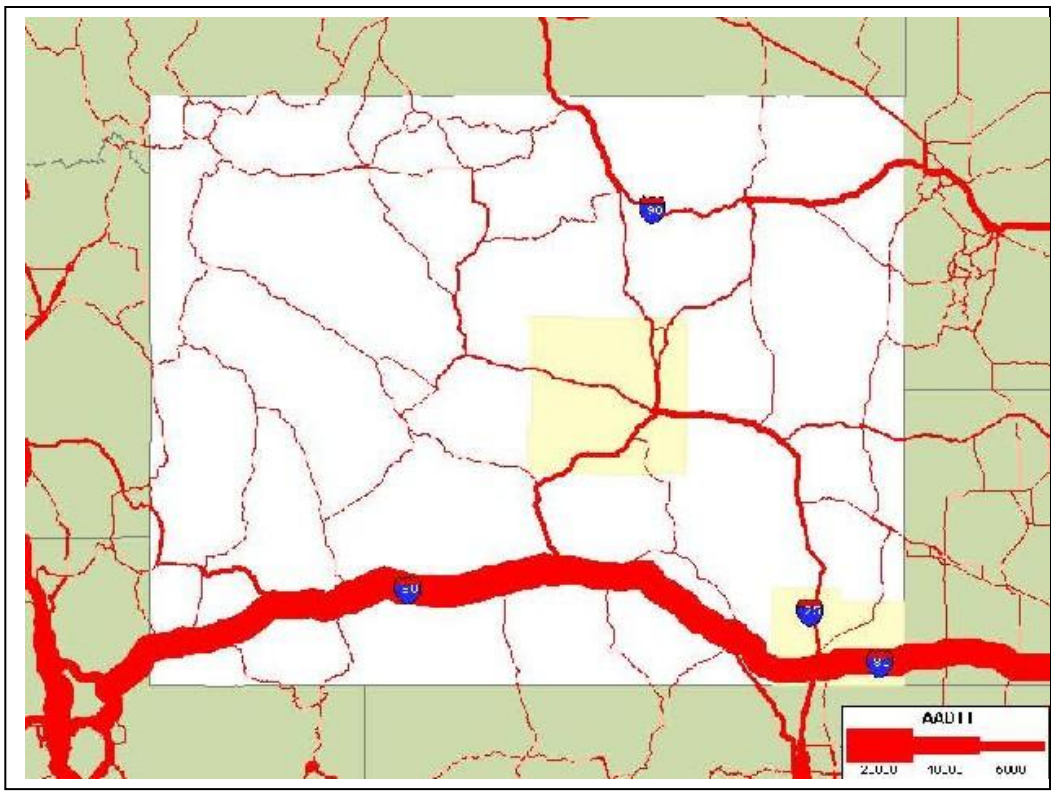


Figure 8. 2020 FAF Projections of Wyoming Freight Flows for Commodities Transported by Truck (Source: USDOT).

Table 2 shows the top five commodity groups shipped to, from, and within Wyoming by all modes. The top commodities by weight are coal and clay, concrete, glass or stone products. By value, the top commodities are chemicals or allied products and farm products. Although interesting to note, these bulk commodities shipped to, from or within are normally transported only short distances by truck either from or to a distribution point. The primary mode used to transport the bulk commodities listed in Table 2 is almost exclusively rail. Hence movement of these commodities does not significantly impact the number of trucks on I-80.

Table 2. Top Five Commodities Shipped To, From, and Within Wyoming by All Modes: 1998 and 2020 (Source: FAF).

Commodity	Tons (millions)		Commodity	Value (billions $)	
	1998	2020		1998	2020
Coal	297	360	Chemicals/Allied Products	15	58
Clay/Concrete/Glass/Stone	19	51	Farm Products	7	12
Chemicals/Allied Products	19	48	Coal	6	9
Farm Products	18	22	Food/Kindred Products	4	17
Nonmetallic Minerals	4	6	Secondary Traffic [a]	3	16

[a] Secondary traffic is defined as freight flows to and from distribution centers or through intermodal facilities. No commodities are assigned to this intermediate step in the transportation process.

In summary, the FAF is a very robust model that considers production volumes of commodities, sources and destinations for commodities, routes within the freight transportation network and likely modes of transport. Recently, a TRB committee on freight data reviewed FAF projections and while in agreement that freight volumes will continue to increase – primarily predicated on U.S. population growth – the committee developed projections in freight growth that were lower than the FAF projections (King, 2008).

Truck Traffic Projections – Tomasini and Young

In 2006 a report sponsored by WYDOT and USDOT, Tomasini and Young forecasted growth in I-80 truck traffic by segment for 2010 and 2020. This forecast was developed using a regression model based on ten years (1995 – 2005) of I-80 truck traffic data from WYDOT's Vehicle Miles

2004. This regression analysis forecast I-80 truck VMT to increase at a significantly lower rate than the FAF.

Table 3 and Figures 8 and 9 were derived from data provided by WYDOT to Tomasini and Young. The figures show projections for select segments along I-80. The difference in forecasted freight volume varies from across segments. For various segments of I-80 projected 2010 truck VMT varies from 28% to 43% between the Tomasini and FAF lower bound forecasts and in 2020 from 33% to 47% between the Tomasini and the FAF upper bound forecasts. In practical terms this is a forecast difference of over 5,000 trucks per day in 2010 and over 7,000 per trucks per day in 2020.

Table 3. Comparison of I-80 Truck Volume for 2010 and 2020.

2010						
M.P	**Tomasini**	**FAF (lower)**	**FAF (upper)**	**% Difference between Tomasini and FAF Lower Bound Projections**	**% Difference between Tomasini and FAF Upper Bound Projections**	**% Difference between FAF Lower and Upper Bound Projections**
0-72.3	9558	13264	14258	28%	33%	7%
235-310.4	8751	12584	13664	30%	36%	8%
364-402.7	7080	12326	13404	43%	47%	8%
2020						
	Tomasini	**FAF (lower)**	**FAF (upper)**			
0-72.3	12418	16797	19781	26%	37%	15%
235-310.4	11774	16141	18946	27%	38%	15%
364-402.7	9517	15781	18577	40%	49%	15%

Each forecasting technique and resultant projections in freight flows have inherent strengths and weaknesses, but they are still forecasts and by nature will be wrong. More important than forecasts, is the actual freight data (such as the origin, destination and freight type) and the transparency of the relationships and soundness of the casual factors influencing the movement of freight on Wyoming I-80.

In order to better understand the characteristics of freight flows across Wyoming an extensive freight survey was conducted as part of this study. The intent of this survey was to collect much more extensive and detailed data on freight movements for use in analysis and scenario development in subsequent phases of this study. Chapter 3 describes the survey and the logistics of conducting the survey. Chapter 4 provides survey data analytics.

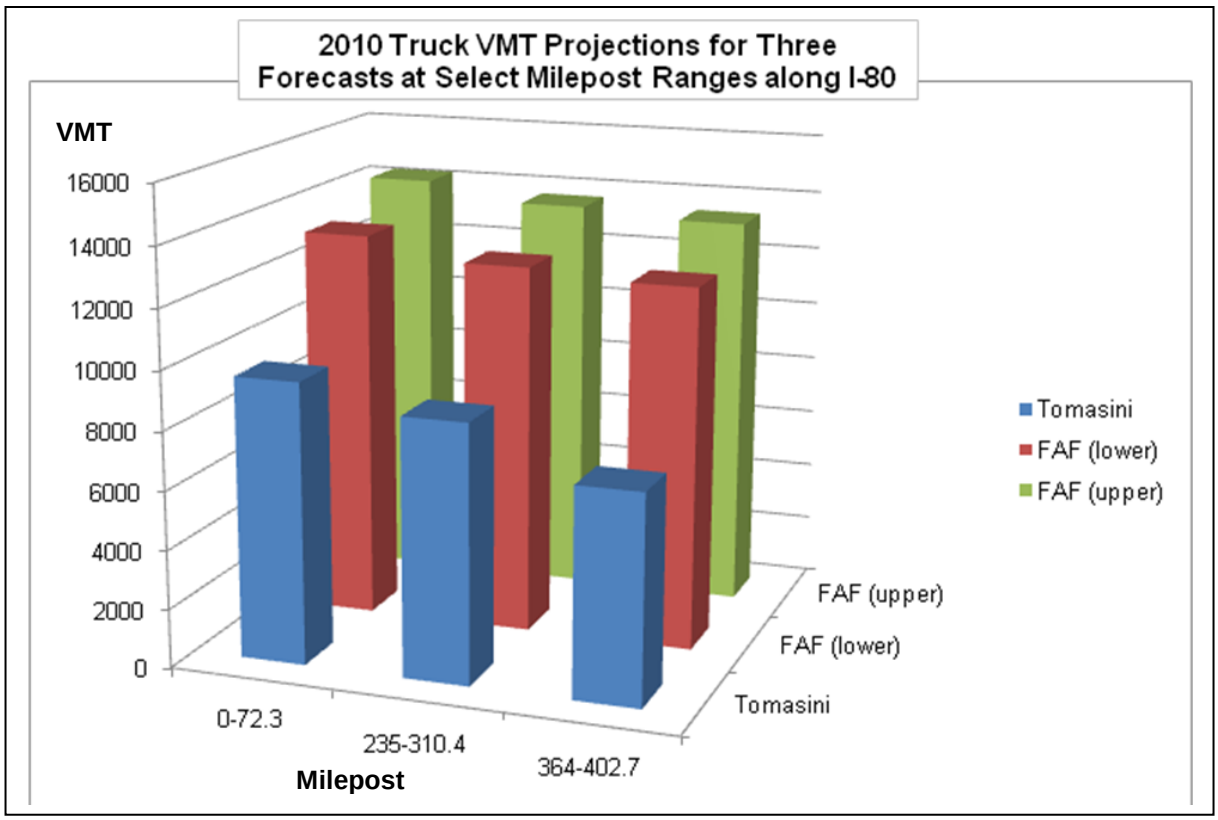


Figure 9. Comparison of Three 2010 Truck Volume Projections.

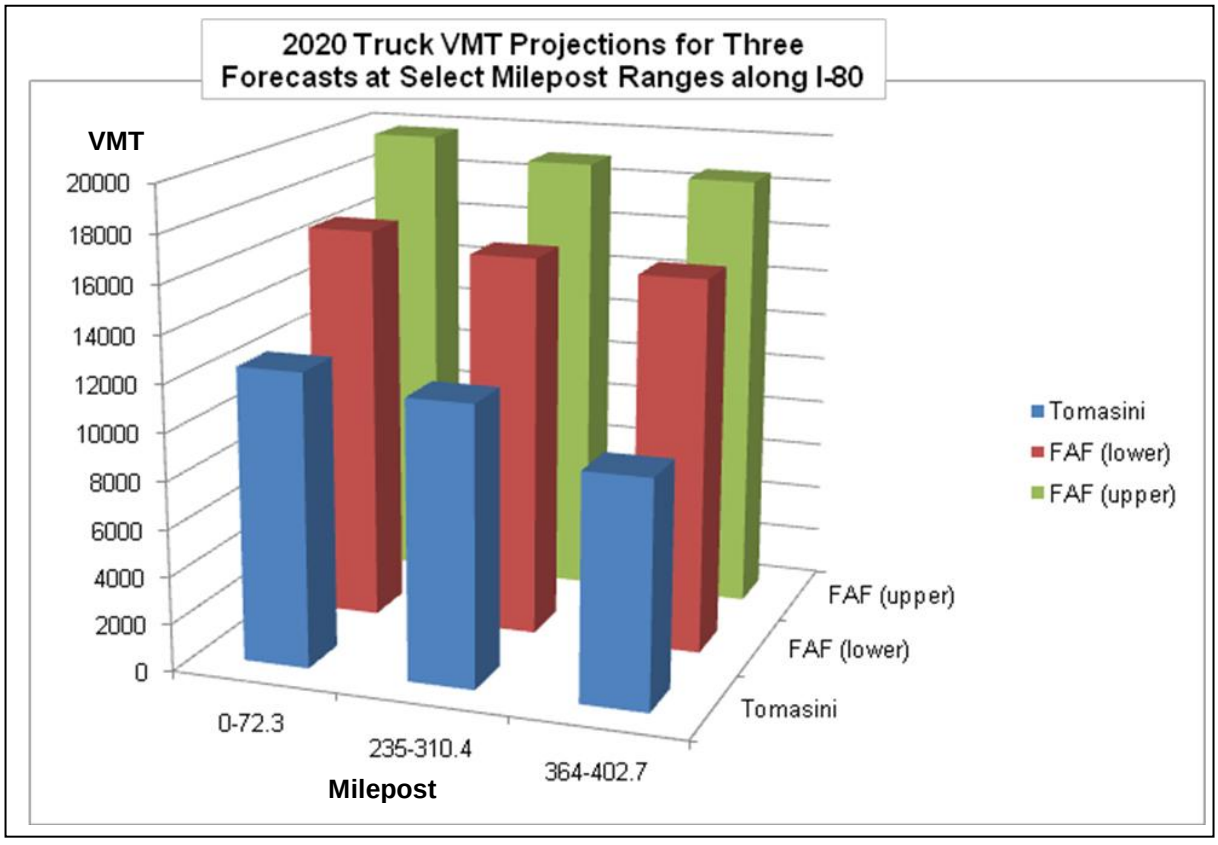


Figure 10. Comparison of Three 2020 Truck Volume Projections.

Chapter 3 – On-the-Ground Freight Movement Data Collection

The second phase of this study involved interviewing approximately 2,000 truck drivers over a 180-day period between September 2007 and March 2008 using a roadside intercept survey on Wyoming I-80. Survey locations were the Cheyenne Port of Entry for westbound traffic and the Evanston Port of Entry for eastbound traffic. Table 4 shows the number of surveys taken at each location.

Table 4. Number of Surveys Taken at Each Location.

Survey Location	Number of Respondents
Cheyenne (westbound)	1,002
Evanston (eastbound)	1,010

Figure 11 shows that approximately 70 percent of surveying occurred on Tuesday, Wednesday and Thursday. Not enough is known specifically about freight movement by day of the week to determine if this pattern introduced any biases in the dataset.

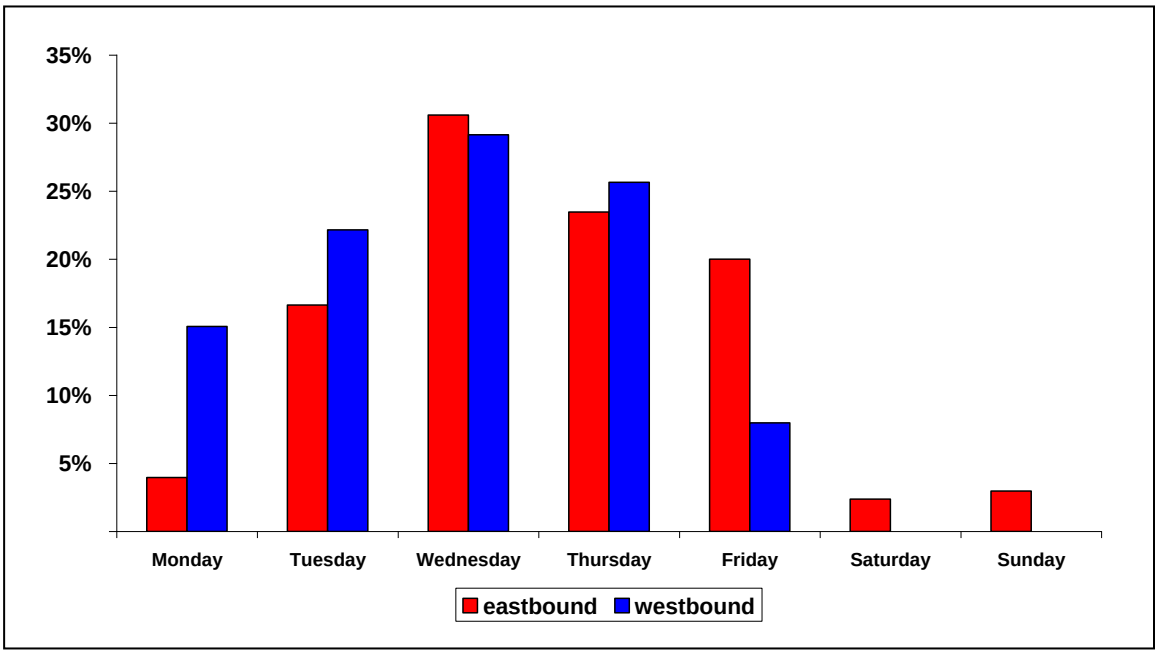


Figure 11. Days of the Week When Surveys Were Conducted.

Each survey took approximately 10 – 15 minutes. Surveyors were stationed inside the Port facility. The survey technique was one-on-one interviews with the surveyor asking the driver a series of questions and documenting the response. Most surveying was conducted after a driver completed their check-in with Port officials. In some cases surveying was performed while drivers were waiting in line. During the time surveyors were stationed at the Port of Entry approximately 75% of all drivers stopping at the Port were surveyed.

The survey was divided into four sections. The first section captured business data, freight type, origin, destination, time sensitivity and other information. The second section collected truck driver demographic information. The third section polled truckers on their satisfaction with the Wyoming Interstate 80 facility and opportunities for improvement. The fourth section provided drivers with basic information on the "land ferry" concept. (The land ferry is a conceptual intermodal service that would haul complete tractor-trailer rigs and drivers long distances across major freight corridors.) The survey asked several questions regarding the land ferry's potential level of service, price points and other service requirements to assess drivers' willingness to consider using a new intermodal service and determine value points. Each section of the survey supported specific study objectives and provided useful information A sample survey is provided in Appendix A.

Drivers using Pre-pass (the electronic pre-registration and weight-in-motion system that permits truckers to by-pass the Wyoming Ports of Entry) were not surveyed. Originally the proposed plan was to survey at the Ports of Entry as well as other locations such as truck stops and rest areas. This would enable drivers with Pre-pass who by-pass the ports of entry to participate in the survey. Prior to beginning the survey campaign the survey was "piloted" to test the content and the flow, to train surveyors and to determine the best locations for surveying. During the pilot it became evident that surveying truck drivers at rest areas and truck stops was not feasible. The "effective" time required to complete a single survey – the time for a surveyor to locate and approach a candidate and administer the survey, combined with the candidate's willingness to participate in a ten-minute survey – was determined to be impractical. Furthermore, there was concern for the safety of a single surveyor approaching idling trucks in rest areas and truck stop parking lots. Therefore, it was decided to position surveyors exclusively at the Ports of Entry.

Since the survey was conducted at the Ports drivers may have perceived their participation as compulsory. Consequently, the number of drivers who declined a request to be surveyed was estimated to be less than five-percent.

However, what was gained in efficiency came at the expense of precluding Pre-pass drivers in the survey.

The impact of not including Pre-pass drivers in the survey may introduce a systemic bias in the data but there is no real way of knowing. Data on freight, customers, origins/destinations is closely protected in the highly-competitive freight business and Pre-pass data does not include freight type or origin/destination. Based on the relatively large sample size and the diversity of freight the absence of Pre-pass drivers should not materially affect inferences derived from analysis of survey data nor development and evaluation of the freight growth scenarios. For informational purposes, Table 5 shows many of the largest trucking companies in the U.S. use Pre-pass.

Obtaining Pre-pass data for this study that could have been used to identify potential biases was unsuccessful. Inquiries made to Pre-pass were directed to their website which states Pre-pass policy in regards to accessing Pre-pass information:

"Your bypass transactions and carrier business information are treated with the utmost privacy. This data is not publicly disclosed and not permanently retained after payment of relevant transaction fees." (Pre-pass.com, 2008) The website also includes the following statement from Dick Landis, President and CEO of HELP, Inc., *"It is the policy of HELP, Inc. to ensure that PrePass carriers are not subjected to a higher level of regulatory compliance than non-PrePass carriers. To that end, HELP, Inc. will retain carrier specific event data for a defined period of time for the purpose of operating the PrePass System only. HELP, Inc. intends not to provide carrier specific event data to jurisdictions without authorization of the individual carrier."*

No bias was expected or evident in the responses to the first section of the survey which included objective questions on operational ownership, freight type and origin and destination. Responses to these questions should be independent of the use of Pre-pass. The second section of the survey focusing on driver demographics and professional satisfaction may be biased. Presumably drivers with larger firms (who predominantly use Pre-pass) would be more professionally satisfied. These firms have large customer bases and a steady supply of loads.

Employee drivers have benefits and more time off than drivers paid on a strict mileage basis. However, the survey showed that over 90% of respondents had a sense of professional satisfaction. The third section of the survey which focused on drivers' receptivity to the land ferry was definitely biased by the fact that non owner-operator drivers were reluctant or unable to identify a price point at which they would realize adequate economic savings by using the land ferry versus driving. From follow-up (off-the-record) questions it appears that these drivers did not know their employers' operating costs. Therefore they could not adequately compare their per mile cost of transporting a load against the assumed price point ($0.90 per mile) for the land ferry to determine the value of the service.

Table 5. Sample of Pre-pass Customers (Source: HELP Website).

AAA Cooper Transportation	G&P Trucking Company, Inc.	Saia Motor Freight Line, Inc.
ABF Freight Systems, Inc.	Gainey Transportation	Schneider
American Freightways, Inc./FedEx Freight East	Groendyke Transport, Inc.	Service Transport, Inc.
ATS Specialized-Anderson	JB Hunt Transport Services, Inc.	
Trucking Service, Inc.	J&R Schugel Trucking, Inc.	Sitton Motor Lines, Inc.
Averitt Express, Inc.	KLLM Transport Services, Inc.	Southeastern Freight Lines
Boyd Brothers Transportation, Inc.	Knight Transportation	Transport Corporation Of America, Inc.
Cassens Transport	Landstar System, Inc.	United Van Lines
Covenant Transport, Inc.	Marten Transport, Ltd.	US Xpress Enterprises, Inc.
Celadon Trucking Services, Inc.	Mayflower Transit	Vons Companies
Estes Express Lines, Inc.	McKenzie Tank Lines, Inc.	Wal-Mart Stores
Federal Express, Inc. - Los Angeles	Mercer Transportation Co.	Watkins Motor Lines, Inc.
FedEx Custom Critical, Inc.	National Freight, Inc.	Werner Enterprises
	Old Dominion Freight Line, Inc.	
	Penske Logistics	
	Prime, Inc.	Willis Shaw Express, Inc.
	Ryder Dedicated Logistics	

To better understand biases introduced by the absence of shippers who use Pre-pass, information was collected from Walmart. Walmart ships a tremendous volume of freight on I-80 and uses Pre-pass. Approximately 6% of I-80 freight is owned by Walmart; on average Walmart has 534 trucks traversing I-80 per day (Walmart). Walmart freight primarily includes food and other consumer goods. Given this tremendous volume of freight, the percentage of products shipped on I-80 may be slightly higher for freight categories such as food and household-related products. Appendix B provides additional information and data on Walmart freight movements.

Chapter 4 – Presentation of Freight Movement Survey Data

After completing surveying, data was entered into a database for analysis. Some minor data cleansing and validating of origins or destinations was required. After the data was cleansed and validated it was extracted, transformed and loaded into a second database for geospatial analysis.

Business and Demographic Information

For compactness, Figures 12a and 12b illustrate the results from several survey questions. As mentioned in the previous chapter approximately 25% of drivers surveyed were independent owner-operators. Approximately 25% were under some type of time penalty which was most commonly associated with hauling food products (Figure 13). On average approximately 5% of drivers surveyed were running empty. Over 90% of drivers surveyed liked driving. Of the less than 10% that expressed dissatisfaction with their profession, approximately 40% cited excessive time away from home as the primary reason for their dissatisfaction (Figure 12b).

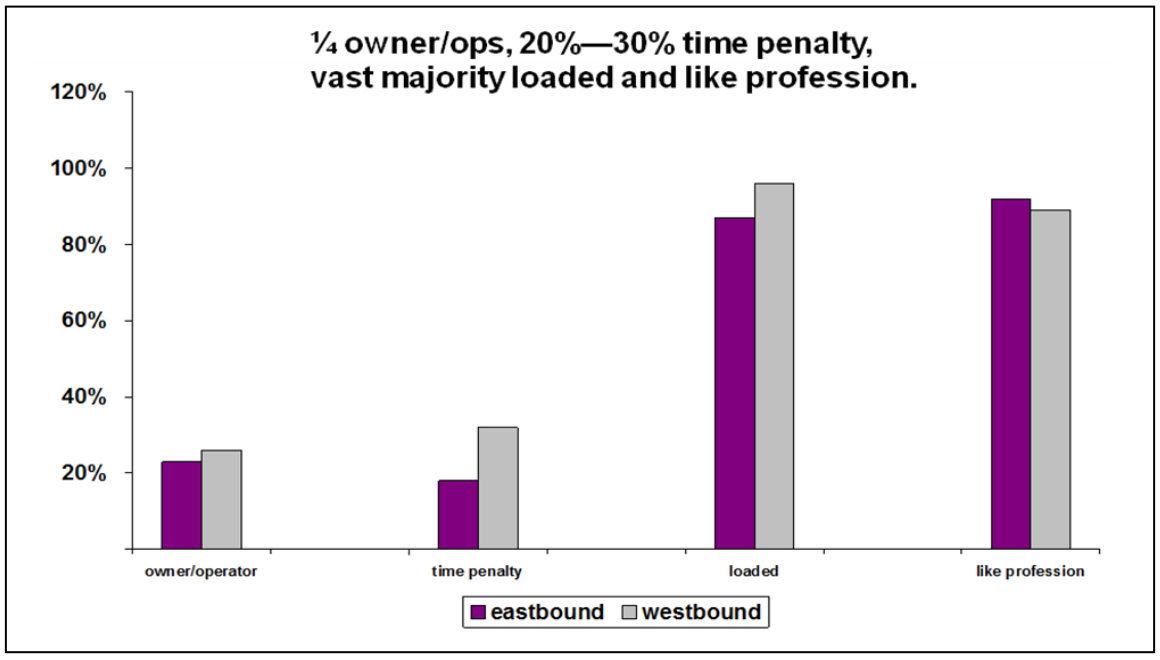


Figure 12a. Business and Demographic Data from Trucker Survey.

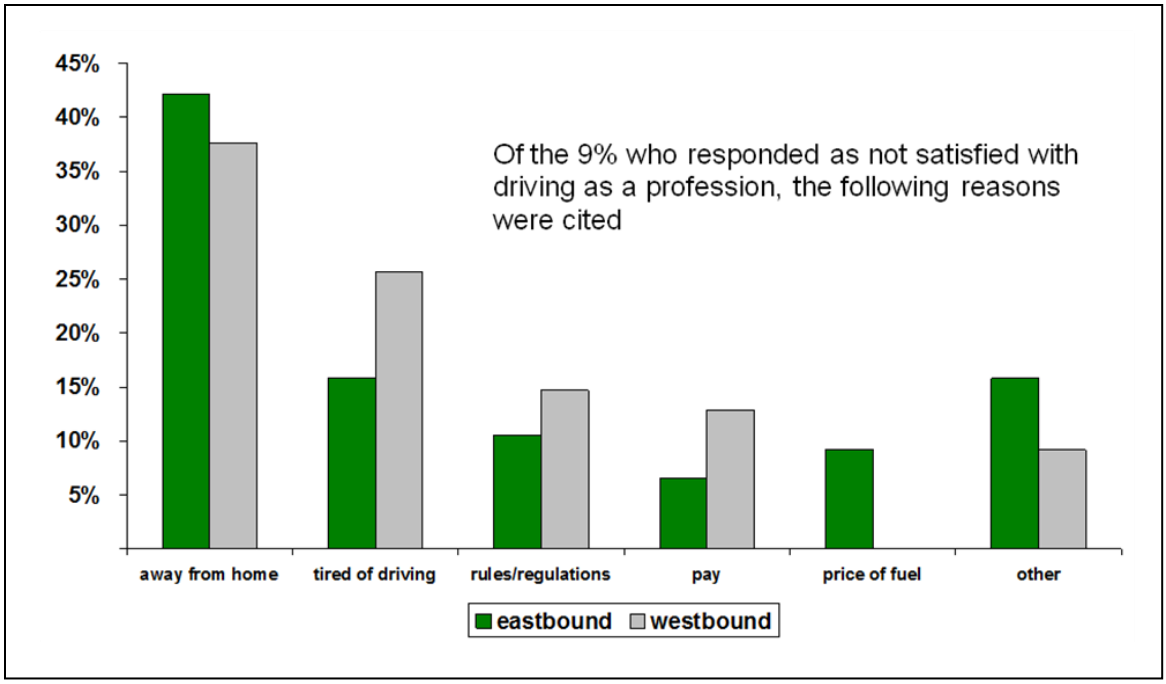


Figure 12b. Reasons Why Respondents Did Not Like their Profession.

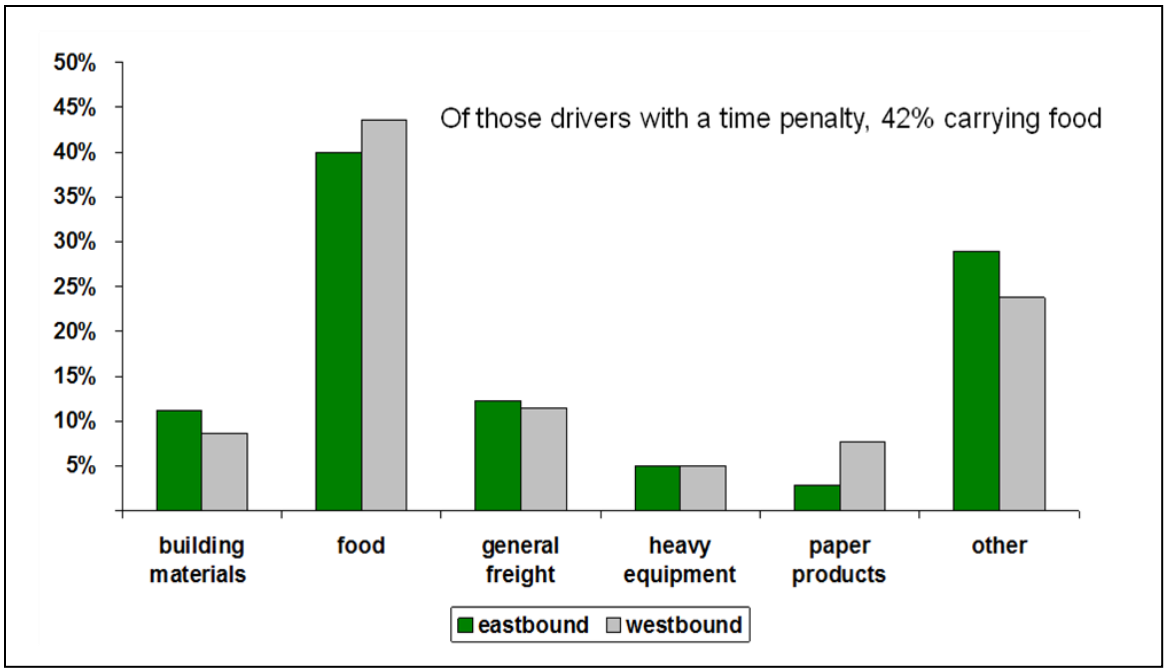


Figure 13. Freight Types Subject to Penalty.

Most drivers surveyed travel I-80 regularly. Drivers were asked to recall how many times they drove I-80 over the past year. The estimated average number of westbound and eastbound trips reported by drivers was 57 and 72, respectively (Figure 15).

The average age of drivers surveyed was 45 and the median age was 46 (Figure 16). Average driving experience was 15 years (Figure 17). As shown in Figure 18, approximately 44% of drivers have 10 of fewer years of driving experience. Figure 19 shows that over 30% of drivers plan to retire within five years and 50% of drivers plan to retire within ten years.

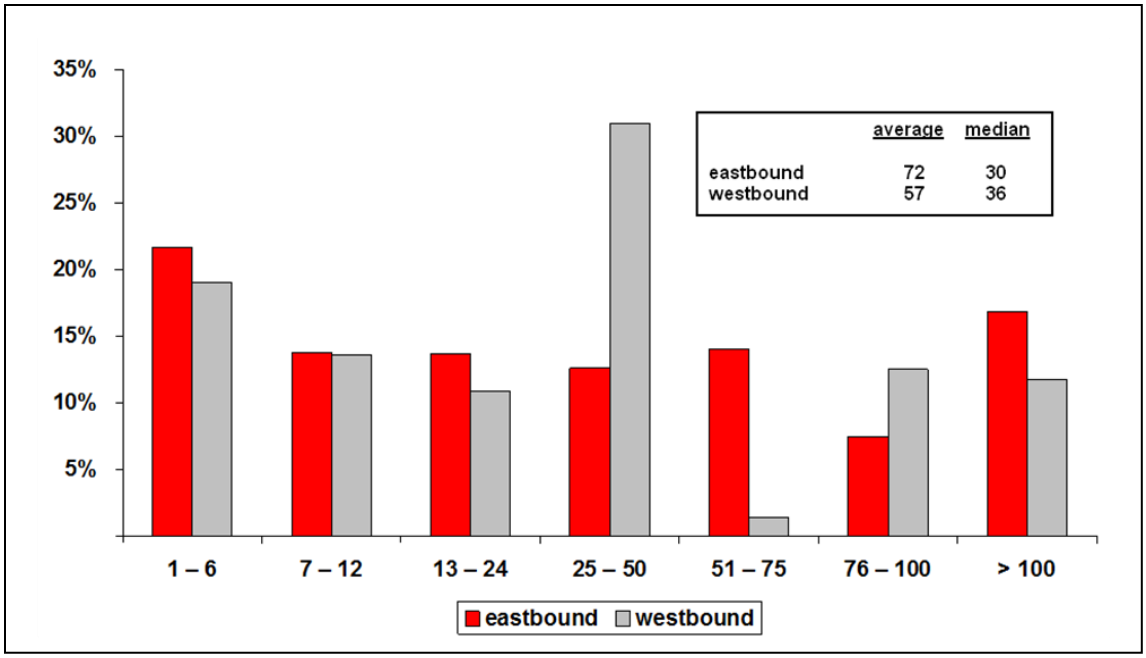


Figure 14. Estimated Times Drivers Surveyed Traveled on I-80 During the Past Year.

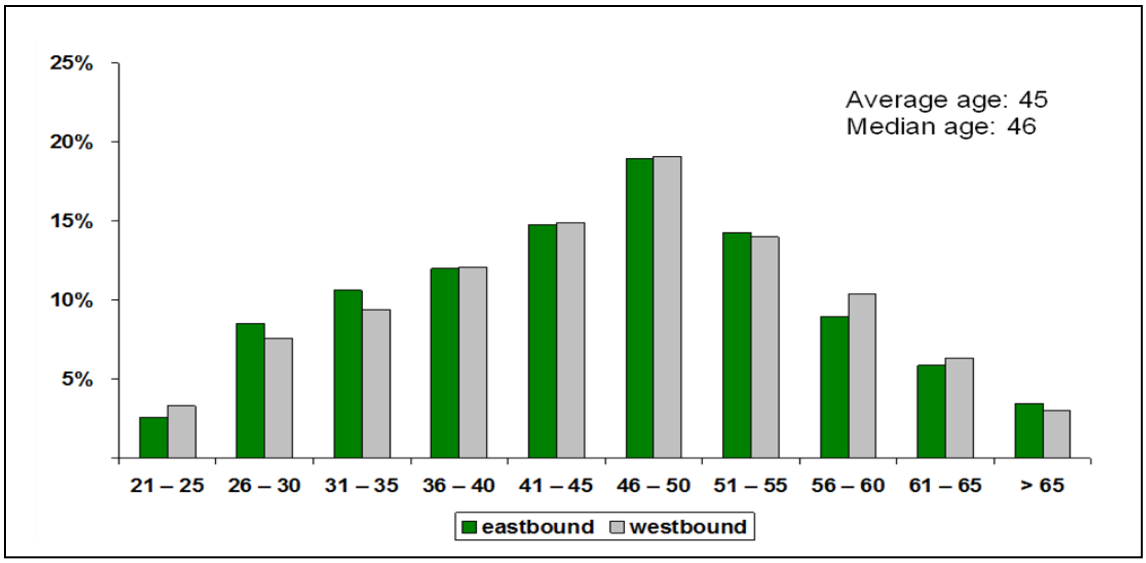


Figure 15. Age Range of Drivers Surveyed.

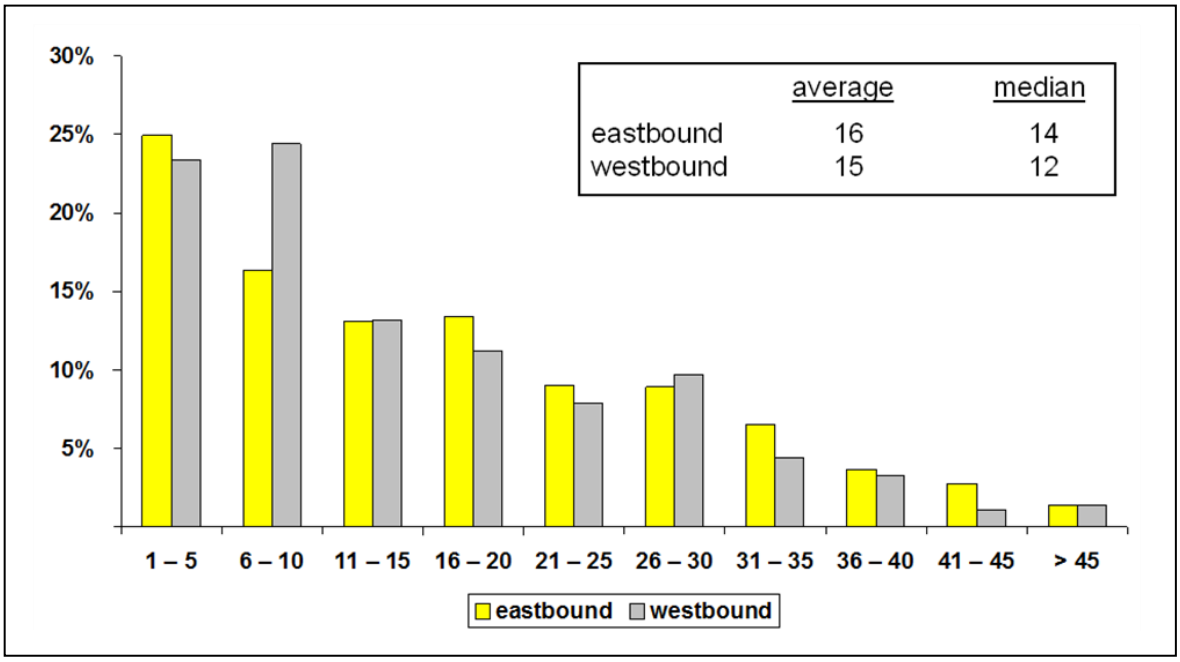


Figure 16. Number of Years of Driving Experience.

Although not explicitly captured in the survey, it was observed by surveyors that approximately 7-8% of drivers were not fluent in English. Surveyors indicated that the predominant non-English languages were Spanish, Eastern European, Russian and Indian/Pakistani. It is unknown from the surveys whether these drivers could read English which could affect the efficacy of dynamic message signs.

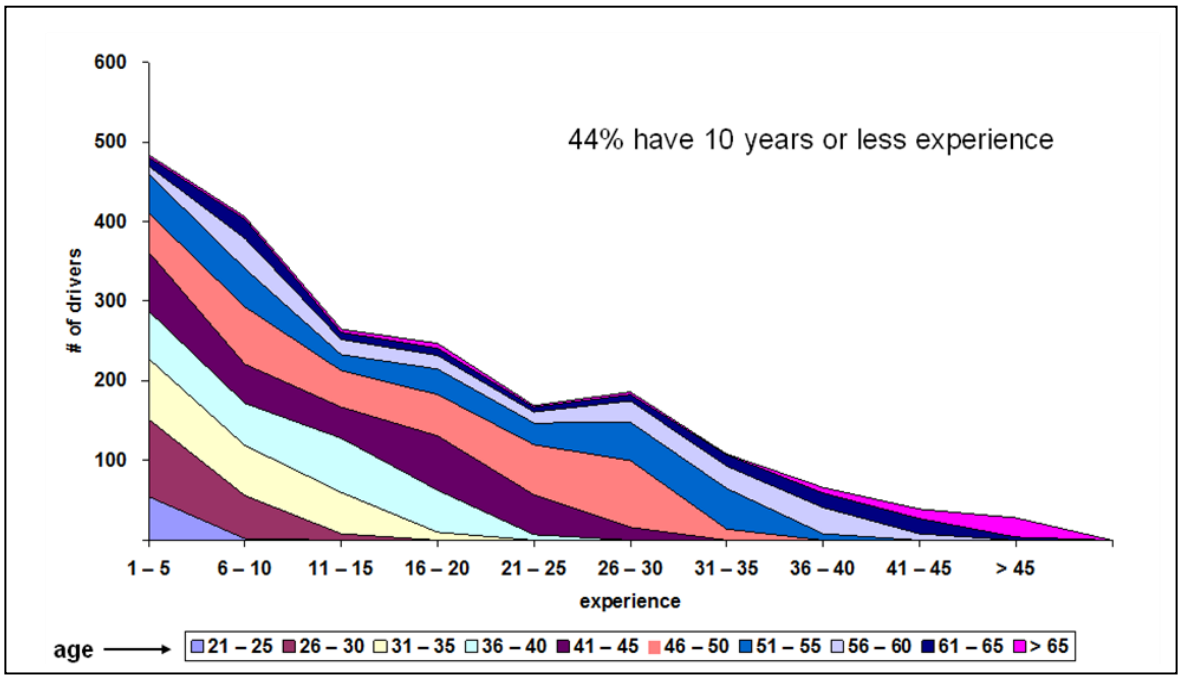


Figure 17. Number of Years of Driving Experience by Age Group.

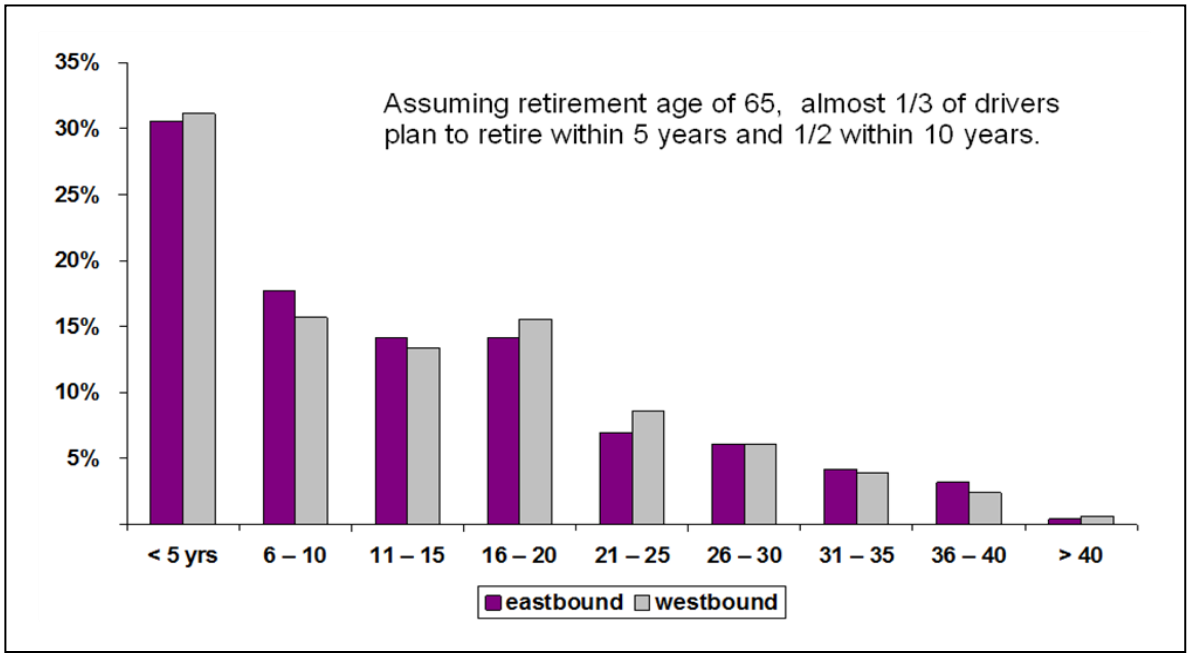


Figure 18. Number of Drivers Surveyed Intending to Retire.

Figure 19 shows the number of drivers by age hauling hazardous chemicals. The data indicates that almost 50% of hazardous shipments were driven by drivers with the least amount of experience.

Figure 19. Years of Experience for Drivers Hauling Hazardous Loads.

Westbound Freight Origins and Destinations

Almost 90 percent of westbound drivers surveyed had neither an origin or destination in Wyoming. Eleven percent of westbound freight had Wyoming as the destination (Table 6a).

Table 6a. Westbound Trucks Originating in, Destined for

Origin	Destination	#	%
Outside WY	Outside WY	882	88%
Outside WY	WY	112	11%
WY	Outside WY	8	1%
		1,002	

Tables 6b and 6c show the origins and destinations for all westbound freight surveyed. Over 50% of westbound freight was destined for California or Utah. Approximately 30% of westbound freight originated in Illinois, Iowa and Nebraska. Twenty-one percent (21%) of westbound freight originated in states east of Illinois.

Tables 6b and 6c. Origins and Destinations for Westbound Freight.

Origin states	#	% of total	cum %
Illinois	109	11%	—
Nebraska	104	10%	21%
Iowa	94	9%	31%
Missouri	89	9%	40%
Ohio	59	6%	45%
Indiana	55	5%	51%
Wisconsin	47	5%	56%
Pennsylvania	41	4%	60%
Tennessee	38	4%	64%
Kansas	34	3%	67%
Michigan	33	3%	70%
Minnesota	33	3%	74%
North Carolina	25	2%	76%
New York	22	2%	78%
Kentucky	22	2%	80%
Ontario	22	2%	83%

Destination states	#	% of total	cum %
Utah	258	26%	—
California	255	25%	51%
Oregon	113	11%	63%
Washington	88	9%	71%
Idaho	64	6%	78%
Nevada	63	6%	84%
Colorado	19	2%	86%
Montana	10	1%	87%
Calgary/AB	9	1%	88%
British Columbia	5	<1%	88%
Wyoming	112	11%	100%

Eastbound Freight Origins and Destinations

The number of eastbound trucks passing through Wyoming was 70% percent – 20% less than the westbound data sample. This was primarily due to the comparatively high number (20%) of eastbound trucks for which Wyoming was the destination. Similar to the westbound data, less than 1% of the trucks surveyed originated in Wyoming. This number is not unexpected – few eastbound loads originating in Wyoming would pass through the Evanston port of entry. Similarly very few westbound loads originating in Wyoming would be expected to pass through the Cheyenne Port of Entry. Eleven percent (11%) of eastbound freight was destined for Wyoming (Table 7a). This is identical to the westbound sample.

Table 7a. Eastbound Trucks Originating in, Destined for or Passing through Wyoming.

Origin	Destination	#	%
Outside WY	**Outside WY**	**712**	**70%**
Outside WY	**WY**	**207**	**20%**
WY	**Outside WY**	**83**	**8%**
WY	**WY**	**8**	**1%**
Total		**1,010**	

Tables 7b and 7c show the origins and destinations for all eastbound freight surveyed. Utah was identified as the destination for drivers that were in Wyoming with an empty truck to pick up a load – in most cases a less-than-truckload (LTL). Approximately 63% of eastbound freight originates in Utah (41%) and California (22%). Beyond freight destined for Wyoming, Colorado was the destination for 12% of shipments while other eastbound freight destinations varied from 6% to 2% among ten states.

Tables 7b and 7c. Origins and Destinations for Eastbound Freight.

Origin states	#	% of total	cum %
Utah	410	41%	—
California	222	22%	63%
Wyoming	91	9%	72%
Oregon	87	9%	80%
Idaho	65	6%	87%
Washington	57	6%	92%
Nevada	49	5%	97%
other	29	3%	100%

Destination states	#	% of total	cum %
Wyoming	215	21%	—
Colorado	123	12%	33%
Utah[1]	72	7%	41%
Illinois	65	6%	47%
Nebraska	39	4%	51%
Missouri	34	4%	54%
Ohio	34	3%	58%
Wisconsin	32	3%	61%
Minnesota	29	3%	64%
Texas	29	3%	67%
Iowa	27	3%	69%
Pennsylvania	23	2%	72%
Tennessee	22	2%	74%

Observations on Origins and Destinations of Westbound and Eastbound Freight

Figures 20 and 21 provide geospatial renderings of the origins and destinations for westbound and eastbound freight movement on I-80. The collection of origin and destination points shows the I-80 "land bridge" across Wyoming and Nebraska. The trace of this corridor is particularly evident in viewing the westbound data.

Eastbound surveys revealed that almost 70% of eastbound freight did not have an origination or destination in Wyoming. Westbound surveys showed 88% of shipments did not have an origin or destination in Wyoming which is consistent with estimates from previous studies (Young and R&S Consulting). However, for eastbound freight 70% was purely pass-through traffic which is significantly lower than expected. Although not a survey question notes by the surveyors indicate that eastbound traffic included a greater number of LTL shipments than westbound shipments. Another contributor to the higher number of Wyoming destinations for eastbound

traffic may be due to the number of large firms that use Pre-pass (with much of their business in the truck load (TL) service category). This may bias the data somewhat since truckers who used Pre-pass are not represented in the survey as previously discussed and would have increased the number of drivers pass through Wyoming. As a result, the number of eastbound trucks with neither an origin nor a destination in Wyoming may be at least 5-10% higher than indicated in the survey results.

Figure 20 and 21 shows Cheyenne as a sizeable destination and origin. This is evidence of the growth of Cheyenne as a regional distribution hub.As shown in Figure 20 and 21, the origins of westbound freight are more disbursed than for eastbound freight. The concentrations of originations in Salt Lake City, Reno, Los Angeles, Oakland, Sacramento, Portland and Seattle/Tacoma are shown in Figure 21 and will be discussed in Chapter 5.

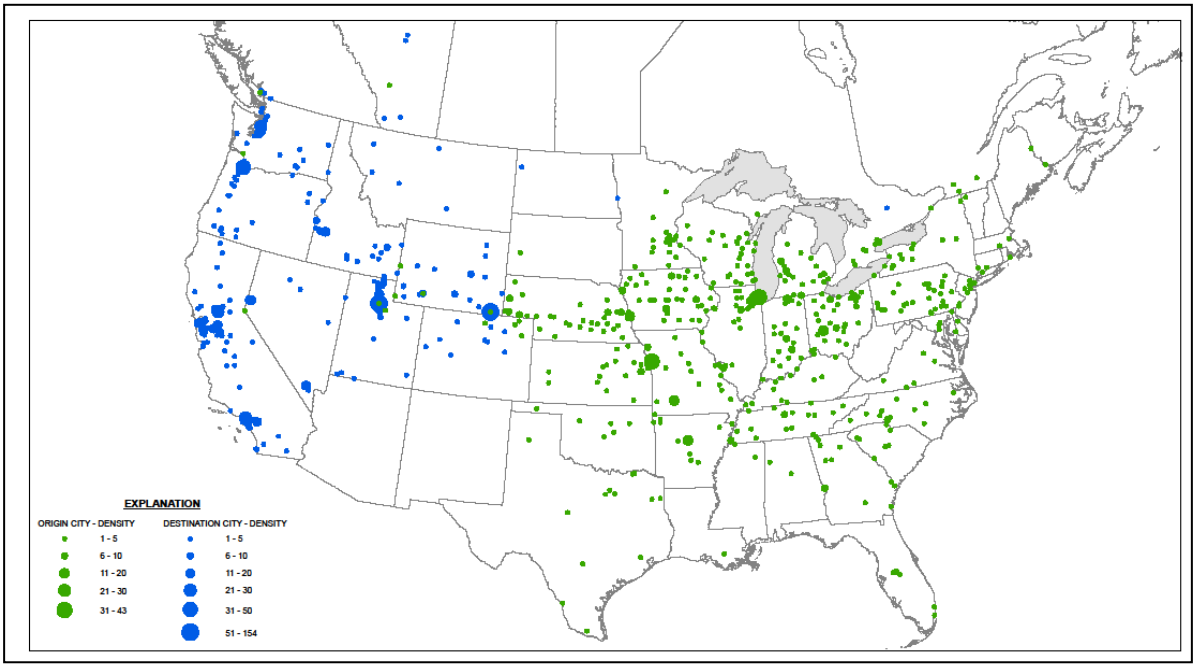


Figure 20. Origins and Destinations of Westbound Freight.

Figures 22 and 23 were generated using geospatial analysis to infer, based on origin and destination, the most likely "feeder" routes into I-80. Surprisingly, there was not more eastbound traffic originating in Southern California using I-15 through Nevada and Utah to connect with I-80. This may be due to the large transshipment and warehousing facilities that have been built up in the Salt Lake City/Ogden, Utah area. A significant volume of freight from

Southern California is trans-loaded in Utah and involves modal shifts and re-packaging and combining with other freight based on shipper requirements and economic shipping quantities. This freight then moves eastbound on I-80 across Wyoming. Under this scenario the original Southern California origin was not evident from the survey data.

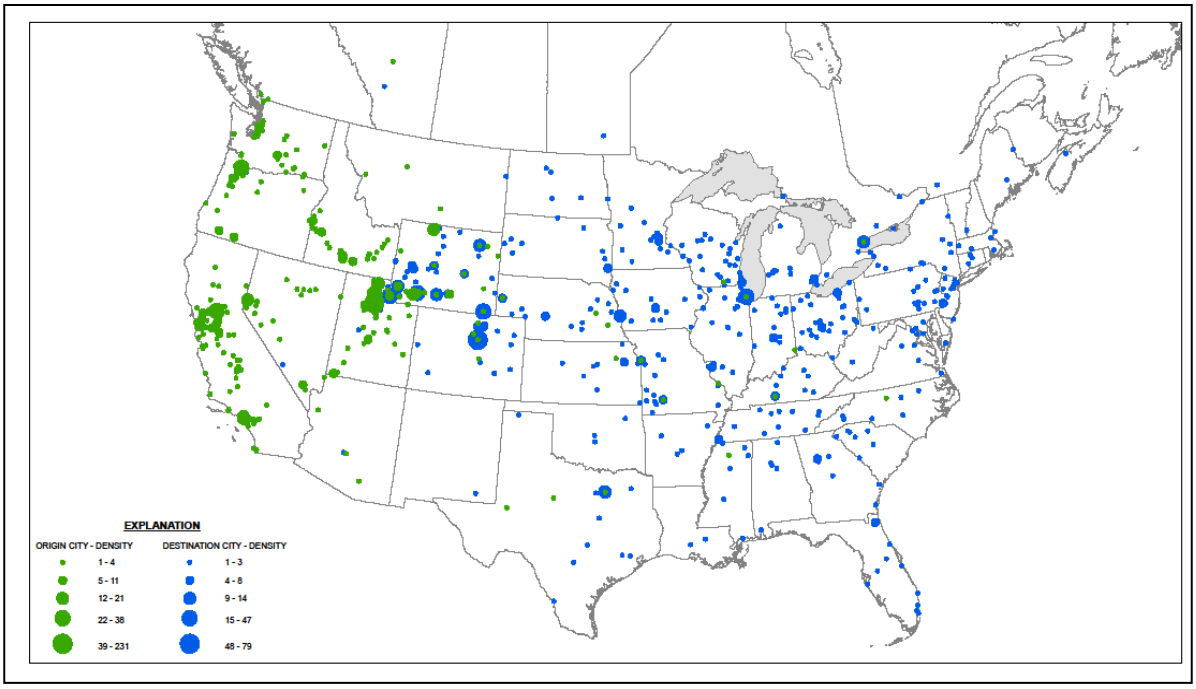


Figure 21. Origins and Destinations of Eastbound Freight.

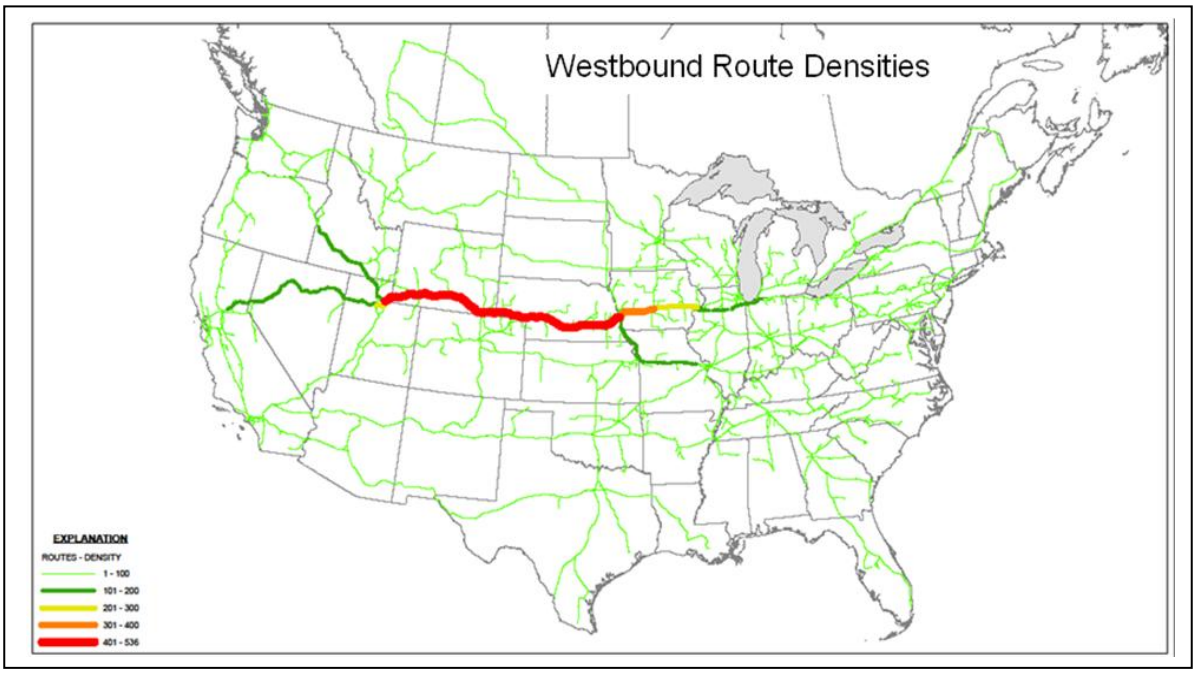


Figure 22. Predominant Routes for Westbound Trucks Extrapolated from Geospatial Analysis.

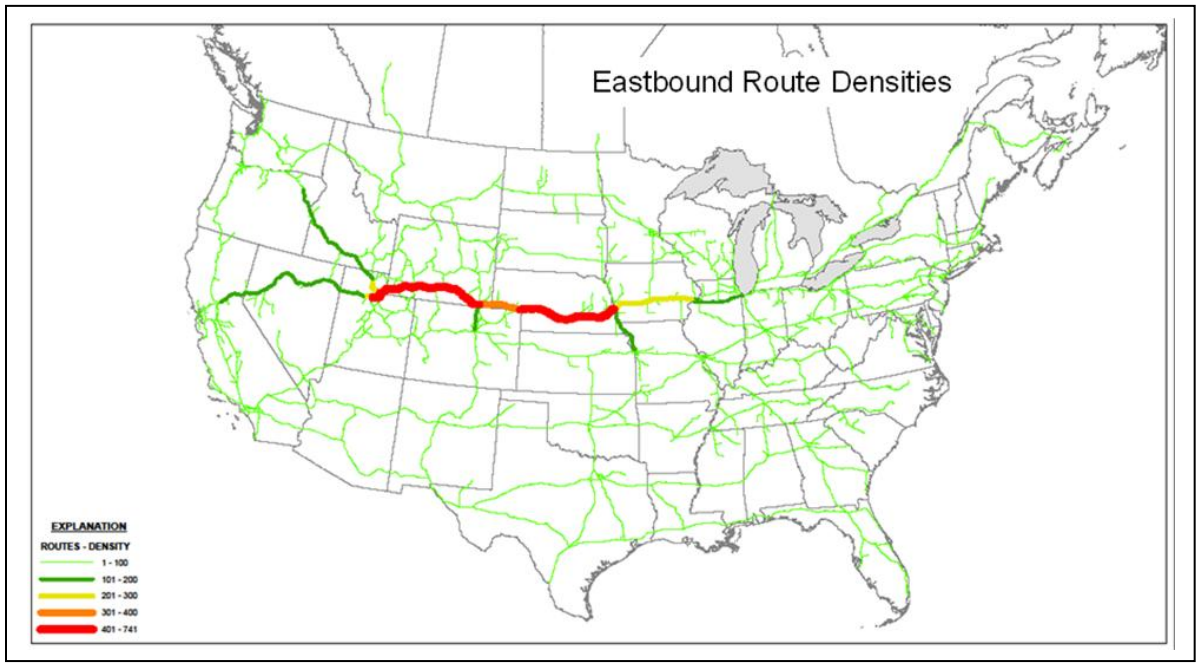


Figure 23. Predominant Routes for Eastbound Trucks Extrapolated from Geospatial Analysis.

Categories of Freight

Freight was categorized in a two-step process. During the survey drivers were asked open-ended questions about the contents of their load. Drivers were forthcoming with this information. Less than 5% of drivers surveyed could not adequately characterize their loads. Responses regarding truck contents were mapped to 15 freight types. Preliminary analysis of freight types included determining the percentage of freight traffic in each category. After preliminary analysis, these 15 freight categories were consolidated into eight categories for geospatial analysis. Geospatial analysis provided insight into freight density flows and origins and destination by each category.

Before presenting the data on freight categories, trailer types will be briefly discussed.

Equipment Type

The survey included one question about trailer type. Figure 24 shows the distribution of the types of trailers hauled by drivers participating in the survey. The predominant trailer types were

vans and refrigerated vans (reefers) which comprised over 70% of trailer types. Many of these vans were hauling food products.

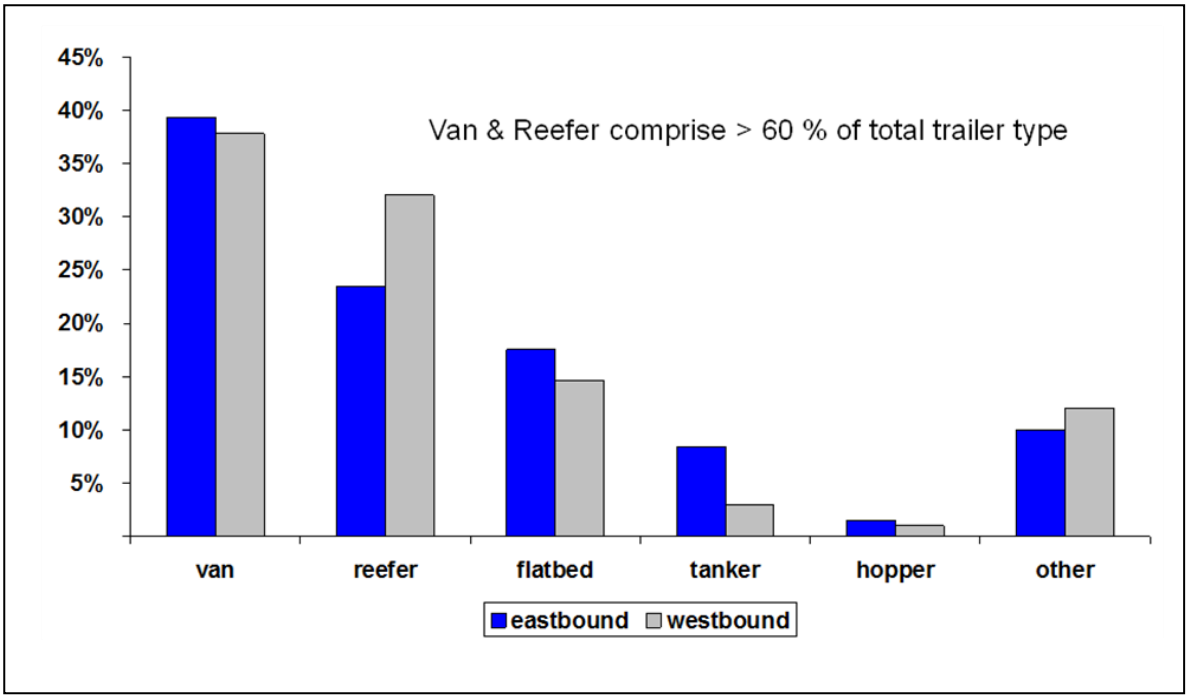
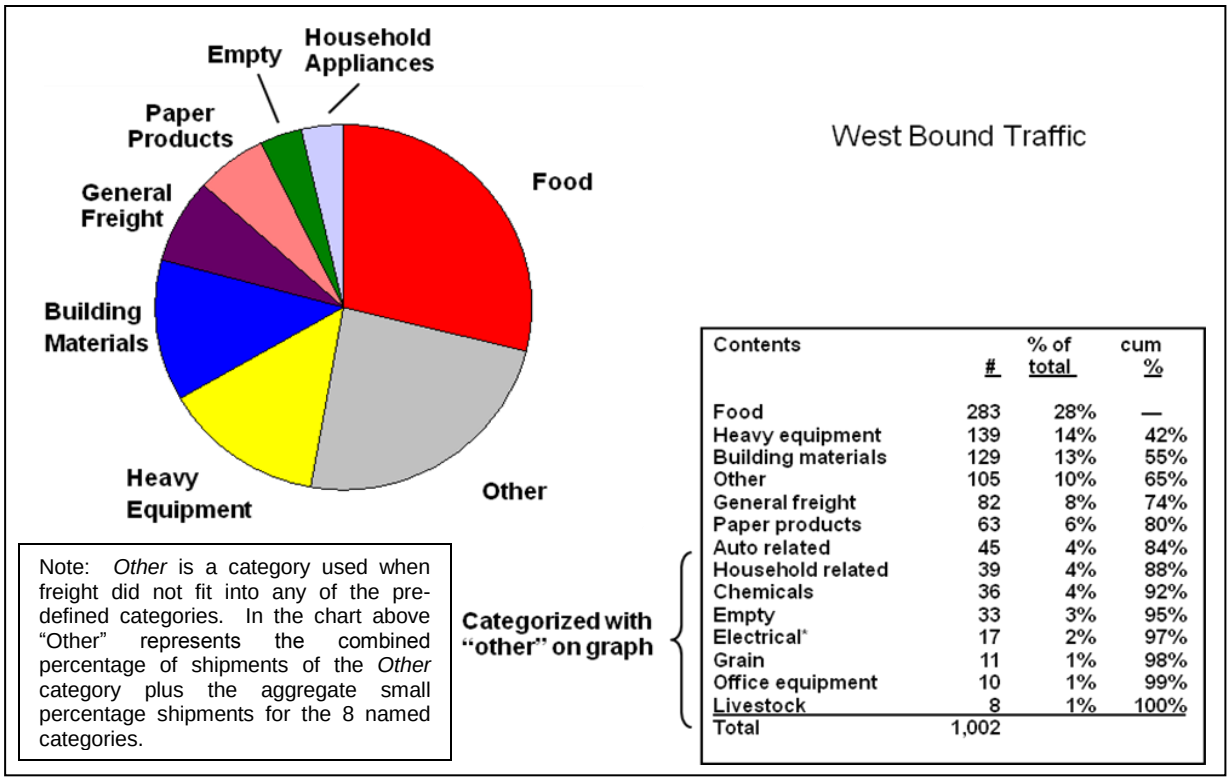


Figure 24. Types of Trailers Being Hauled During the Survey.

Figure 25 shows the distribution of westbound freight by fifteen categories. Food shipments comprised 28% of freight volume. The next two highest categories were heavy equipment and building materials which made up 14% and 13% of shipments, respectively.

Figure 26 shows the distribution of eastbound freight by the same fifteen categories. Again, food shipments comprised the greatest single category with over 30% of eastbound freight volume. The next highest category was building materials with 11%.

Interestingly, there were no mail shipments captured in the westbound surveys.

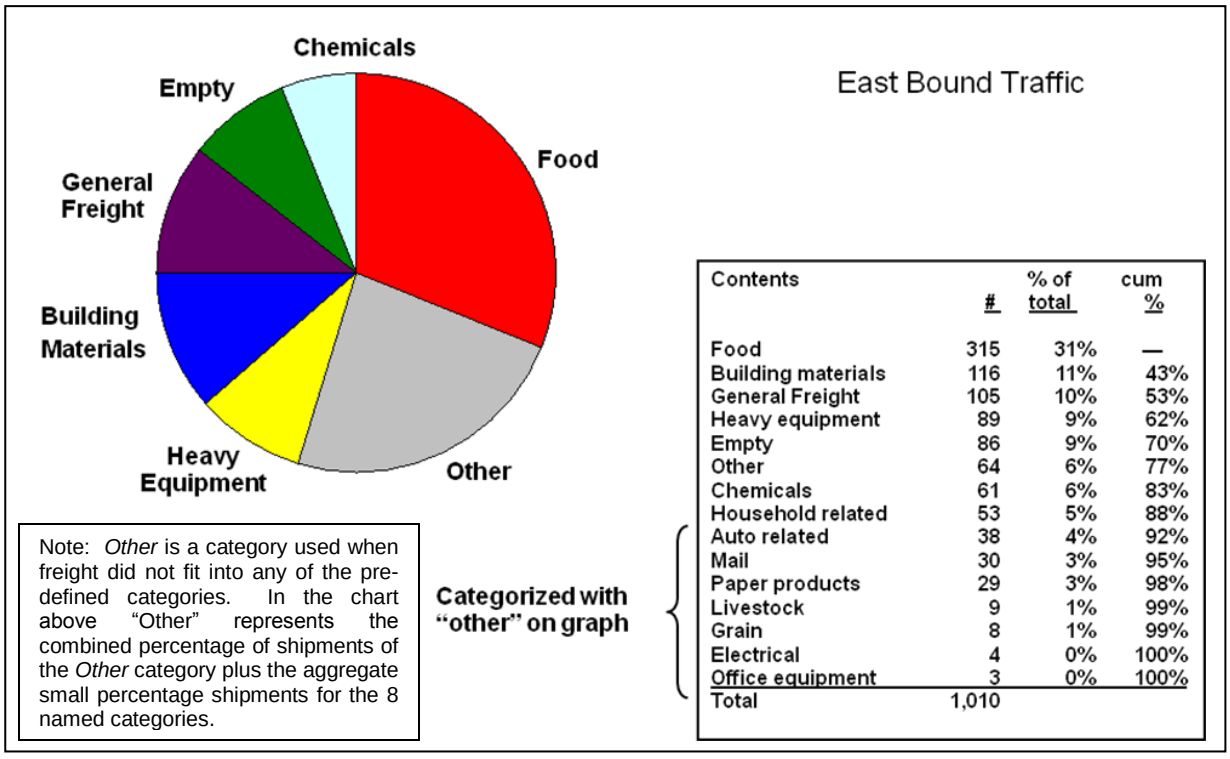


Note: *Other* is a category used when freight did not fit into any of the pre-defined categories. In the chart above "Other" represents the combined percentage of shipments of the *Other* category plus the aggregate small percentage shipments for the 8 named categories.

Categorized with "other" on graph

Contents	#	% of total	cum %
Food	283	28%	—
Heavy equipment	139	14%	42%
Building materials	129	13%	55%
Other	105	10%	65%
General freight	82	8%	74%
Paper products	63	6%	80%
Auto related	45	4%	84%
Household related	39	4%	88%
Chemicals	36	4%	92%
Empty	33	3%	95%
Electrical*	17	2%	97%
Grain	11	1%	98%
Office equipment	10	1%	99%
Livestock	8	1%	100%
Total	1,002		

Figure 25. Distribution of Westbound Freight by Category.



Note: *Other* is a category used when freight did not fit into any of the pre-defined categories. In the chart above "Other" represents the combined percentage of shipments of the *Other* category plus the aggregate small percentage shipments for the 8 named categories.

Categorized with "other" on graph

Contents	#	% of total	cum %
Food	315	31%	—
Building materials	116	11%	43%
General Freight	105	10%	53%
Heavy equipment	89	9%	62%
Empty	86	9%	70%
Other	64	6%	77%
Chemicals	61	6%	83%
Household related	53	5%	88%
Auto related	38	4%	92%
Mail	30	3%	95%
Paper products	29	3%	98%
Livestock	9	1%	99%
Grain	8	1%	99%
Electrical	4	0%	100%
Office equipment	3	0%	100%
Total	1,010		

Figure 26. Distribution of Eastbound Freight by Category.

Analysis of the bi-directional flows of each of the eight freight categories is presented below.

Food Products

The food products category constituted approximately 30% of the freight captured in the survey. Westbound and eastbound food shipments were 28% and 31%, respectively of all shipments. Food shipments included raw and processed (final and intermediate) products but did not include grain or livestock. Westbound and eastbound shipments of grain and livestock constituted less than one percent each and were identified individually as one of the original 15 freight categories. Grain and livestock were included in the "other" category. Based on the results of the survey, shipments of food products are the most prevalent freight category on Wyoming I-80.

Origins of westbound food product shipments are clustered around the upper Midwest and concentrated near Chicago (Figure 27). Destinations include the Salt Lake City/Ogden area – a major distribution point in the food products supply chain – where shipments are broken down, recombined, loaded and shipped to population centers in the west – primarily on the West Coast . Major routes from SLC/Ogden are to central California via I-80, to southern California via I-15 south and to the Pacific Northwest via I-15 north. Figure 28 shows increasing concentration of food products shipments at the Iowa/Nebraska border which funnel onto I-80 westbound at the Nebraska/Iowa border.

Origins of eastbound food product shipments are concentrated in Southern California, up and down California's central valley, the Bay Area, Idaho, Oregon's Willamette valley and the Yakima area of central Washington (Figure 29). Again, the Salt Lake City/Ogden area is a major origin primarily due to warehousing, distribution and trans-loading operations. Destinations are surprisingly disbursed both north and south as shipments proceed further east. Concentrated destinations include population centers such as Denver, Chicago and Philadelphia. The eastbound route density map for food shipments shows the highest concentration across Wyoming to Cheyenne where a significant volume of food shipments turn south on I-25 to Denver.

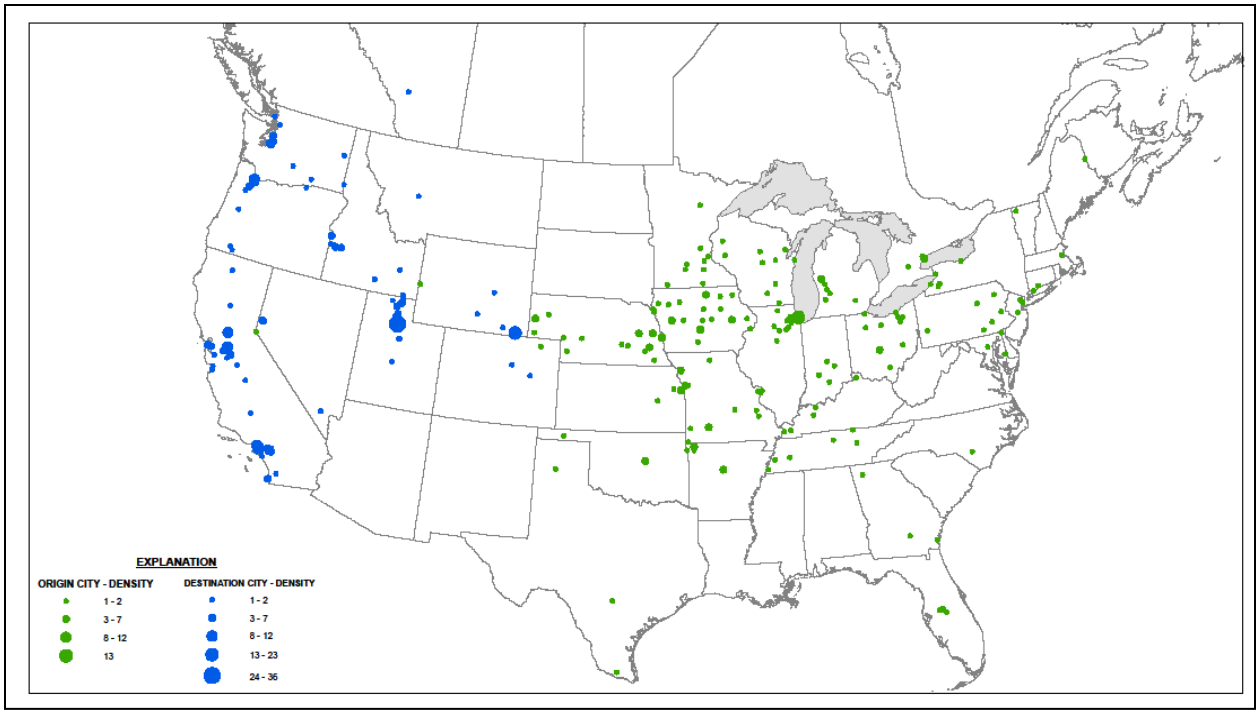


Figure 27. Westbound Origins and Destinations for Food Product Shipments.

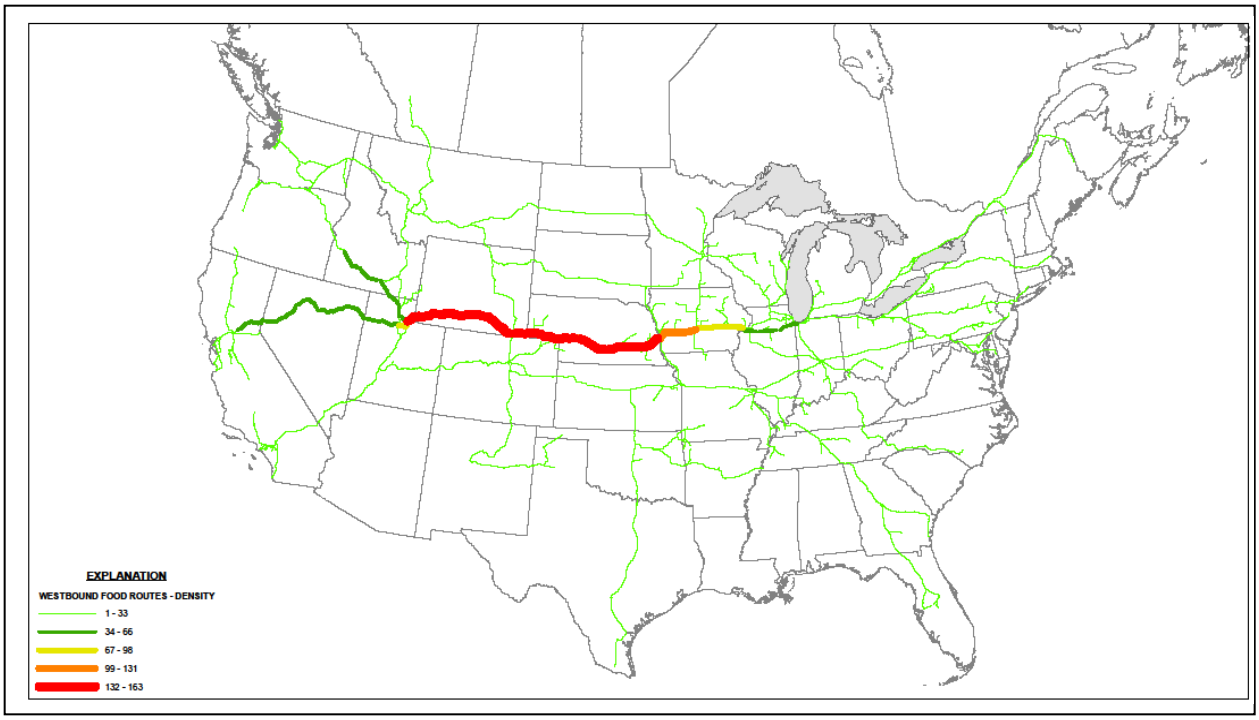


Figure 28. Westbound Route Densities for Food Product Shipments.

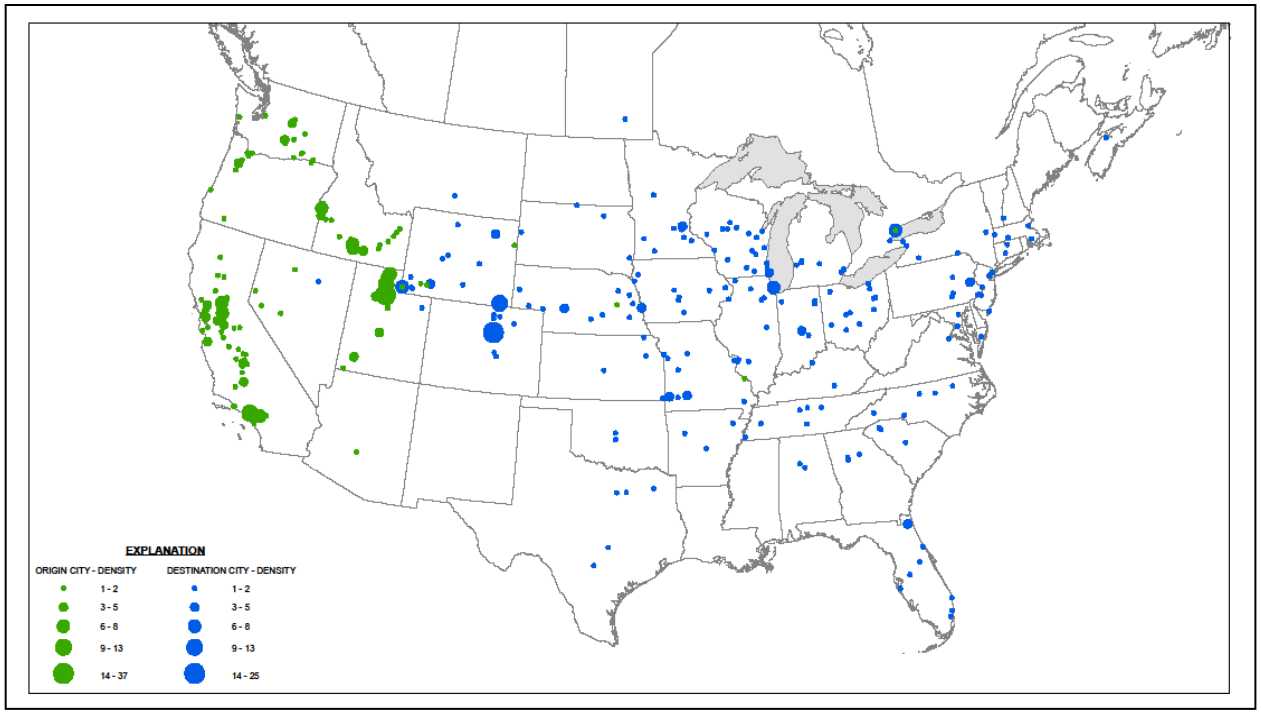


Figure 29. Eastbound Origins and Destinations for Food Product Shipments.

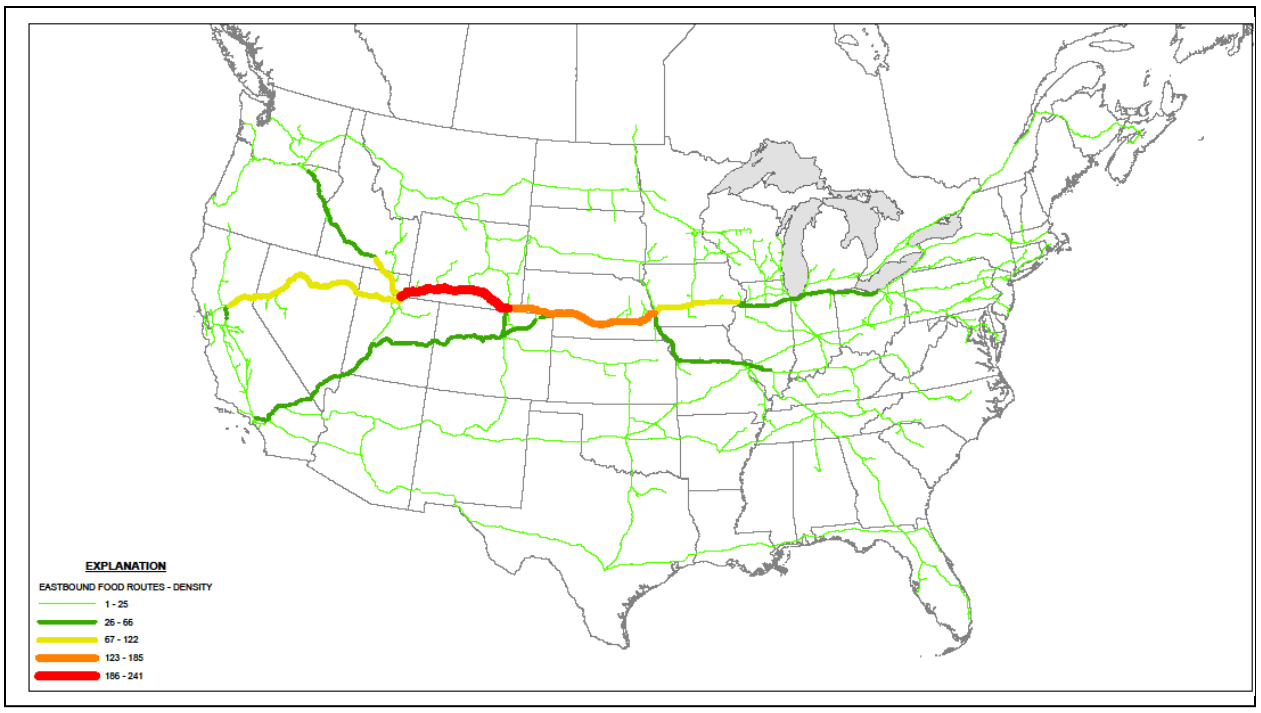


Figure 30. Eastbound Route Densities for Food Product Shipments.

Shipments of food products, which are approximately 30% of I-80 freight, constitute consumer staples. This should be considered a stable freight stream that originates from established manufacturers who have comparative advantage in raw materials. Therefore, future growth of one-third of Wyoming I-80's freight stream is likely to correlate with U.S. population growth.

Building Materials

After food shipments, building materials represented the next highest number of shipments in the sample with 13% of westbound shipments and 11% of eastbound shipments. Overall building material shipments could be characterized as westbound shipments of manufactured goods such as insulation and fasteners for domestic consumption and export while eastbound shipments are primarily raw and processed forest products. As with food shipments, the distribution hub of Salt Lake City/Ogden is a primary origin and destination for westbound and eastbound shipments of building materials.

As shown in Figure 31, westbound shipments of building materials originated in approximately 20 states east of Wyoming. Origins of building material shipments were concentrated in Nebraska, Iowa, the Great Lake states and states along the Ohio River. Major destinations for westbound shipments of building materials were Salt Lake City/Ogden for trans-loading and distribution, Las Vegas to support the unprecedented building boom (and bust) and the West Coast ports (Portland, Tacoma, Seattle, Oakland and Los Angeles and Long Beach) for building material exports. Wyoming was identified as a destination by a sizable number of respondents. Most likely these shipments of building materials are in support of the rapid growth of the State's energy exploration and production industry. Figure 32 shows the volume of shipments across the Nebraska and Wyoming I-80 corridor. The density of shipments decreases west of Cheyenne.

As expected, most eastbound shipments of domestically produced building materials (raw and value-added forest products) originated in the Pacific Northwest (Figure 33). A much lower volume of eastbound building materials (imports) originated from the west coast ports. The most concentrated origination of building material shipments was the Salt Lake City/Ogden area.

Western Wyoming was a significant destination for eastbound building material shipments – again most likely attributable to the boom in energy production. The highest density of eastbound shipments of building materials was in western Wyoming.

Heavy Equipment

Heavy equipment was the second highest category for westbound freight flow accounting for 14% of shipments surveyed. The heavy equipment category had the fourth highest number of eastbound shipments contributing 9% of total volume.

Figure 35 shows concentrated origins at manufacturing facilities in Indiana, Illinois and Iowa which produce high-value industrial products such as automobiles and farm equipment. Primary destinations are the Pacific Northwest including ports for export, Salt Lake City/Ogden for distribution and Nevada, central California and Wyoming for local sale and use. Figure 36 shows a high density of heavy equipment shipments equally across Nebraska and Wyoming.

Eastbound shipments of heavy equipment originate primarily in the SLC/Ogden area (Figure 37). This freight includes manufactured goods and trans-shipments. The SLC/Ogden transportation hub originates shipments of heavy equipment from western states (imports and domestically manufactured products) and funnels them east along I-80. Route densities for eastbound shipments of heavy equipment were heaviest in western Wyoming decreasing eastward through Nebraska.

General Freight

General freight was defined as mixed freight. Much of this freight was an aggregation of LTL shipments and could not be characterized into one of the fifteen categories (Figures 25 and 26) Westbound general freight shipments were 8% making this category the fifth highest of the survey. General freight shipments were 10% – the third highest category for eastbound trucks.

Origins and destinations for general freight shipments are primarily freight hubs located in or near major metropolitan areas (Figure 39). Westbound shipments originated mostly in Kansas

City, Chicago, Omaha, Little Rock and Indianapolis. Major destinations for westbound general freight were SLC/Ogden, Portland, Sacramento and the Bay Area. Wyoming and Nebraska have equally high densities for westbound general freight shipments (Figure 40).

Patterns for eastbound general freight are similar to the westbound general freight category. Origins for eastbound general freight are concentrated in SLC/Ogden, Reno and Sacramento (Figure 41). Eastbound general freight flow density is high across most of Wyoming with a significant number of trucks turning south on I-25 towards Denver (Figure 42).

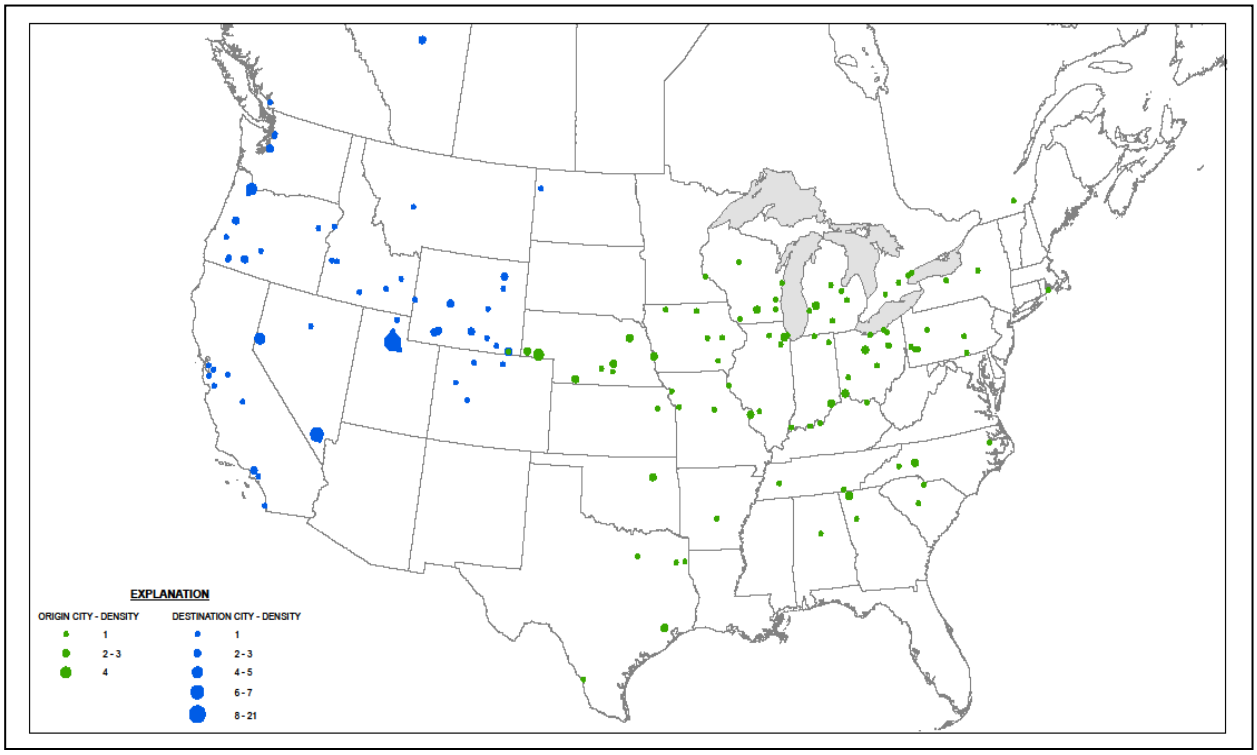


Figure 31. Westbound Origins and Destinations for Building Materials Product Shipments.

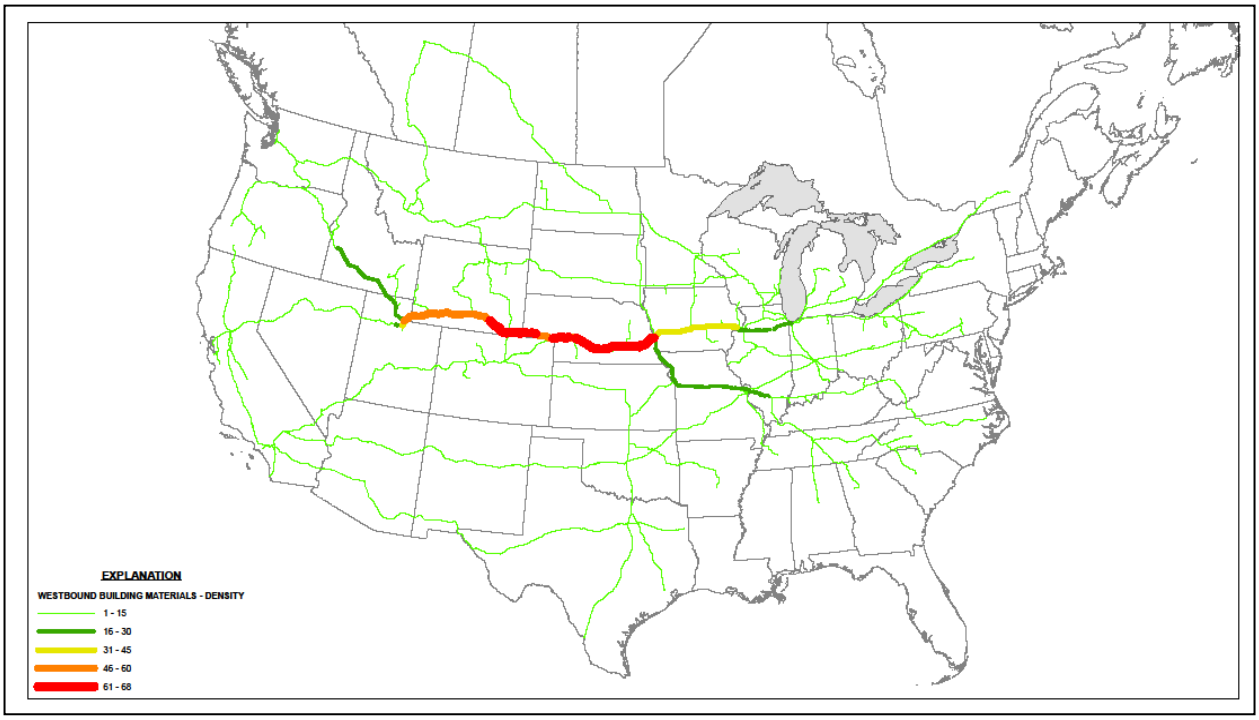


Figure 32. Westbound Route Densities for Building Materials Product Shipments.

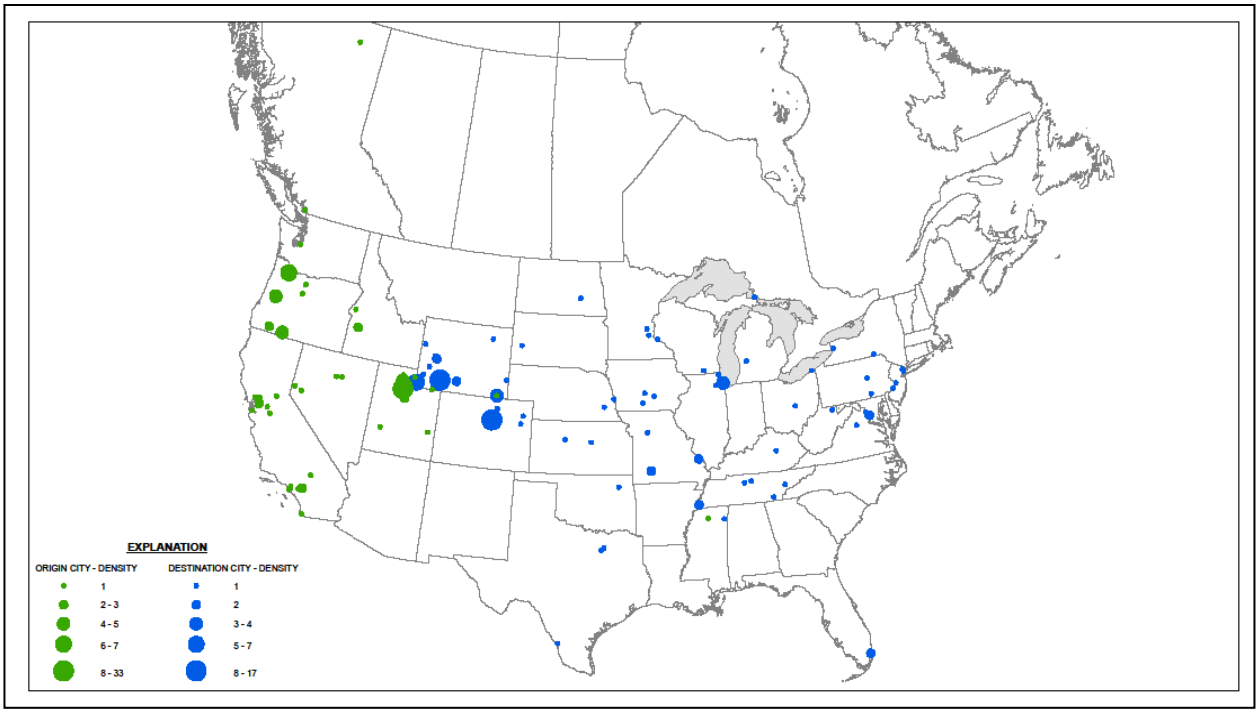


Figure 33. Eastbound Origins and Destinations for Building Materials Product Shipments.

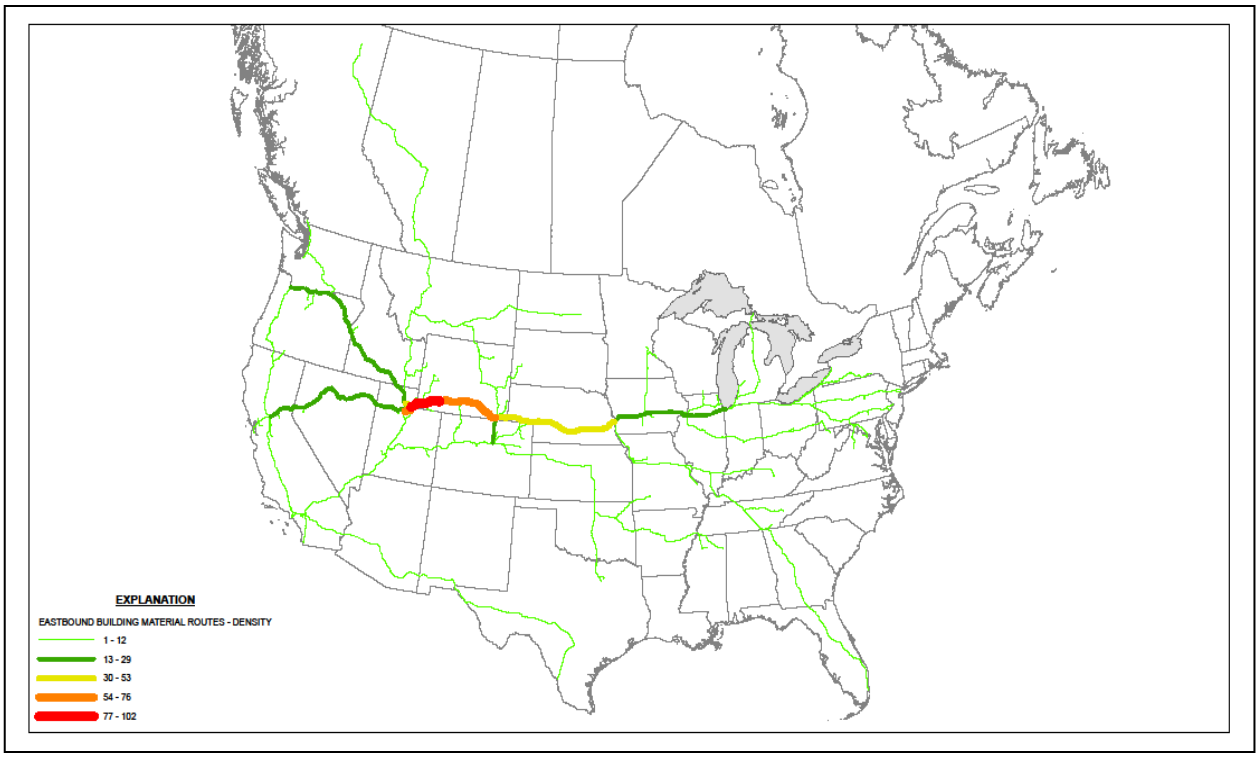


Figure 34. Eastbound Route Densities for Building Material Product Shipments.

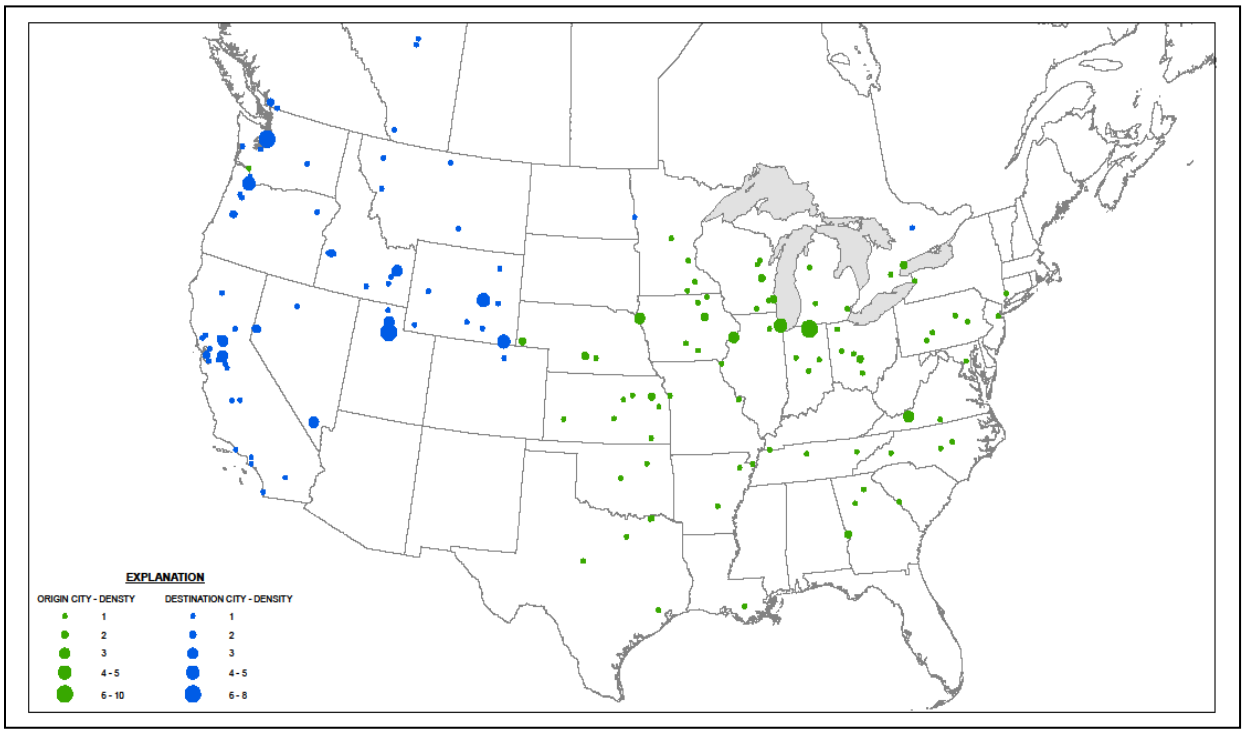


Figure 35. Westbound Origins and Destinations for Heavy Equipment Product Shipments.

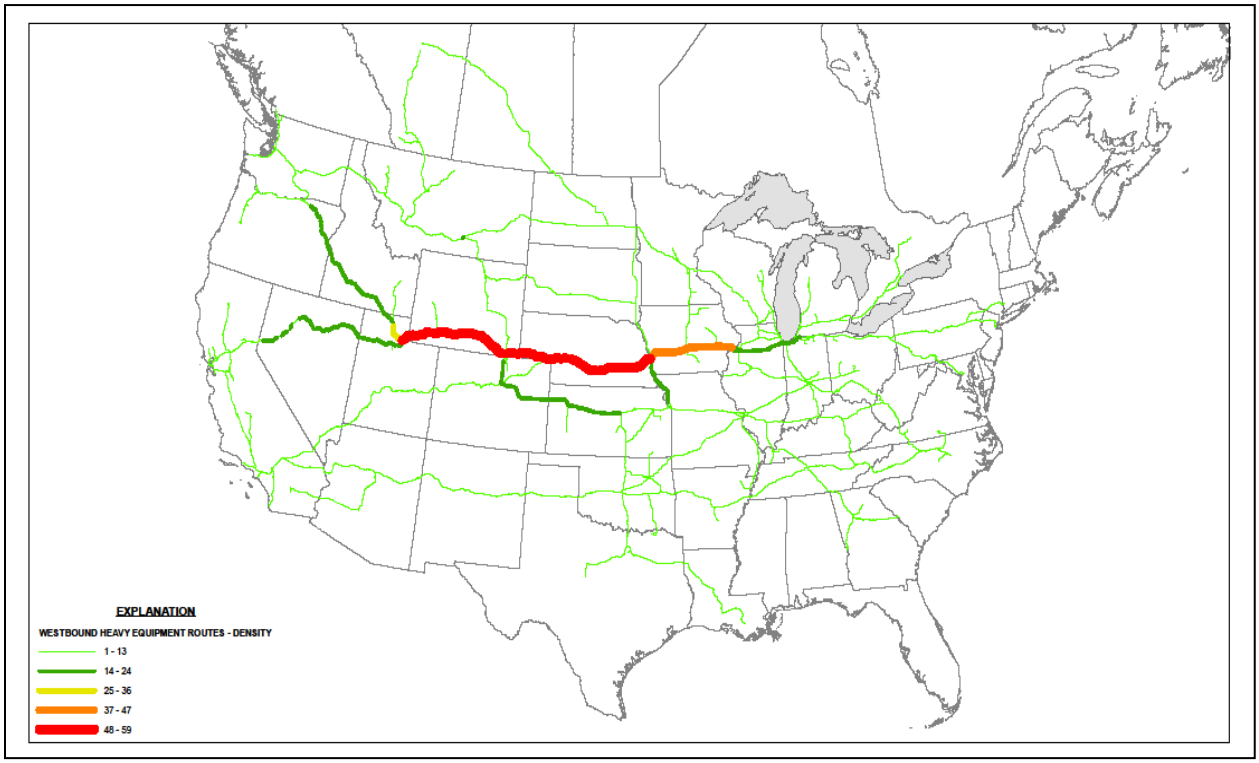


Figure 36. Westbound Route Densities for Heavy Equipment Product Shipments.

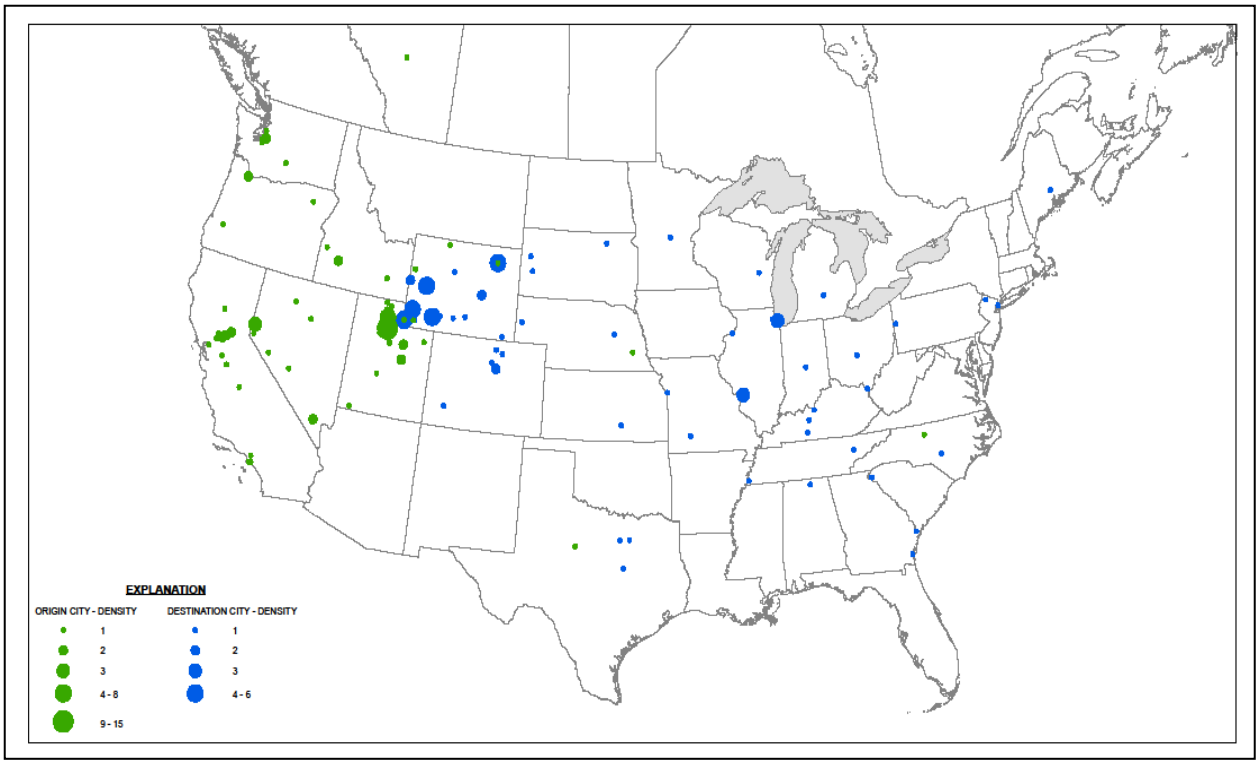


Figure 37. Eastbound Origins and Destinations for Heavy Equipment Product Shipments.

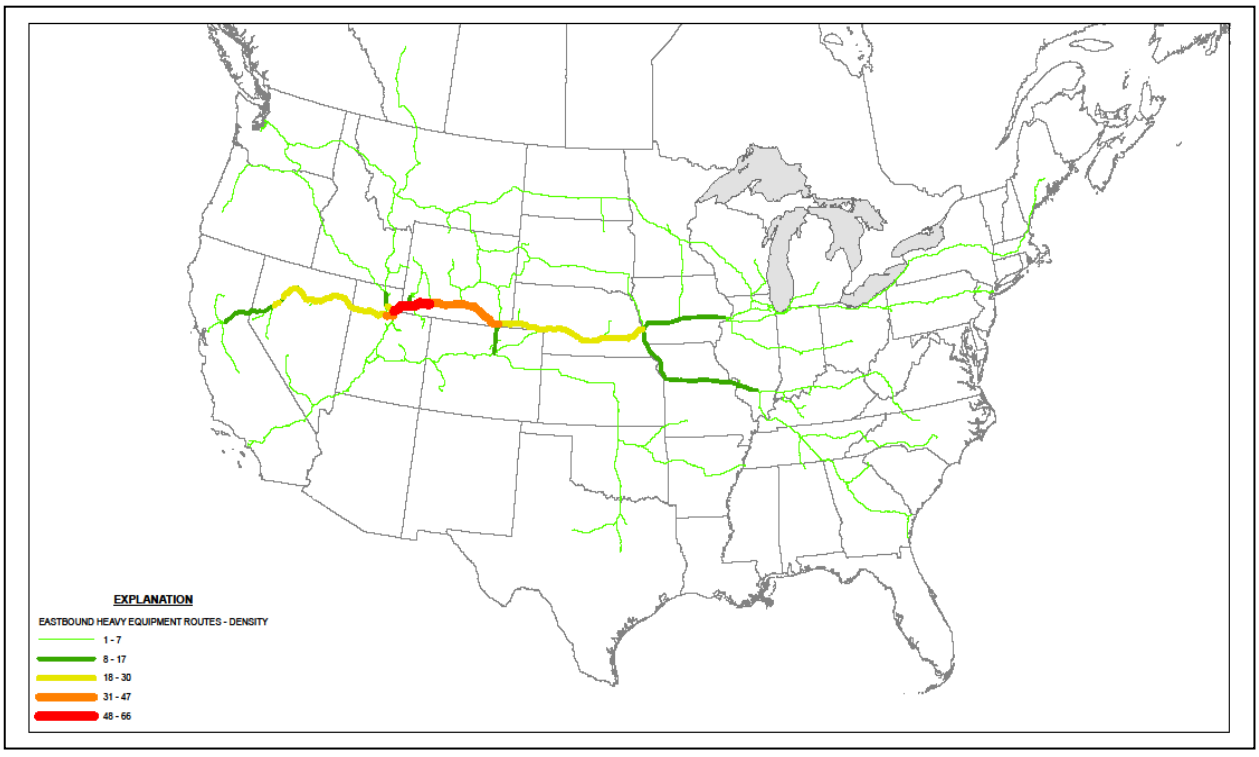


Figure 38. Eastbound Route Densities for Heavy Equipment Product Shipments.

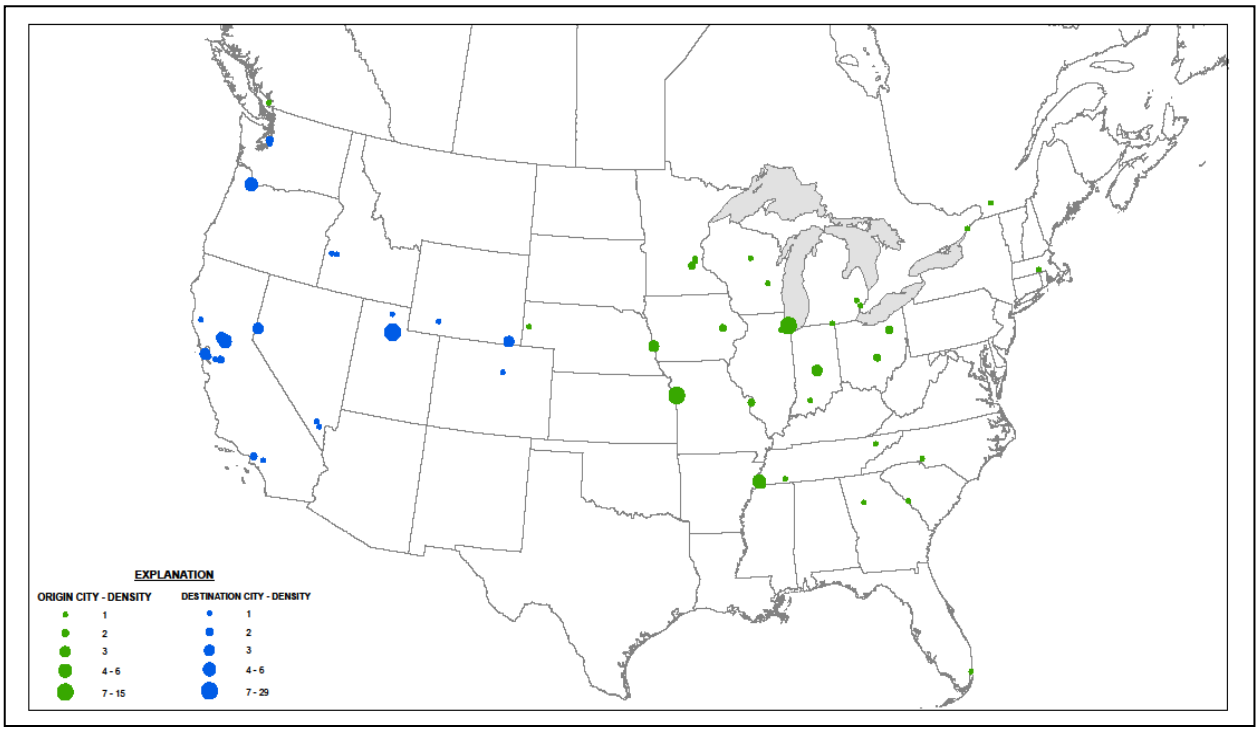


Figure 39. Westbound Origins and Destinations for General Freight Product Shipments.

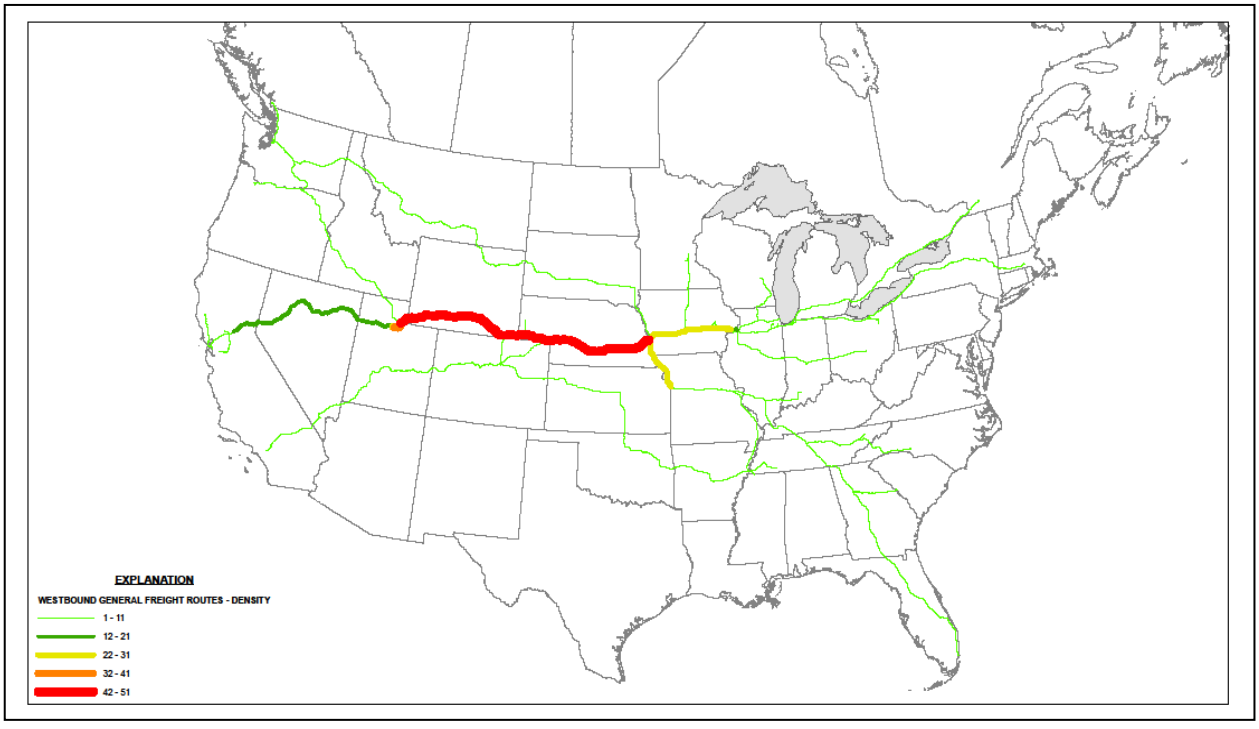


Figure 40. Westbound Route Densities for General Freight Product Shipments.

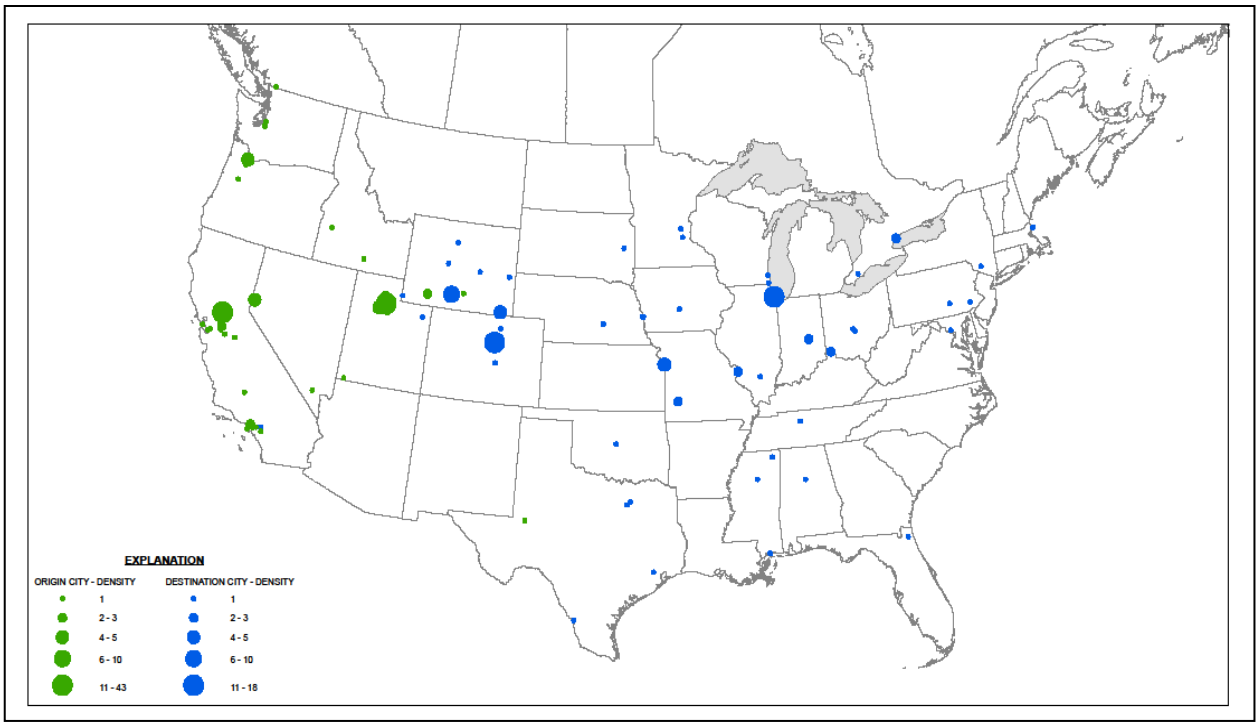


Figure 41. Eastbound Origins and Destinations for General Freight Product Shipments.

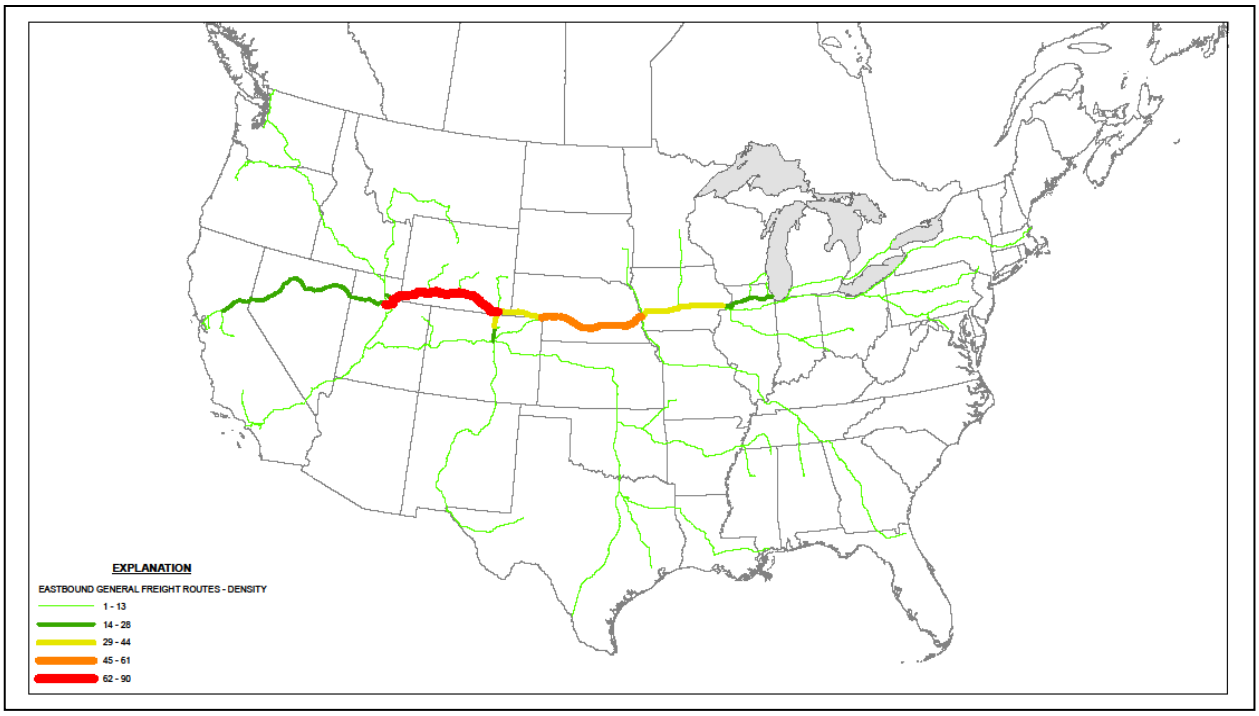


Figure 42. Eastbound Route Densities for General Freight Product Shipments.

Paper Products

Paper products were 6% of westbound shipments. This category included finished paper products but also shipments of used cardboard bound for China to be recycled and used in new packaging of finished goods. Eastbound shipments of paper products were 3% of eastbound shipments – only half the volume of westbound shipments.

Origins and destinations for paper products show a similar pattern as most other product categories. Chicago was a concentrated origin. SLC/Ogden was a destination concentration point and to a lesser extent Reno. As mentioned above export of paper products and especially used cardboard is evident from the number of shipments of paper products destined for the major west coast ports (Figure 43). There were only a couple of Wyoming destinations for paper product shipments. Figure 44 shows eastbound route densities are consistent through Wyoming and Nebraska – with few origins or destinations for paper goods shipments.

Eastbound shipments of paper products show several major origins as SLC/Ogden, southern Oregon and central Idaho (Figure 45). There were several destinations in western Wyoming but most shipments were bound for the Midwest and destinations in northeast states. The lone destination concentration point was Chicago. Similar to westbound shipments of paper products eastbound route densities were consistent across Wyoming and Nebraska (Figure 46).

Household Related Products

Household related product (i.e. non-food consumables) shipments represented 4% of westbound freight and 5% of eastbound freight. These products are finished goods manufactured in a multitude of states. Dispersed origins suggests these goods are shipped directly from plants versus distribution centers.

Household products primarily originated in a band of states across the Midwest with outliers in North Carolina and Alabama. Destinations were concentrated in SLC/Ogden. Other destinations

were scattered across the West Coast states with destination concentration points in California's and Washington's population centers (Figure 47). Several shipments were bound for Cheyenne. Route densities were similar for Wyoming and Nebraska – again showing a pattern similar to many other product categories – freight is funneled across Wyoming and Nebraska with few origins or destinations (Figure 48).

Eastbound shipment of household related products originated from the SLC/Ogden distribution hub as well as the west coast ports. A significant share of this freight is imports. Products are bound for Chicago and many destinations scattered across the eastern half of the U.S. (Figure 49). A handful of household goods shipments (probably mixed loads) were destined for Wyoming to serve local markets. Figure 50 shows eastbound route densities highest through Wyoming with some trucks turning south on I-25 towards Denver.

Other Freight

A survey category called "Other" freight was used to group shipments of various product types that did not fit within the pre-defined categories (Table 8). A sub-grouping labeled as "other" was created for summarizing the data for shipments related to autos, household, chemicals, empties, electrical, grain, etc., were the pre-defined categories These categories were grouped together for analysis and presentation purposes since they represented small volumes of freight.

Table 8. "Other" Product Categories of Westbound Shipments.

	Contents	#	% of total	cum %
	Food	283	28%	—
	Heavy equipment	139	14%	42%
	Building materials	129	13%	55%
	Other	105	10%	65%
	General freight	82	8%	74%
	Paper products	63	6%	80%
Categorized as "other" freight	Auto related	45	4%	84%
	Household related	39	4%	88%
	Chemicals	36	4%	92%
	Empty	33	3%	95%
	Electrical*	17	2%	97%
	Grain	11	1%	98%
	Office equipment	10	1%	99%
	Livestock	8	1%	100%
	Total	1,002		

Westbound shipments of this grouping of

categories were 16% of total shipments. Origins of these small volume westbound product categories were dispersed across the eastern half of the U.S. with some concentration points in Chicago, Kansas City and St. Louis (Figure 51). It is likely that westbound shipments of grain and livestock probably originated in Nebraska and Kansas as raw agricultural commodities which generally travel less than 500 miles by truck. Destinations for other shipments in these categories include SLC/Ogden as well as population centers on the west coast, Reno and Las Vegas. Figure 52 shows westbound freight densities are high from Nebraska through Wyoming. As with other product shipment freight patterns after reaching the SLC/Ogden area, freight disburses north and south on I-15 reducing I-80 freight flows by more than one-half of that traveling through Nebraska and Wyoming.

As shown in Table 9 product shipments related to autos, household, chemicals, mail, paper, livestock, grain, etc., were the major categories combined for analysis and presentation purposes due to their small percentage of overall shipments.

Eastbound shipments of "Other" product categories were only 8% of total shipments – less than one-half westbound shipments. Table 9 shows the largest number of shipments of products categorized as "Other" were related to autos, mail and paper products (discussed above).

Table 9. "Other" Product Categories of Eastbound Shipments.

Contents	#	% of total	cum %
Food	315	31%	—
Building materials	116	11%	43%
General Freight	105	10%	53%
Heavy equipment	89	9%	62%
Empty	86	9%	70%
Other	64	6%	77%
Chemicals	61	6%	83%
Household related	53	5%	88%
Auto related	38	4%	92%
Mail	30	3%	95%
Paper products	29	3%	98%
Livestock	9	1%	99%
Grain	8	1%	99%
Electrical	4	0%	100%
Office equipment	3	0%	100%
Total	1,010		

Categorized with "other" on graph

Origins of eastbound product categories comprising "Other" are the SLC/Ogden area and population centers in California, Oregon and Idaho (Figure 53). Destinations for eastbound "Other" product categories include nearly all states east of Wyoming with concentrations in

Denver, Omaha and Chicago. Figure 53 shows some origins and destinations in Wyoming which (in conversations with drivers) was found to be Less-Than-Truckload (LTL) shipments originating in Wyoming, delivered to the SLC/Ogden area then returning to Wyoming with LTL shipments of various products. Figure 54 shows route densities for eastbound "Other" freight shipments heaviest in Wyoming with significant freight flows routed south at Cheyenne on I-25 towards Denver. This pattern, like several other eastbound freight flows, is heaviest in Wyoming.

Empty Loads

Empty loads constituted 6% percent of total shipments in the survey with 3% westbound trips running empty and 9% of eastbound trips running empty.

Figure 55 shows origins and destinations of westbound empties. Distances between origins and destinations are short since for many independents and small firms it is extremely unprofitable to travel empty versus larger trucking firms that can afford to travel empty (but rarely do so due to a much larger client base). Both Cheyenne and SLC/Ogden were major destinations for westbound empties. Westbound route densities for empty trips were highest in eastern Wyoming (Figure 56).

Figure 57 shows origins and destinations for eastbound empties. Origins were primarily the SLC/Ogden area and Evanston. Destinations are both east and west of Wyoming; drivers of empty loads responded to the survey question of destination by identifying the location where they would pick up their assigned load east of Wyoming to be delivered west of Wyoming. Again, LTL shipments between Wyoming and the SLC/Ogden freight hub accounted for the mixture of origins and destinations of eastbound freight within Wyoming. Figure 58 illustrates route densities which show the highest freight flows of eastbound empties in western Wyoming.

It is possible that eastbound empties are three times higher than was westbound empties due to unbalanced freight patterns between rail and truck modes. BNSF and UPRR double-stack intermodal shipments and haul the majority of imported goods from the west coast ports and

return many empty containers west for transport back to Asia. Westbound trucks carrying manufactured goods (including food products for domestic consumption and export) often have difficulty finding full Truck Load (TL) loads to haul on their return trips east.

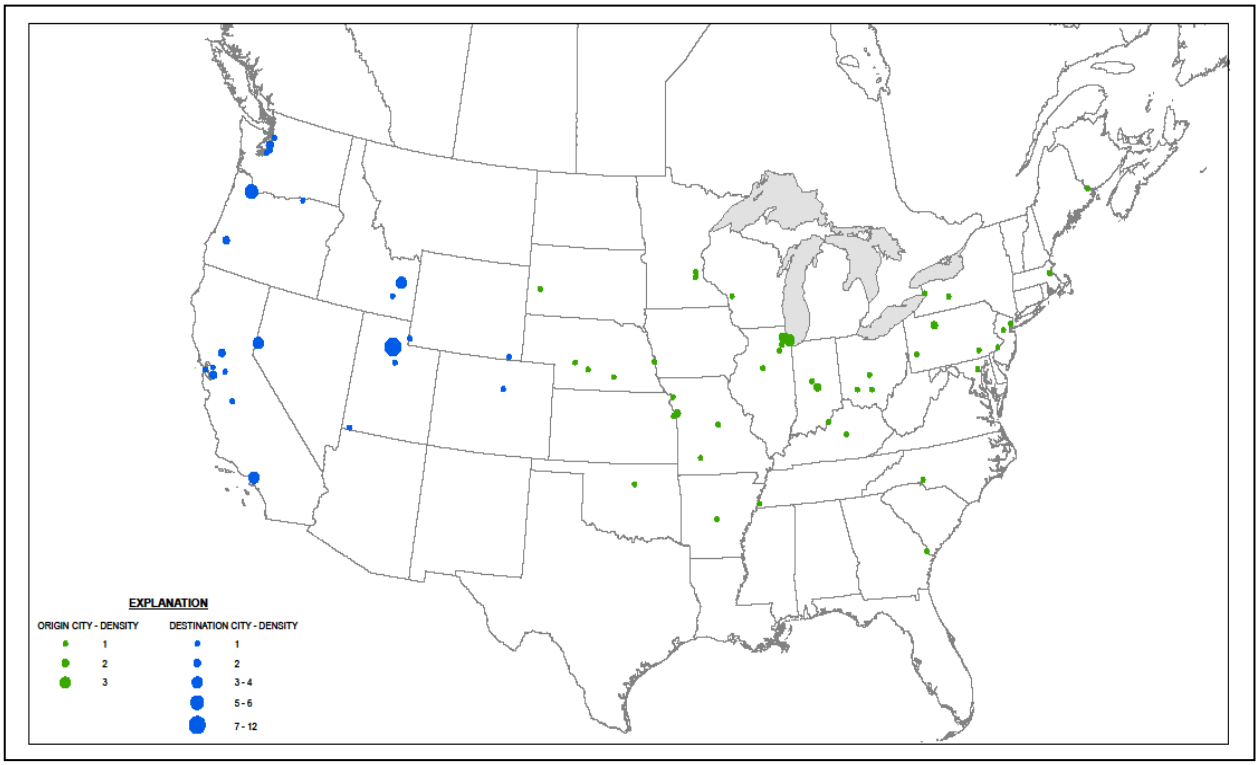


Figure 43. Westbound Origins and Destinations for Paper Product Shipments.

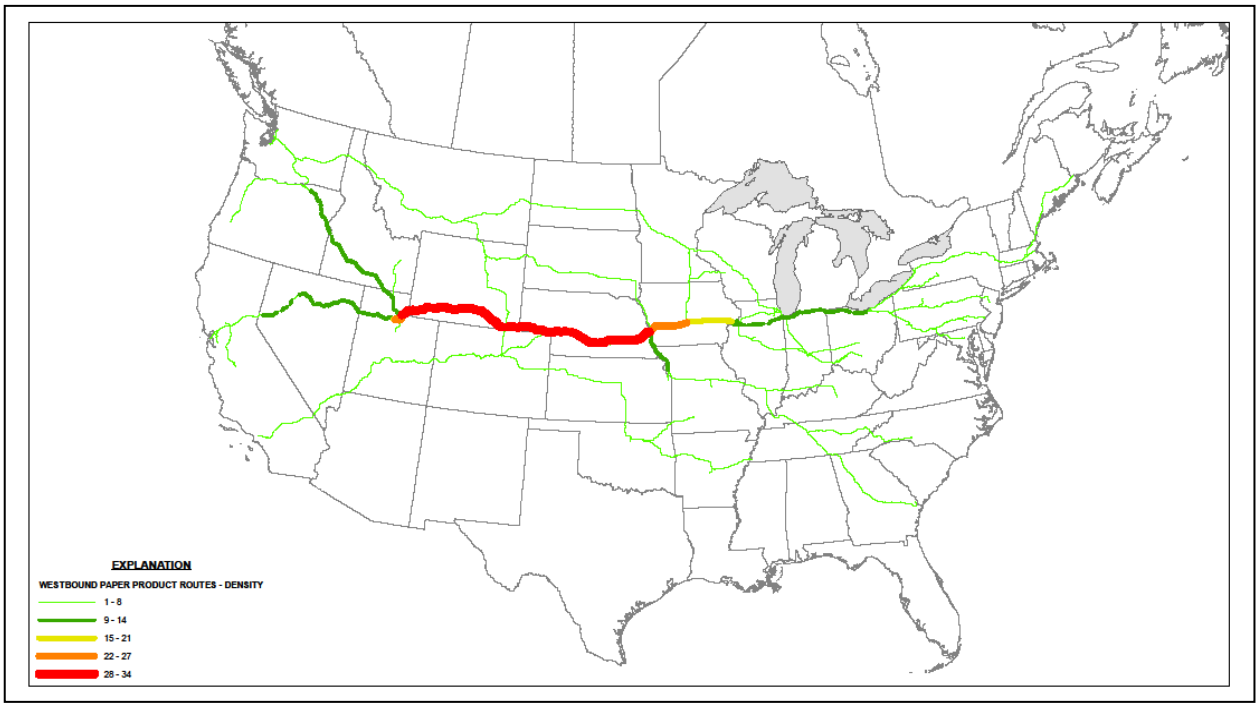


Figure 44. Westbound Route Densities for Paper Product Shipments.

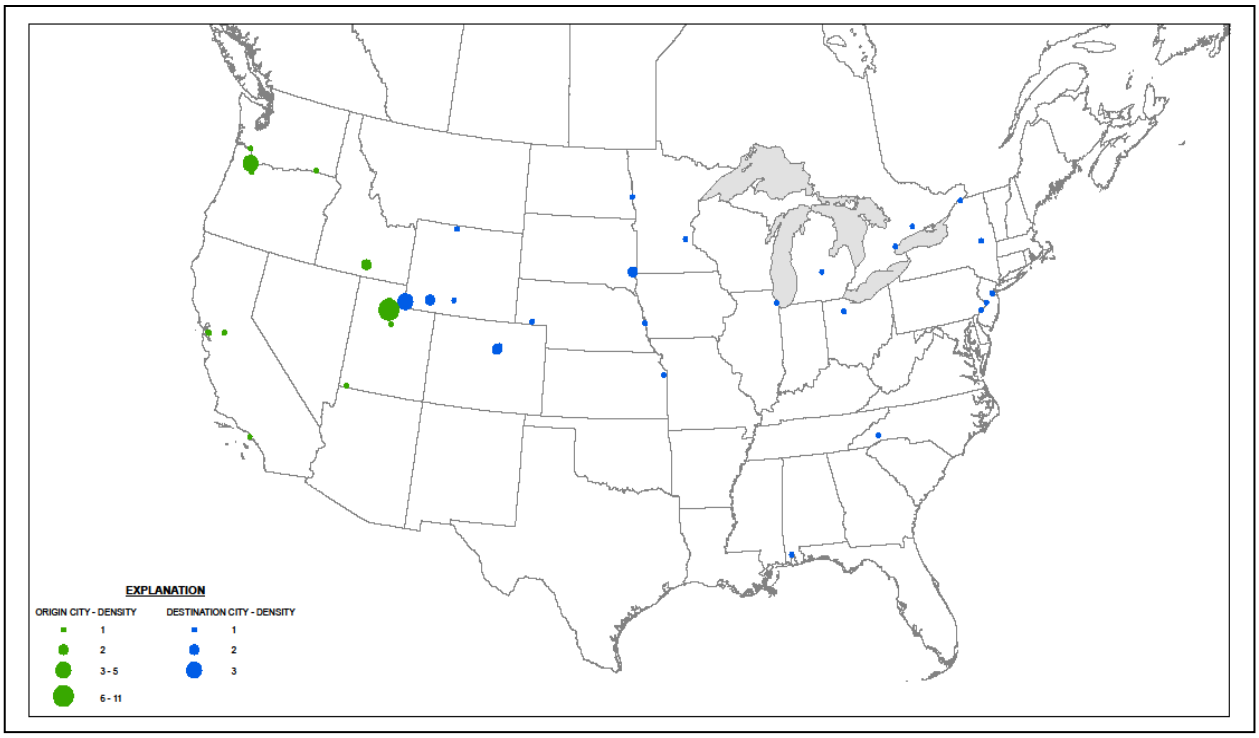


Figure 45. Eastbound Origins and Destinations for Paper Product Shipments.

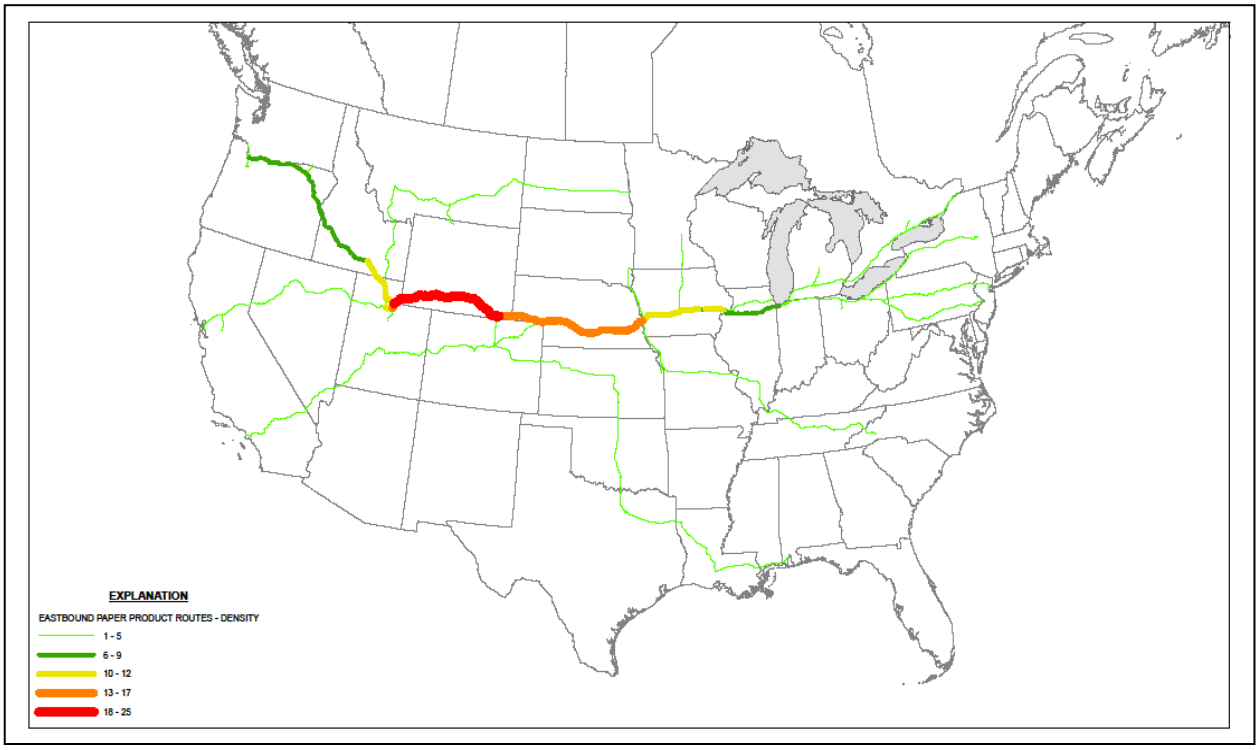


Figure 46. Eastbound Route Densities for Paper Product Shipments.

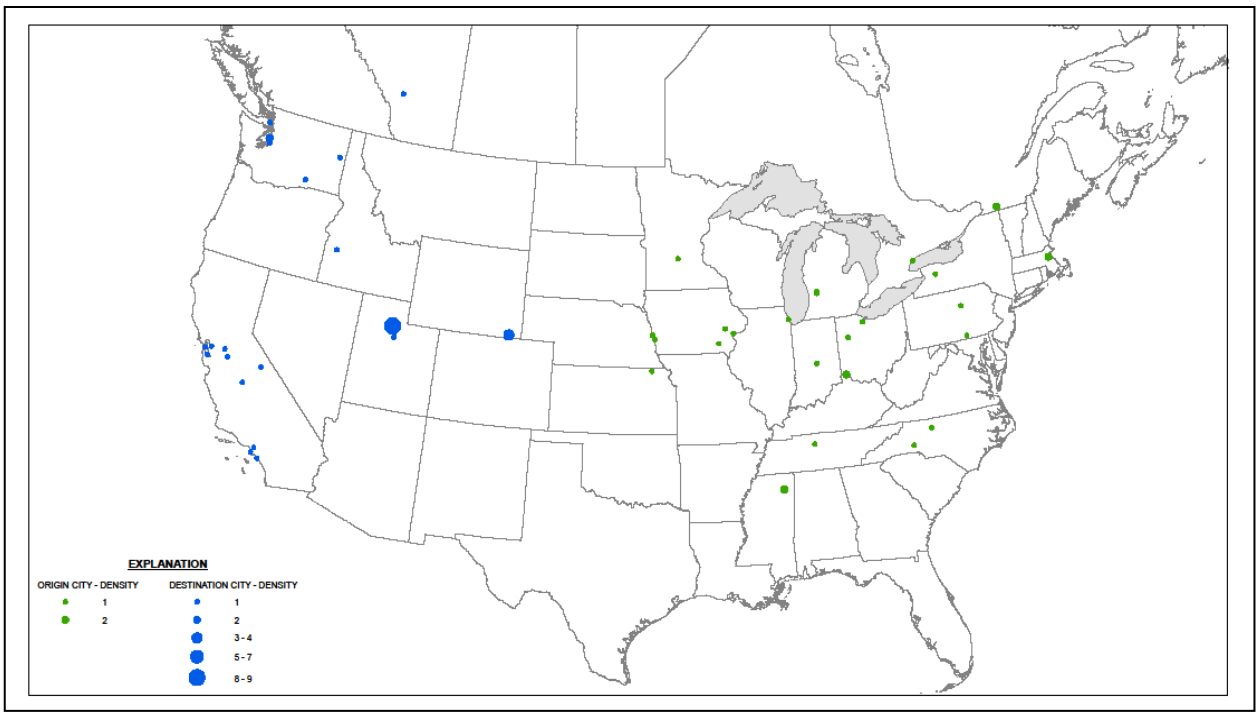


Figure 47. Westbound Origins and Destinations for Household Product Shipments.

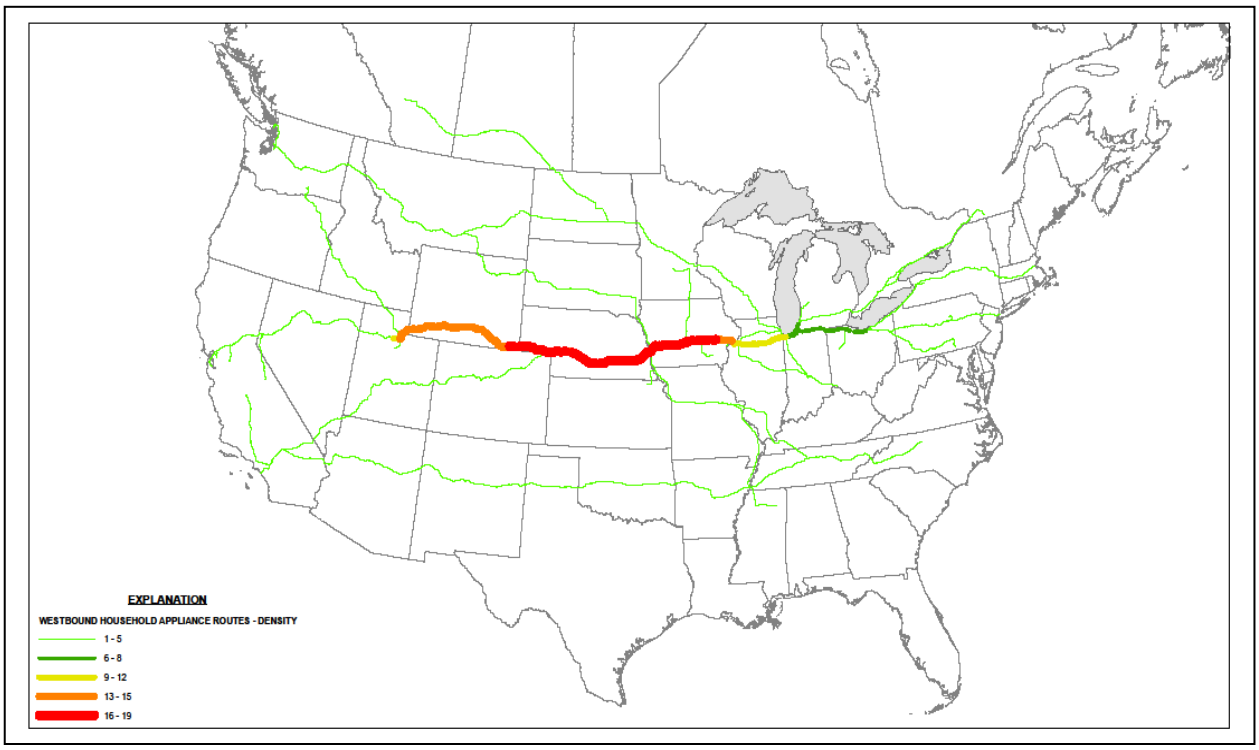


Figure 48. Westbound Route Densities for Household Product Shipments.

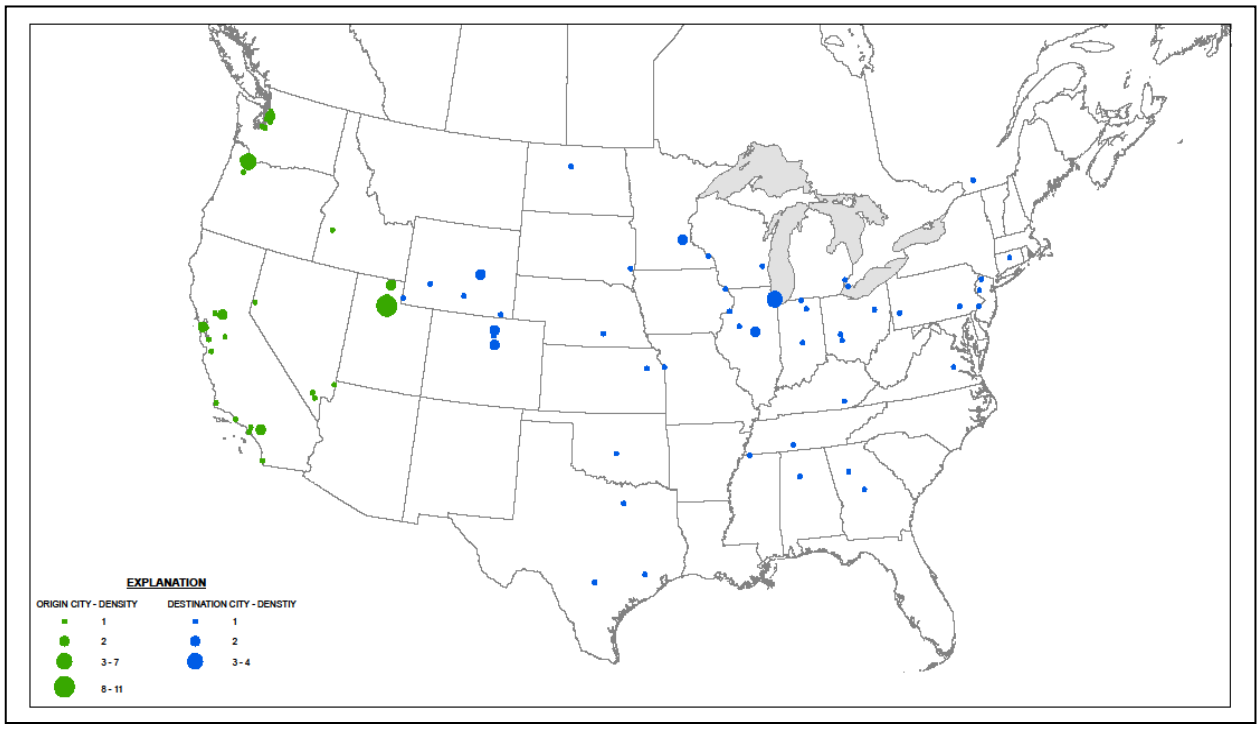


Figure 49. Eastbound Origins and Destinations for Household Product Shipments.

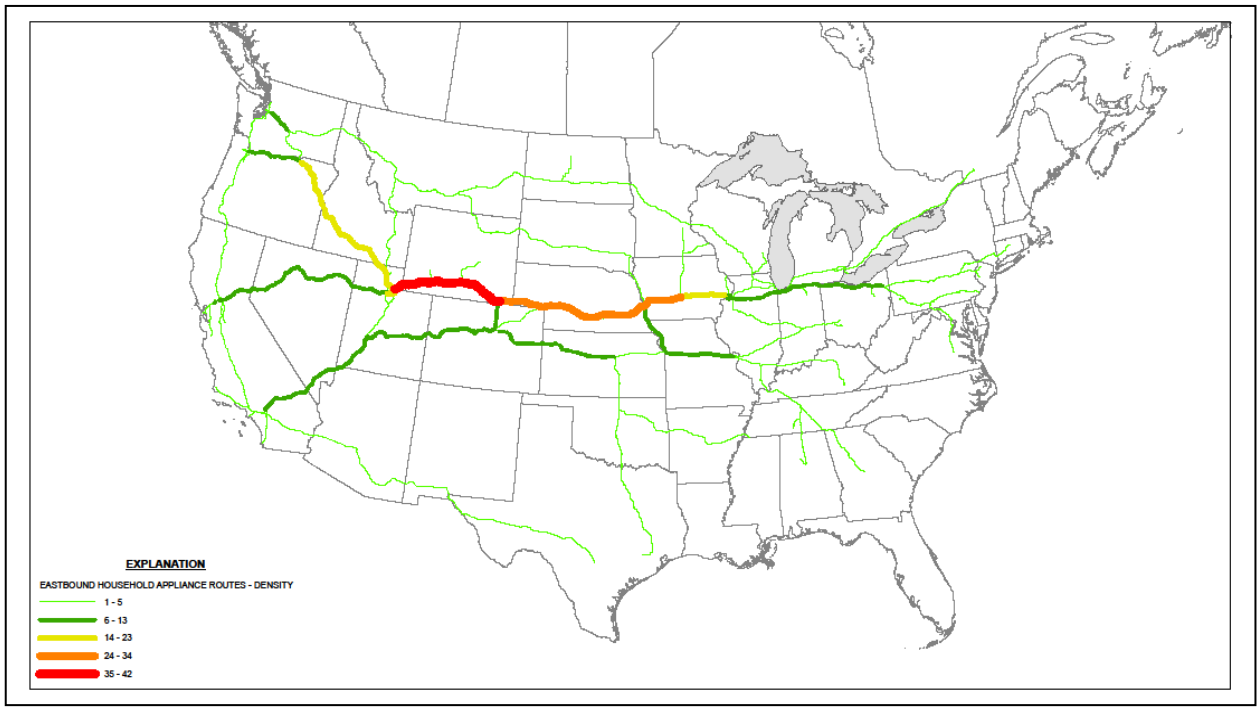


Figure 50. Eastbound Route Densities for Household Product Shipments.

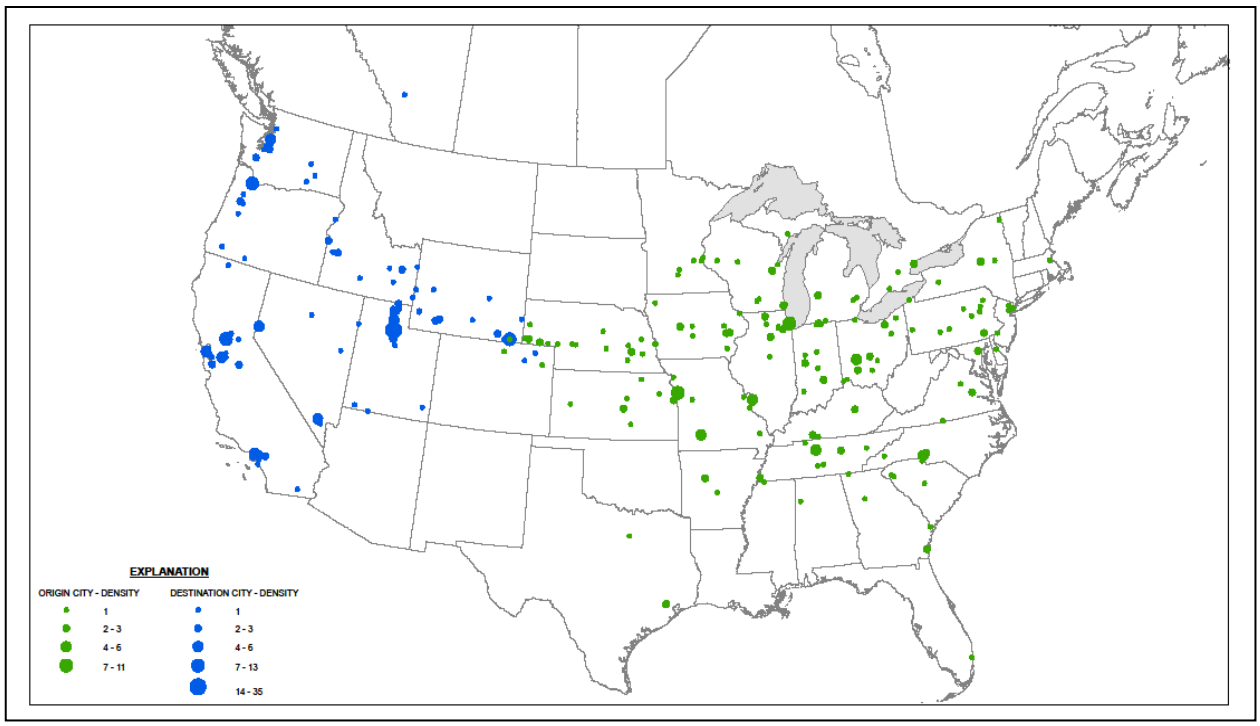


Figure 51. Westbound Origins and Destinations for "Other" Category of Product Shipments.

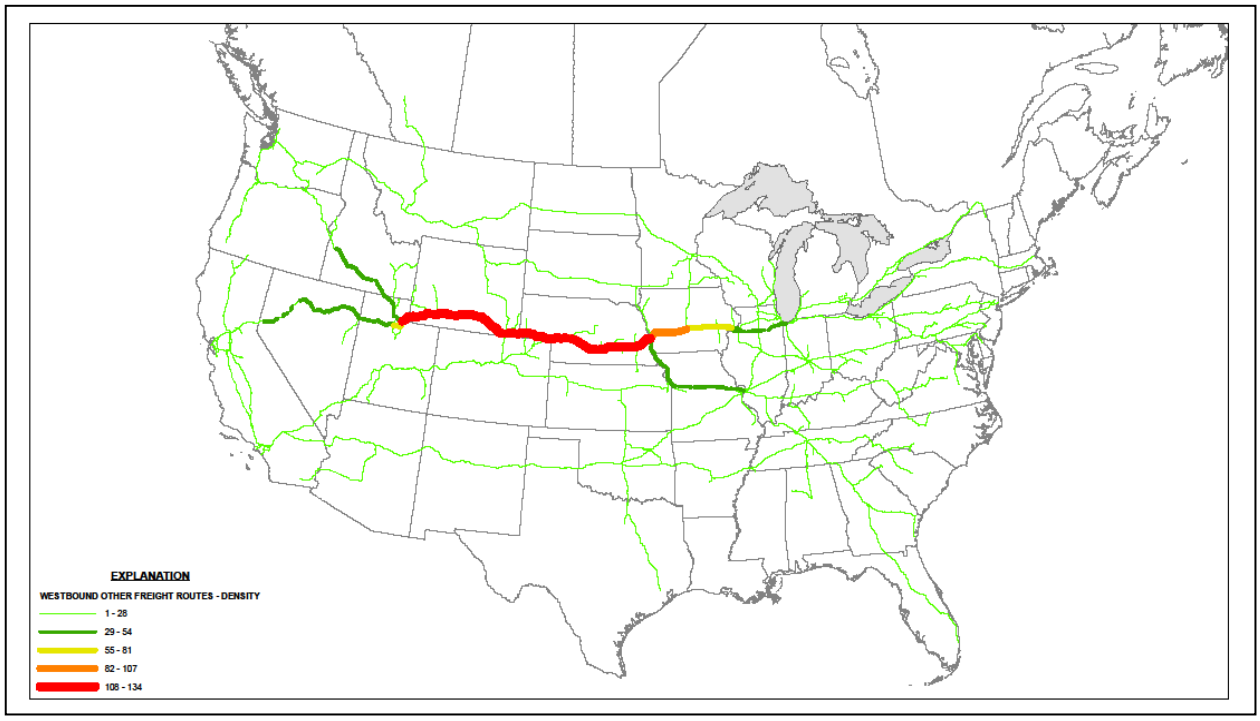


Figure 52. Westbound Route Densities for "Other" Category of Product Shipments.

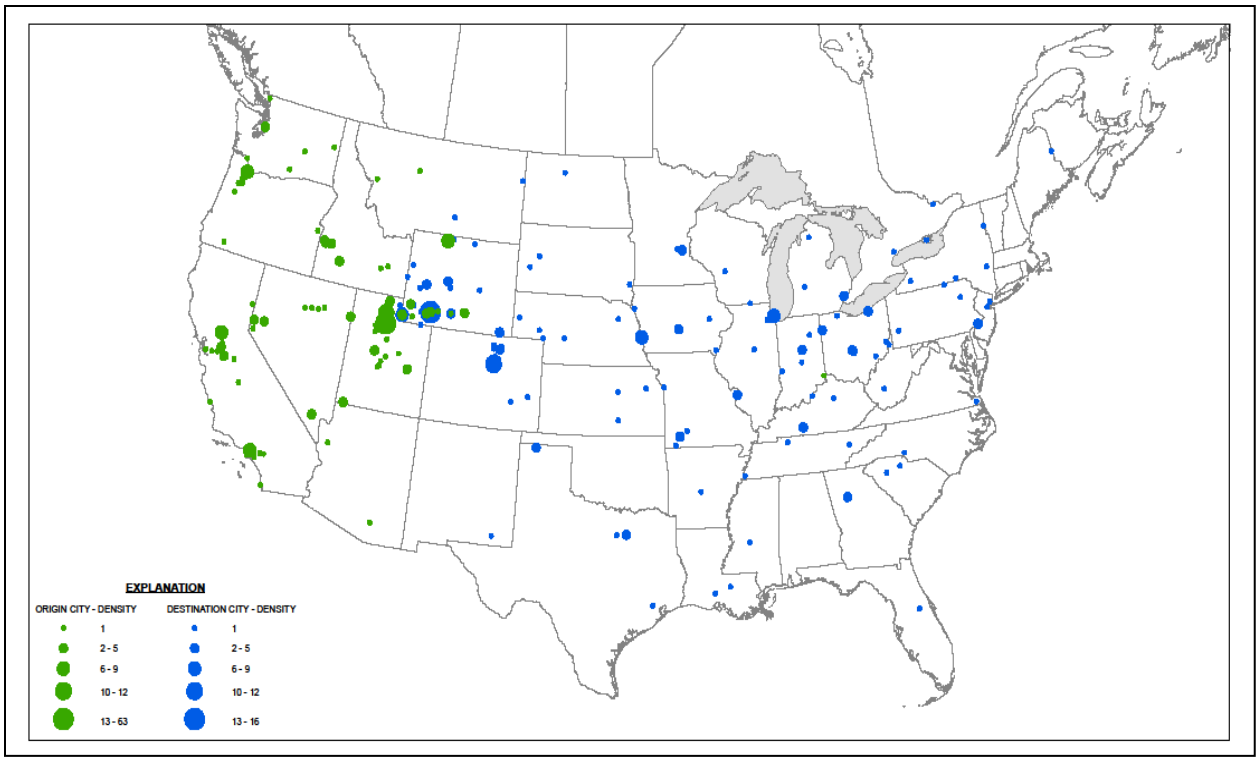


Figure 53. Eastbound Origins and Destinations for "Other" Category of Product Shipments.

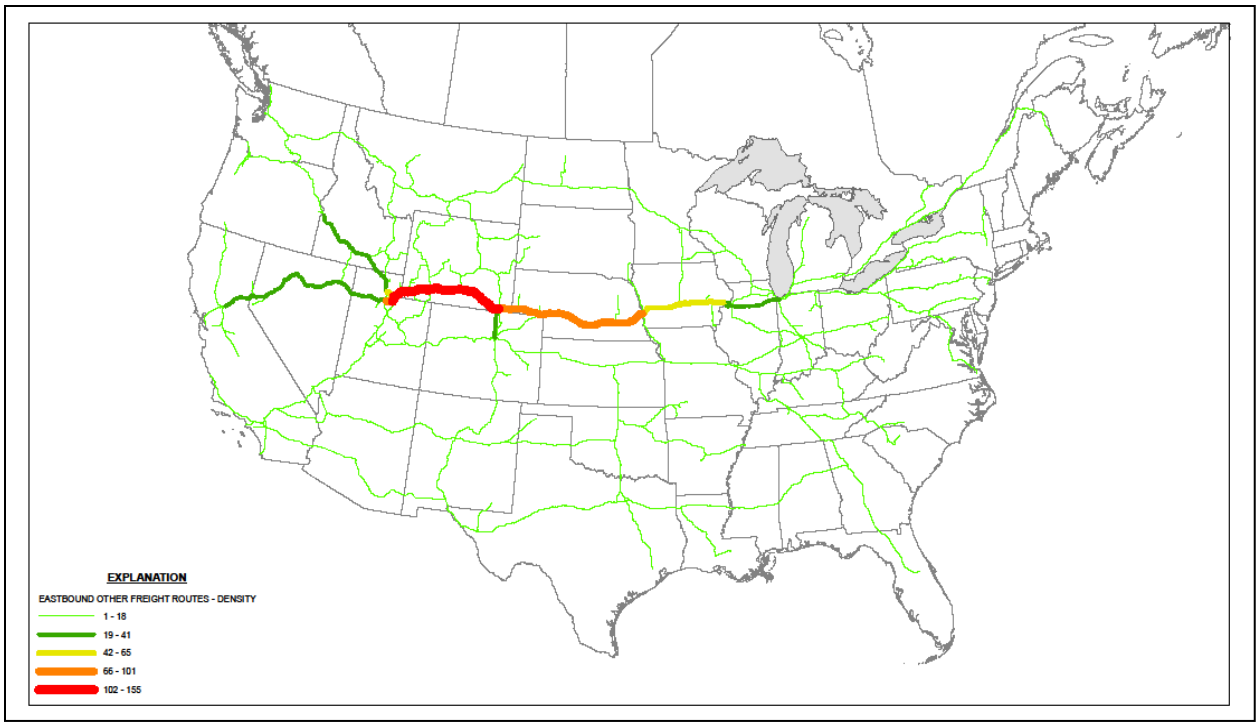


Figure 54. Eastbound Route Densities for "Other" Category of Product Shipments.

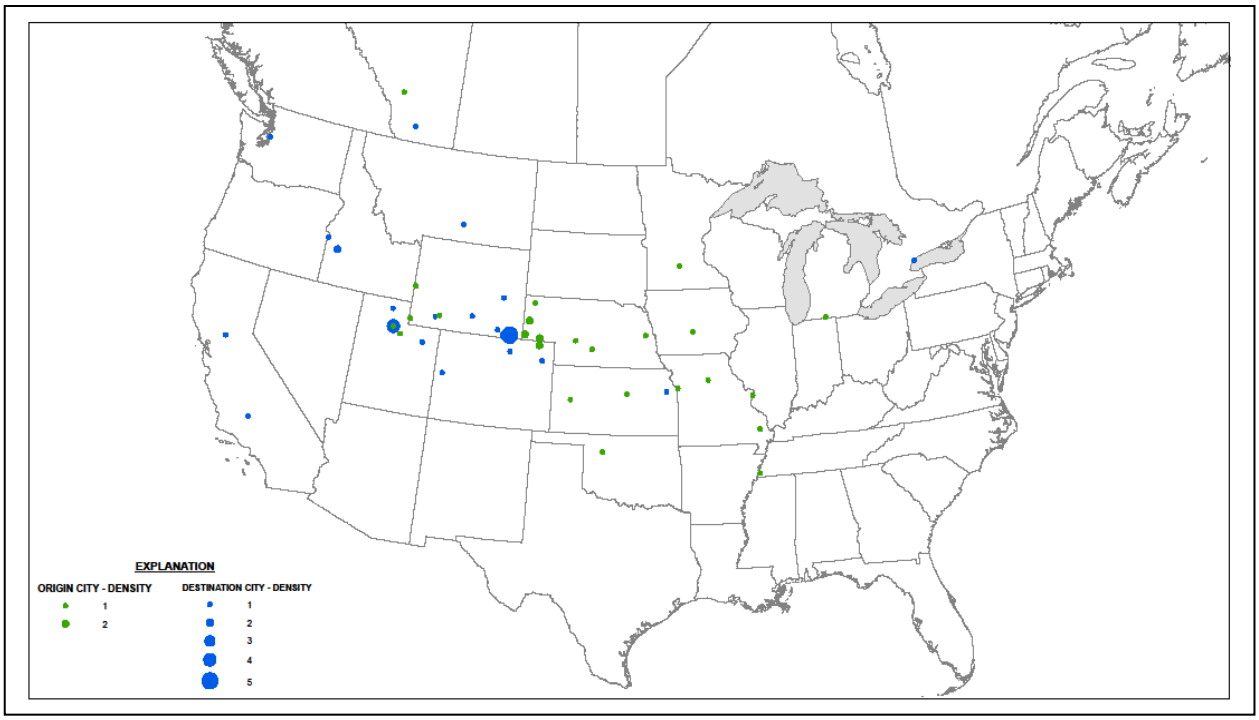


Figure 55. Westbound Origins and Destinations for Empty Loads.

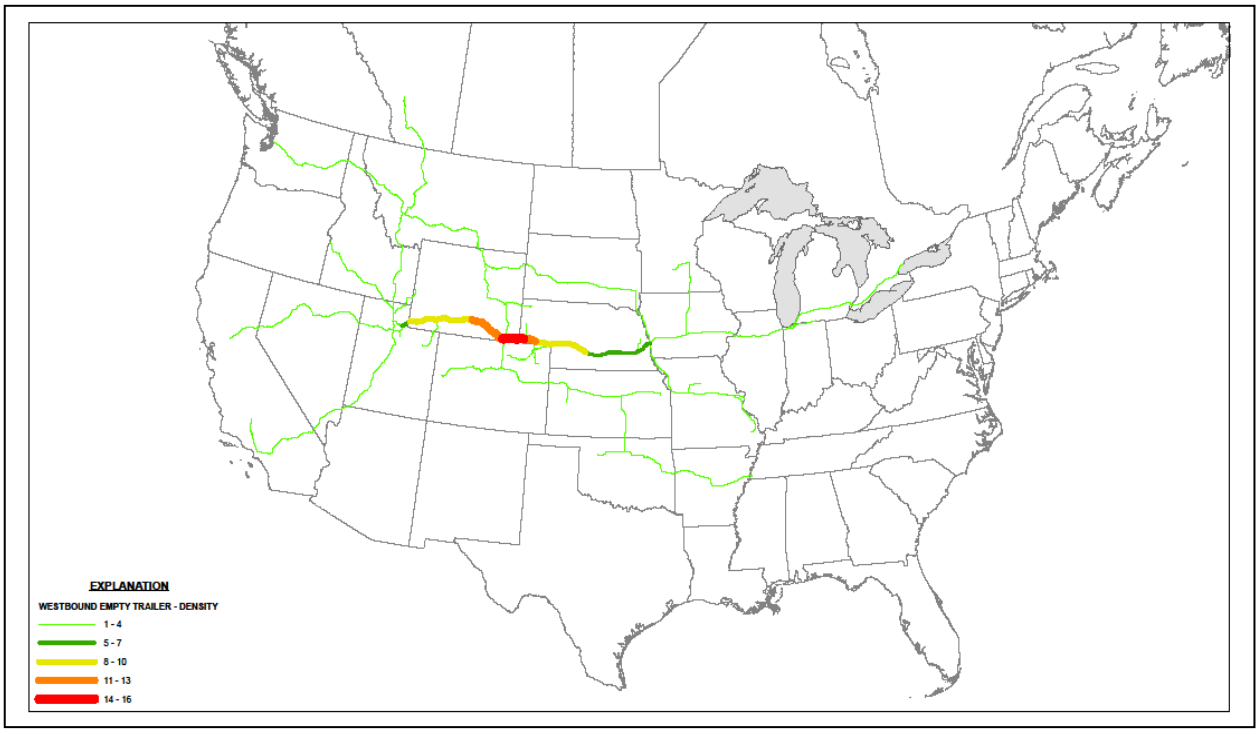


Figure 56. Westbound Route Densities for Empty Loads.

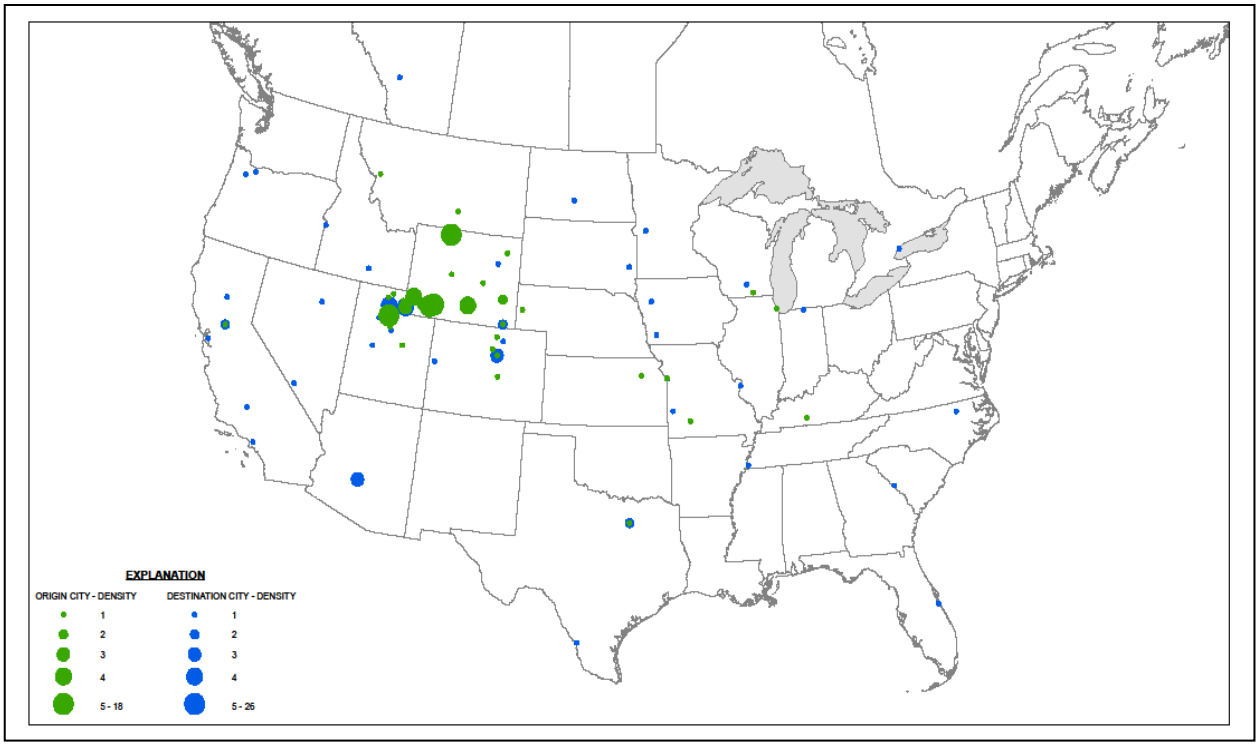


Figure 57. Eastbound Origins and Destinations for Empty Loads.

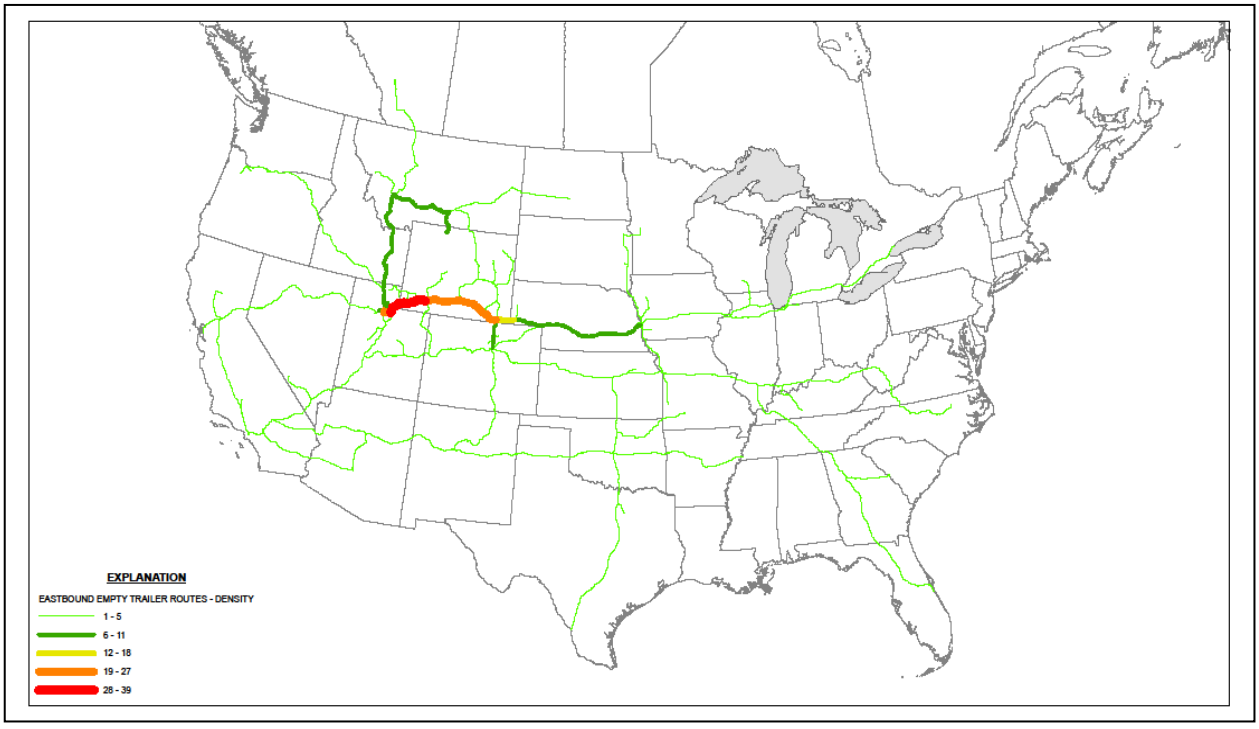


Figure 58. Eastbound Route Densities for Empty Loads.

Length of Haul Distributions among Origin/Destination Pairs

Survey data for origin destination pairs were loaded into a spatial database to analyze the number of trips of specific distances along I-80. Geospatial reference data and algorithms were used to determine the number of truck trips with origins and destinations within twenty miles of two city pairs. Table 10 shows the percentage of trips with origin destination pairs matched to cities along I-80 and the large number of origin/destination pairs of eastbound and westbound freight between Ogden/SLC and Chicago.

Table 10. Origin and Destination Pairs for Cities along I-80.

		Origin					
		Chicago & East of Chicago	**Omaha**	**Cheynne**	**SLC/Ogden**	**Reno**	**Sacramento**
Destination	**Chicago & East of Chicago**		Not surveyed	Not surveyed	65, 6.4% eastbound	6, 0.6% eastbound	12, 1.2% eastbound
	Omaha	Not surveyed		Not surveyed	5, 0.5% eastbound	0, 0% eastbound	1, 0.1% eastbound
	Cheynne	10, 1.2% westbound	4, 0.5% westbound		6, 0.6% eastbound	1, 0.1% eastbound	1, 0.1% eastbound
	SLC/Ogden	82, 10.2% westbound	1, 0.1% westbound	0, 0.0% westbound		Not surveyed	Not surveyed
	Reno	12, 1.5% westbound	0, 0.0% westbound	0, 0.0% westbound	Not surveyed		Not surveyed
	Sacramento	9, 1.1% westbound	1, 0.1% westbound	0, 0.0% westbound	Not surveyed	Not surveyed	

NOTES: Not all westbound origins and destinations were locatable. Percentages are based on 801 routes (origin/destination pairs).
All eastbound origin and destinations were locateable. Percentages are based on 1010 routes (origin/destination pairs).

The number of trips between Chicago and SLC/Ogden are approximately 6x to 8x any other city pairs along I-80. From Table 10 it is evident that Interstate-80 through Iowa, Nebraska and Wyoming indeed serves as a "land bridge" with its gathering points and primary approaches being Chicago and the SLC.

Summary of Freight Patterns Surveyed

Observations presented in the previous sections of this chapter are summarized below:

- Food was the largest product category identified in the survey. Thirty percent (30%) of all westbound and eastbound loads were food related. Two other high volume westbound and eastbound product categories were heavy equipment and building materials.

- Overall, 35% of westbound drivers responded that they were subject to late penalties while approximately 20% of eastbound drivers reported being subject to penalties. Food products was the highest product category subject to the time penalties with over 40% of respondents indicating that they as owner operators or their firms were subject to monetary penalties if the shipment did not reach the destination within the specified time.

- For many product categories freight flow density is comparable across Wyoming and Nebraska with these two states having few destinations and fewer, if any origins. Wyoming and Nebraska act as a "land bridge" linking the Midwest with the West Coast. For all product categories, approximately five to ten percent of eastbound freight shipments turn south on I-25 to Denver after reaching Cheyenne.

- The SLC/Ogden area was the origin and destination for over 50% of freight. SLC/Ogden could be characterized as the predominant western inland freight hub. Westbound loads are broken down, combined with other products, re-distributed and routed to the population centers and ports in Southern California, the Pacific Northwest and Central California. The SLC/Ogden area is the key eastbound mid-land freight hub breaking down loads from points west, combining products, redistributing and funneling shipments eastward onto I-80 and across Wyoming (Figure 59).

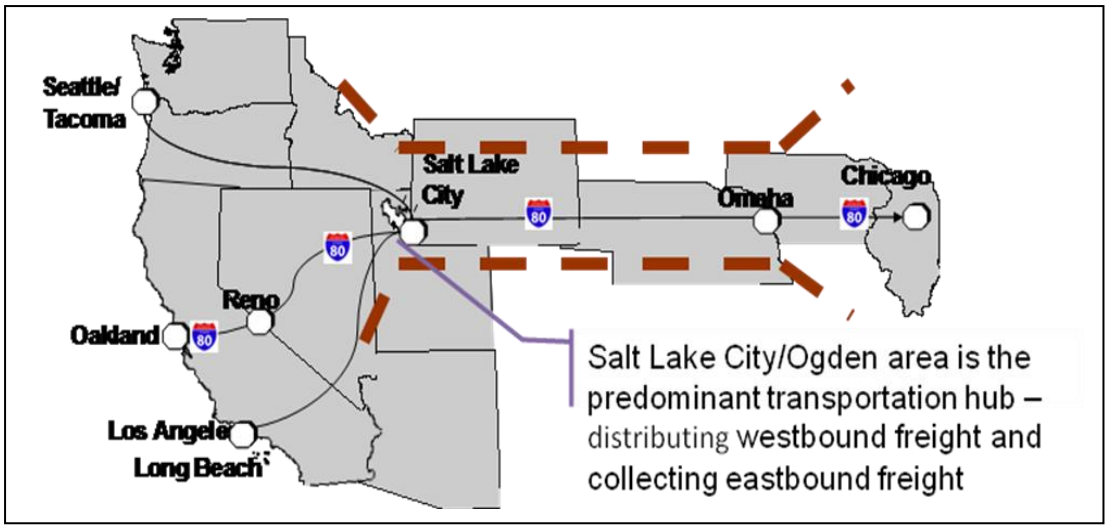


Figure 59. Role of Salt Lake City as Predominant Interior Western Freight Hub.

- Chicago was the major eastern freight concentration point and distribution point identified by survey data. Chicago was most often cited as the primary origin and destination. Although it varied by product, Chicago was identified as an origin slightly more than as a destination. Chicago is a concentration point for products manufactured in the Midwestern U.S. In the distribution function, these products are received in Chicago, re-combined and routed west on I-80. A significant percentage of products are manufactured in the vicinity of Chicago and travel west on I-80 to western states or the West Coast ports.

- The survey revealed 6 times and 8 times as many trips between Chicago and SLC/Ogden and SLC/Ogden and Chicago as any other city pairs along I-80. This high number of trips between Chicago and SLC/Ogden illustrates how northern U.S. freight flows depends upon the "land bridge" formed by I-80 across the corridor states of Iowa, Nebraska and especially Wyoming.

Suggestions for Improving Interstate 80

Although not directly related to freight flows, during development of the survey and discussions with WYDOT, it was decided to ask drivers how I-80 could be improved. Once the ports of entry were selected as survey locations it was recognized that this could compromise the value of this

question since drivers would only have been traveling on I-80 for a relatively short distance. However as shown in Figure 14, drivers surveyed drove Wyoming I-80 an average of 57 times (westbound) and 72 times (eastbound) during the last year so most of these drivers knew the route and the condition of the facility.

The question was open-ended, but the following answer prompts were used by surveyors if the driver was initially non-responsive:

- more rest areas/truck parking areas
- more passing lanes
- more dynamic messaging signs
- more effective use of messaging signs
- other

These prompts may have introduced bias and this bias should be considered while reviewing the responses and the analysis. It is unknown how many drivers where prompted or what prompts were used during a particular interview.

Of the drivers surveyed, 891 westbound drivers and 691 eastbound drivers responded to the question. Approximately 25% did not respond to the question despite prompting. There was no documented criticism of Wyoming I-80 pavement condition. Given that many of these drivers traverse I-80 50 or more times per year, this is highly complementary to WYDOT's care of, and investment in, the I-80 asset.

Table 11 shows driver suggestions for improving the Wyoming I-80 facility. Improving winter snow removal was mentioned by over 20% of eastbound drivers. As discussed at the beginning of this chapter, westbound drivers were predominantly surveyed between September and November of 2007 before the onset of winter, while eastbound drivers were surveyed between December 2007 and February 2008.

Table 11. Suggested Areas of Improvement for the I-80 Facility.

	Westbound	Eastbound
More rest/parking areas	69%	14%
More passing lanes	6%	2%
Winter clean-up		22%

Additional rest areas and parking areas were the predominant response. The reason for the difference between the high number of responses for westbound drivers versus eastbound drivers is not clear but may be attributable to combinations of factors such as: 1) how long the driver was on the road at the time of the survey, 2) the number of rest areas the driver past before entering Wyoming, and 3) the fact that there were more LTL eastbound drivers from the SLC/Ogden area surveyed at the Evanston port of entry which is a short haul compared the predominant long haul westbound TL drivers surveyed at the Cheyenne port of entry. Requests for more rest areas and parking areas were not unexpected. Drivers traveling along I-80 may reach their legal driving time limit at any point along the route. If when approaching their legal drive time limit a driver exits I-80 and cannot find a parking space for the legally required rest period the driver must either continue driving until the next opportunity to park and risk a fine or park illegally (if possible) and risk a fine. In 2000, WYDOT commissioned a study of truck parking facilities in Wyoming (WYDOT). The study identified over 3,300 available public and private parking spaces along I-80. Given traffic volumes at the time, the study concluded that with the exception of the section between Laramie and Rawlins, I-80 had a sufficient number of spaces to meet demand under normal conditions. Public and private spaces have been added along I-80 over the past decade however it is unknown if the number of spaces added since the study was completed is proportional to the growth in I-80 truck traffic.

Other opportunities for improving I-80 cited by drivers included additional passing lanes and more frequent snow removal. As shown in Table 11 a small percentage of drivers suggested WYDOT construct more passing lanes. Over 20 percent of eastbound drivers would like WYDOT to improve snow removal and improve surface treatments to increase traction in snow and ice. Snow removal was not identified as an issue by westbound drivers probably due to the time of year that westbound drivers were surveyed.

Summary and Use of Freight Movement Data

There were two objectives for collecting on-the-ground data on freight movement:

1) Provide WYDOT with more information on one of their key "customer" constituencies (the number of trucks has surpassed the number of personal vehicles on much of Wyoming I-80).

   and

2) Provide the necessary background to develop freight growth scenarios to assist WYDOT in forecasting truck volume growth.

The survey accomplished both objectives. Analysis of on-the-ground survey data presented in this chapter should provide WYDOT with a better understanding of the demographics of truck drivers, origins and destinations of freight, the type and mix of freight, suggestions on I-80 improvements and preliminary market reaction to the "land ferry" diversion strategy. Knowledge gained from analysis of on-the-ground survey data and patterns, while more nebulous, was useful in: 1) constructing and validating the framework used to formulate various freight growth scenarios and 2) analyzing and "ground truthing" these scenarios.

Before moving to scenario building, some final observations and considerations on freight movement are presented below.

- Information provided on the percentage of trucks subject to penalties for delay as well as the percentage of shipments of each product category can be used to validate the cost of I-80 road closures or to generate a more accurate method of computing the cost of delay from I-80 road closures. Perhaps this will precipitate the need to better address (from a trucking industry and highway safety standpoint) the inherent conflict between: 1) Wyoming's winter driving conditions, 2) limitations on WYDOT's snow removal

capacity (budget and resources) and 3) shippers' pressuring drivers to deliver on-time or face a penalty in an extremely tight margin business.

- Food products constituted almost one-third of the total freight captured in the survey and were the largest freight category on I-80 across Wyoming. From the data it could be assumed that shipments across I-80 for this category of consumer staples – whose products originate from established manufacturers with comparative advantage in brands, production assets, raw materials, etc. – is likely to correlate with U.S. population growth. Changes in demand are dampened with consumer products such as food. Significant change in the food component of the I-80 freight profile is unlikely.

- The SLC/Ogden area's role as the major western, inland freight hub will continue to "pull" westbound freight (and the growth of freight) from destination states across Wyoming I-80 while and "pushing" more of the growth of eastbound freight across Wyoming I-80.

- What is stated above for SLC/Ogden applies (in geographical reverse) to Chicago.

- Balancing transportation routes is especially important for a profitable trucking industry but is difficult for independents. Three percent (3%) of westbound trucks were reported empty while three times as many (9%) of eastbound trucks were reported empty.

- Interstate 80 corridor states between Chicago and SLC/Ogden must continue to invest relatively large amounts of funding to operate and maintain this freight corridor despite the fact that most trucks are primarily traversing between Chicago and SLC/Ogden while the primary beneficiaries of this freight are the upper Midwestern states and states on the West Coast.

Chapter 5 – Freight Patterns Affecting I-80 Freight Volumes and Scenario Constructs

Truck traffic volumes across Wyoming I-80 are influenced by many factors. A three-dimensional framework was developed which encapsulates and groups key factors that will influence future I-80 freight volume across Wyoming and its associated costs for pavement wear, safety, revenue, etc. (Figure 60a).

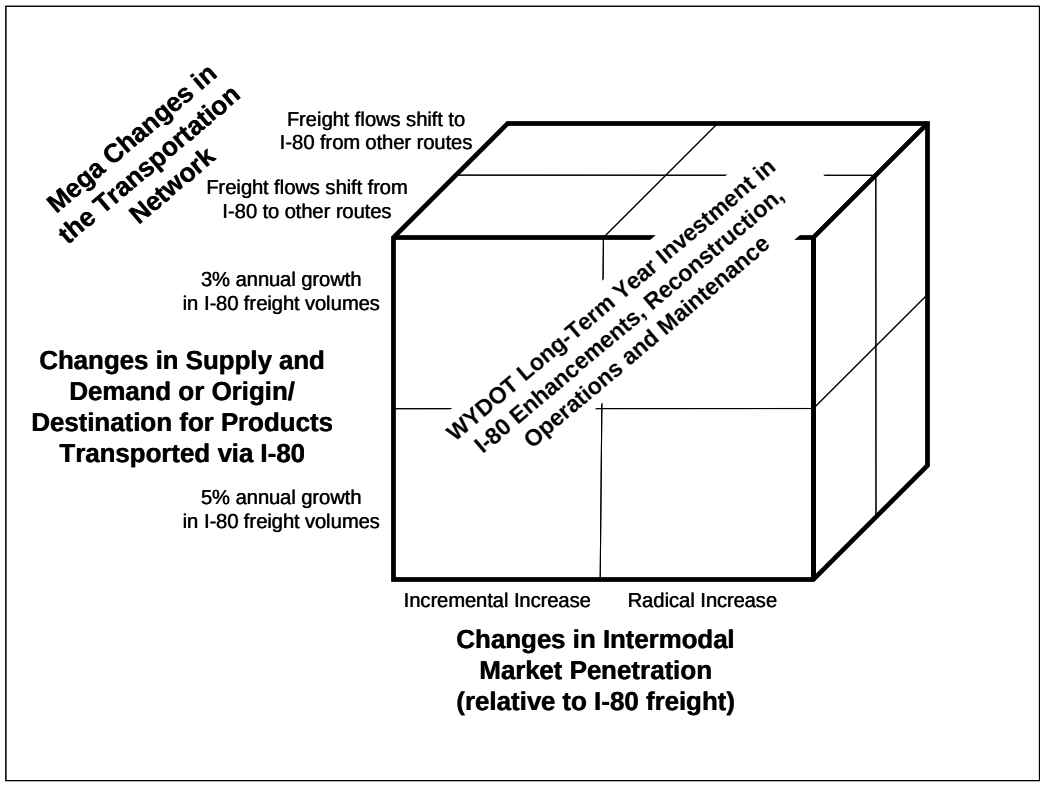


Figure 60a. I-80 Freight Growth Scenario Framework.

Each of the three axes and two possible outcomes leads to eight combinations. This is the basis for formulating eight I-80 growth scenarios. Scenarios are collective and coherent sets of future long-term trends. The eight cubes shown in Figure 60a represent the eight scenarios with each scenario correlating to an average annual growth rate of truck VMT and estimated 30-year reconstruction costs to maintain current levels of service, i.e. condition.

In reality each dimension of this framework is a continuum rather than having two discrete possible outcomes and defined boundaries. However, scenario analysis does not lend itself to working in continuums since continuums have an infinite number of outcomes. The framework provides a context for assessing future growth possibilities given the infinite number of future states. Also, for developing and analyzing scenarios it was necessary to impose boundaries which are defined by the assumptions presented below. The scenario analysis model presented is more qualitative than quantitative and although not explicitly called out in Figure 60a, scenario analysis addresses the probability or likelihood of each scenario being realized.

The three axes of this framework, referred to as *scenario dimensions,* are described below.

1. **Scenario Dimension #1 – Mega changes in the transportation network** infrastructure significantly change I-80 freight flows either by alternate routes which by-pass Wyoming I-80 or shift freight from other routes concentrating more national freight volume on to I-80.

2. **Scenario Dimension #2 – Changes in supply and demand or changes in the origin or destination for products currently transported across I-80** including the location of related industrial sectors which increase or decrease the annual growth rate of truck volumes on I-80. Initial values of 3% and 5% bound this dimension.

3. **Scenario Dimension #3 – Changes in intermodal penetration** and other modal shifts. This dimension encompasses truck-load shipments of domestic freight traveling 1,000 miles or more, the health of the trucking industry, railroad capacity and service. These factors influence whether freight could be diverted from I-80 to rail and thereby reduce future truck volume on I-80.

The scenario analysis framework introduced above is further decomposed in Figure 60b. Scenario dimensions (i.e. the x, y and z axes of the cube) are influenced by many factors that will drive changes in future I-80 freight volume. This analysis distinguishes between factors with 1st order (i.e. direct) effects on I-80 freight volume versus other factors with 2nd order (i.e. indirect)

effects. An example of a 1st order impact on I-80 freight volumes is private sector investment in logistics infrastructure in the SLC/Ogden area. This investment decision, in turn, is driven by dynamic macro-economic factors such as the global price of oil and consumer demand (due to population growth). For the purposes of this analysis, 2nd order factors indirectly increase or decrease (over the long-term) the rate of change in I-80 freight volumes by acting on 1st order factors. Second order factors establish boundaries in formulating I-80 truck traffic growth scenarios. Assumptions for 2nd order factors, such as the long-term price of oil and U.S. population growth will be held constant across scenarios. While the combinatory effects of 1st and 2nd order factors acting upon one another will be briefly discussed in the following sections, this is a complex system that is greatly simplified for this model, model analysis and subsequent forecasts.

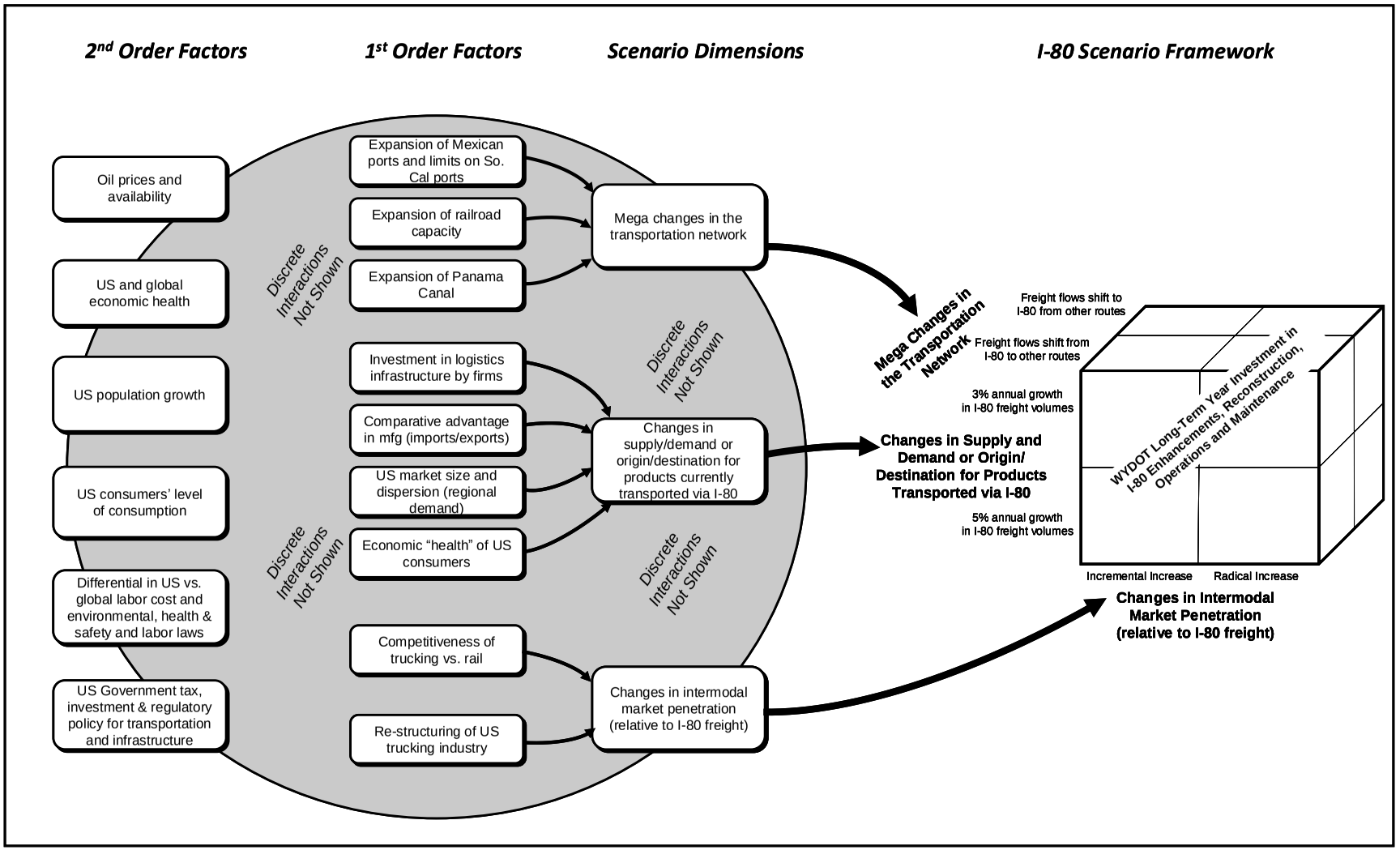


Figure 60b. Constructs of I-80 Freight Growth Scenario Framework.

2nd Order Factors (Driving Future Freight Volumes on Wyoming I-80) and Assumptions

Six 2nd order factors illustrated on the far left of Figure 60b are the boundaries of the system and will be assumed constant across all scenarios.

One might ask, if the second order factors are constant across all scenarios, why have them?

The second order factors are key drivers of first order factors which directly affect I-80 freight volumes. While second order factors are held constant for this analysis this discussion is important for defining and characterizing key assumptions. For example, although US population growth is assumed constant 3% if it drops below this would slow economic growth, demand for goods and hence demand for freight. Similarly for this scenario analysis and forecasting, assumptions around GDP, the price of oil, government actions etc. should be stated and discussed. For any forecasting exercise it is sound to state key assumptions.

Each of these 2nd order factors, assumptions about these factors and the relative value of these factors, as pertaining to the growth in Wyoming I-80 freight volume, are discussed below.

The first 2nd order factor relates to assumptions about the supply and cost of energy.

- **Oil Prices and Availability** – The assumption used in the scenario analysis is that oil prices will gradually increase over the next twenty years and that substitutes will emerge for diesel should the world price of diesel experience a significant long-term price increase. Worldwide demand for diesel fuel (as a personal automobile transportation fuel) is increasing and will continue to place upward pressure on prices.

  The long-term price of oil has several indirect influences on future I-80 volumes. First, the overall "health" of the US economy is and will continue to be influenced by global energy prices for at least the next twenty years. For many businesses energy costs are a significant component of product manufacturing and distribution costs – either as a direct input or in the

transportation component of product distribution. The price of products and hence demand are influenced by energy costs. The long-term price of oil will affect many 1st order factors such as:

- Consumer demand.
- Comparative advantage in manufacturing and distribution.
- Investments in domestic and international transportation infrastructure – both fixed and mobile assets.
- Modal availability and demand.

In the long-run, changes in these factors caused by energy prices will affect domestic freight patterns through changes in supply/demand and origin/destination for products transported on Wyoming I-80. Fuel prices are a factor in decisions about where to place factories and how much inventory to hold, i.e. fuel prices change freight patterns.

Short-term fluctuations in the price of diesel fuel should not appreciably influence I-80 freight flows. During the course of this study, national diesel fuel prices increased from $2.80 per gallon to $4.80 per gallon then dropped to approximately $2.50 per gallon. In the short-term, most transportation firms successfully passed much of this increase on to customers through fuel surcharges which in turn were partially passed on to the products' consumers. Although this short-term increase in fuel costs combined with other factors has had a devastating effect on independent and small and medium size trucking firms (and will be discussed in a subsequent section of this chapter) the fact remains that during this unparalleled run-up in fuel costs, shippers continued to find firms to transport their products.

For the purpose of this analysis it is assumed that oil prices will continue to rise moderately (on average) over time and will not severely impact U.S. economic health and U.S. consumer demand. It is assumed that alternative transportation fuel options will exist to mitigate both significant long-term increases in fuel costs and provide a migration path for freight transportation through the 21st century should one be needed.

The second 2nd order factor relates to assumptions about global and domestic economic health which is a contributor to consumer and business demand.

- **US and Global Economic Health –** This 2nd order factor is comprised of several components such as the cost capital, inflation, unemployment, and GDP growth. At the time of this report the U.S. and countries that make up much of the global economy were entering a time of economic uncertainty and a potentially severe economic downturn. Numerous economists predict a modern financial crisis second only to the Great Depression – characterized by deflation and prolonged and significant annual decreases in GDP. Historically overall economic growth and demand have closely correlated with freight movement. However, as the US economy has restructured into a service economy a large measure of the increase in consumption can be attributed to intangible products (i.e. entertainment and digitally related) for which less economic activity manifests in physical goods requiring transportation. Consequently, there may be a severe economic downturn with proportionately less of an impact on freight volumes than in the past.

  If predictions of a severe multi-year economic contraction are realized with high levels (10-15%) of prolonged unemployment (5+ years), freight growth could actually decline by several percentage points which would be lower than even the lowest I-80 freight forecast scenario presented in this study.

  In terms of an upper bound on growth, if the U.S. economy exhibits multiple years of unexpected growth in the range of four to five percent of GDP, low unemployment and a strong overall economy then growth rates beyond the high growth scenarios could be realized depending on how other 1st order and 2nd order factors materialize. **For the purpose of this analysis it is assumed that despite current economic conditions, within several years the U.S. economy will be healthy (in terms of availability of capital, level of investment, availability of credit to finance trade, employment and consumer demand); the U.S. economy will continue moderate growth in the long-term while growth in the developing world and especially in Brazil, China, India and Russia will be moderate to robust.**

The third 2nd order factor relates to assumptions about population growth which, like U.S. and global economic health, is a strong contributor to demand.

- **US Population Growth –** This analysis assumes that U.S. population will continue to increase at its current rate. It is projected that the U.S. will absorb another 100 million people by 2040. US population increases by three million people each year (Census). Most of this growth will be attributable to legal and illegal immigration. Immigrants have accounted for virtually all of the national increase in public school enrollment over the last two decades. In 2007, there were 10.8 million school-age children from immigrant families in the United States. The nation's immigrant population (legal and illegal) reached a record of 37.9 million in 2007. Immigrants account for one in eight U.S. residents, the highest level in 80 years. Overall, nearly one in three immigrants is an illegal alien. Half of Mexican and Central American immigrants and one-third of South American immigrants are illegal. Since 2000, 10.3 million immigrants have arrived — the highest seven-year period of immigration in U.S. history. More than half of post-2000 arrivals (5.6 million) are estimated to be illegal aliens. The largest increases in immigrants were in California, Florida, Texas, New Jersey, Illinois, Arizona, Virginia, Maryland, Washington, Georgia, North Carolina, and Pennsylvania. (Camarota).

  Although the current economic downturn in the U.S. economy has slowed illegal immigration from Mexico and Central America due to the lack of jobs and the absence of a social safety net, once the economy rebounds it is expected that, barring stricter enforcement of immigration laws, illegal immigration will resume. The differential in wages and opportunities for employment are expected to remain significantly higher in the U.S. than in Mexico and Central America. **For the purpose of this analysis it is assumed that no significant changes that would drastically curb immigration (i.e. immigration laws, enforcement of these laws and motivations for would-be immigrants). U.S. population growth which is the primary contributor to domestic demand and ultimately demand for freight movement will continue on its current 20 year trajectory.**

The fourth 2nd order factor relates to assumptions about U.S. consumer demand.

- **U.S. Consumers' Level of Consumption –** Growth in U.S. consumer demand has been a driving force in increased in economic activity and in freight movement especially in the past ten years. Consumers tapped easily accessible debt sources from home equity to credit cards in order to finance the purchase of durable and consumable goods. For many consumers their debt exceeds their ability to repay. Some economists have argued that the end of easy credit and the hard reality that consumption must decrease to pay down debt could result in a new era of minimalist consumerism, i.e. consumers trade down and pay down debt, and radically reduce spending to align with disposable income. This minimalism in consumerism may grow in popularity and may even spawn a mass movement with consumers asking themselves "how much stuff is enough?"

  At the time of this report retail sales analysts are expecting the worst monthly decline in consumer spending since the recession of 2001. "This is the end of the consumer-based economy, said " Peter Schiff, who runs the investment firm Euro Pacific Capital, told the Associated Press in a recent interview. "Americans have been buying too much stuff, and now the epic shopping spree is over."

  Keeping in mind that almost one-third of I-80 freight traffic is related to food products, if the death of consumerism is not over exaggerated the growth in I-80 freight streams for discretionary products could be impacted. Similar to the assumptions of GDP growth, long-term appreciable reduction in consumerism as a result of the current economic downturn or a shift in values away from consumerism is assumed unlikely. **For the purpose of this analysis it is assumed that U.S. consumers will within two to three years weather their current personal financial crises, pay down (or somehow be relieved of) a portion of their household debt and return to previous consumptive patterns.** This is a major assumption, but patterns of economic growth have proven to follow 10-20-year cycles, i.e. moderate or rapid growth followed by slowdowns (or even negative growth). Should this not turn out to be true, freight growth will be lower across all forecast scenarios.

The fifth 2nd order factor relates to assumptions about differences in labor costs and environmental, health & safety and labor laws between the U.S. and other countries primarily Mexico and China.

- **Differential in U.S. versus Global Labor Costs and Environmental, Health & Safety and Labor Laws –** This second order factor addresses two trends:

  1. Increasing freight volumes due to U.S. manufacturers adopting lean production practices and the relocation of U.S. manufacturing to Mexico and China.

  2. Shift of imported freight from the southern California ports to Mexican ports.

  For manufacturing operations still residing in the U.S., components manufactured in the U.S. or imported into the U.S. are shipped to the U.S. manufacturing facility and assembled into partial or finished products which may be exported or domestically consumed. Lean manufacturing and global outsourcing of components have driven companies to substitute an efficient and responsive global transportation system for warehouses and inventory. This trend has increased manufacturers' reliance on an efficient and predictable transportation system.

  Beyond sourcing components globally, over the past 10 to 20 years there has been a steady stream of U.S. companies that have relocated entire manufacturing operations to Asia (primarily China) and Mexico. Most of these firms were drawn by relatively low labor costs and less stringent environmental, health and safety and labor laws and regulations.

  However, it is likely that the rate of migration of U.S. manufacturing to off-shore producers has peaked. In fact as transportation costs increase the differential in labor costs erodes. As a result, some formerly U.S.-based manufacturing operations are shifting back to the U.S. After $100 oil, fuel prices are a factor in decisions about where to place factories and how much inventory to hold. Some globalization can be reversible. With high fuel prices the cost of moving products from distant manufacturing centers to markets becomes greater than savings from low-wage labor. Also, as foreign labor begins to organize and demands higher

wages (along with downward pressure on U.S. wages) the total cost differential between manufacturing products in the US and abroad shrinks.

Declines in freight related to changes in the traditional U.S. manufacturing base will be somewhat balanced between additional declines and new manufacturing relocating to the U.S. The location of new domestic manufacturing could affect future I-80 freight patterns and these trends such as auto manufacturing continuing to shift from the upper Midwest to the southeastern U.S. **For the purpose of this analysis it is assumed that the freight industry will not experience the dramatic growth of the past 10 – 20 years attributable to U.S. manufacturers transitioning to lean production. Relocation of U.S. manufacturing operations overseas has mostly run its course. The dramatic increase in outsourcing of manufacturing from the U.S. to foreign countries and the associated increase in freight volume have leveled off.**

Another aspect of the differential in U.S. versus Mexican labor costs and environmental, health and safety and labor laws is the impact this could have on the SLC/Ogden area and its role as the premier western interior freight hub. Three potential concurrent catalysts for this shift are:

1. Massive investment in Mexico's Pacific ports and associated transportation infrastructure.
2. Sustained differential in labor costs and in the environmental, health, safety and labor laws between Mexico and the US.
3. Limitations on growth (physical space) of the ports of Los Angeles and Long Beach, pressure to curb emissions, congestion in and out of the ports and the bargaining power of unionized dockworkers.

When combined these three factors could result in shifting freight patterns which could divert significant volumes of freight bound for Chicago and the Midwest via the SLC/Ogden hub to a different route. **For the purpose of this analysis it is assumed that sustained differential in labor costs and in the environmental, health, safety and labor laws between Mexico and the US as well as limitations on future growth of the southern California ports will enable Mexican ports to capture an increasing**

percentage of the market servicing freight imports or freight may shift to Gulf Coast or East Coast ports.

This gradient may lead to a long-term shift in the freight pattern of Asian imports or at the very least the capture of a significant share of the growth in Asian imports from the West Coast ports. This will shift freight south and away from the I-80 transcontinental route. As shown in Figure 60b, this is just one example of a 2nd order factor (the differential in the cost of labor and environmental, safety and labor laws between Mexico and the US) influencing a 1st order factor (the expansion of the Mexican ports) which in turn drives a change in the origin or destination of various product categories which in turn affects future I-80 freight volumes. These causal linkages are used to build and vet the eight I-80 freight growth scenarios.

The sixth 2nd order factor relates to government's ability to influence freight patterns. Government's power over and authority in the transportation sector is pervasive. Government's goals, actions and the unintended consequences of government actions are the most difficult of the six 2nd order factors to predict and account for. Various combinations of the following governmental actions that could impact future Wyoming I-80 freight volumes will be factored into scenario building and analysis.

U.S. Government tax, investment and regulatory policy for transportation and transportation infrastructure – Government actions in the transportation sector have major impacts on freight patterns. Public sector investments have been and continue to be instrumental in the construction and operation of roadways, seaports, airports and other publicly sponsored transportation infrastructure assets. Although investment in railroads and private sector toll roads are not government financed, government tax policies, the power of eminent domain and other policies and regulatory authority at the federal, state and local levels influence private sector investment in these transportation infrastructure assets. It is state-level laws, regulations and policies that are one of the few areas where Wyoming can exert any influence on I-80 freight flows.

Proposed federal tax credits or accelerated depreciation for investment in transportation infrastructure such as rail expansion is an example of a governmental policy that can alter transportation patterns by enabling railroads to profitably increase capacity and pursue additional market share thereby shifting some quantity of freight from highways to rail.

Public sector initiatives may originate at the federal, state or local level. A recent example of a state-level initiative is the possibility of tolling I-80 in Wyoming.

There are numerous examples where government regulatory efforts have and will continue to impact freight patterns. Several areas of proposed government transportation-related initiatives that could impact Wyoming I-80 freight volumes and will be addressed in scenario analysis include:

- Fuel taxes and re-investment of fuel taxes and available highway funding for general or specific uses by states.
- Investment tax credits for capital assets and accelerated depreciation intended to increase investment in transportation capacity.
- Tolling Interstates.
- Investment and incentives for alternate fuels and mandates for use of ethanol and other biofuels.
- Increased regulation of emissions including CO_2.
- Legal hours of service for truck drivers.
- Stringency and frequency of Motor Carrier Safety inspections.
- Stringency of inspections of trucks at border crossings and the ability of Mexican trucks and truck drivers to operate beyond the current border radius.

The impact of any individual government action on the freight transportation system in general and on Wyoming I-80 in particular depends not only on the nature of the action but also upon the collective set of actions undertaken by different branches of government such as DOT, EPA, DOE whose initiatives may be synergistic or conflicting. Similarly, any one or more of these government actions may interact with other 2nd order factors discussed in

this section. This complexity requires that each of the areas of potential government action be considered against many of the 1st order factors in the scenario framework. There are simply too many factors to consider so the range of government actions were simplified. **For the purposes of scenario analysis it is assumed that forecasted government actions include: 1) no re-regulation of the trucking or rail industries, 2) increasing regulation of emissions and reductions in CO_2, and 3) investment and incentives in alternate fuels (i.e. natural gas).**

In conclusion, six 2nd order factors were identified that will influence future I-80 freight volumes and underpin the scenarios developed later in this chapter. These 2nd order factors are in the areas of energy, macro-economic, socio-economic, demographics and government policy. Ten to twenty-year directional forecasts for these 2nd order factors make up foundation assumptions for the scenario analysis. These 2nd order factors bound the scenarios. These six 2nd order factors and their associated forecasts are summarized in Table 12.

Table 12. 2nd Order Factors Driving Freight Volumes and Assumptions Used in Scenarios.

2nd Order Factor Driving Freight Volumes	Assumptions Held Constant across All Scenarios	1st Order Factors Primarily Affected
Oil Prices and Availability	Oil prices will continue to rise moderately (on average) over time and will not severely impact U.S. economic health and U.S. consumer demand. CNG will provide a substitute for diesel fuel if high diesel prices (greater than $4/gal) return and persist.	• Competitiveness of trucking vs. rail • Re-structuring of U.S. trucking industry • Logistics infrastructure investment by firms • Economic "health" of U.S. consumer
US and Global Economic Health	Despite current economic conditions, within 1-2 years the U.S. economy will be healthy (in terms of availability of capital, level of investment, availability of credit to finance trade, unemployment, consumer demand). The U.S. economy will continue moderate growth in the long-term while growth in the developing world and especially in Brazil, China, India and Russia will be moderate to robust.	• Re-structuring of US trucking industry • Logistics infrastructure investment by firms • Economic "health" of U.S. consumer • Expansion of railroad capacity
US Population Growth	No significant changes that would drastically curb immigration (i.e. immigration laws, enforcement of these laws and motivations for would-be immigrants). U.S. population growth which is the primary contributor to domestic demand and ultimately demand for freight movement will continue on its current 20 year trajectory.	• Economic "health" of U.S. consumer • US market size (demand)
U.S. Consumer Level of Consumption	U.S. consumers will within two to three years weather their current personal financial crises, pay down (or somehow be relieved of) a portion of their household debt, benefit from middle-class tax cuts and return to previous consumptive patterns.	• US market size (demand) • Economic "health" of U.S. consumer

2nd Order Factor Driving Freight Volumes	Assumptions Held Constant across All Scenarios	1st Order Factors Primarily Affected
Differential in US versus Global Labor Costs and Environmental, Health & Safety and Labor Laws	The freight industry will not experience the dramatic growth of the past 10 – 20 years attributable to U.S. manufacturers transitioning to lean production. Relocation of U.S. manufacturing operations overseas has mostly run its course. The dramatic increase in outsourcing of manufacturing from the U.S. to foreign countries and the associated increase in freight volume have leveled off. Sustained differential in labor costs and in the environmental, health, safety and labor laws between Mexico and the US as well as limitations on future growth of the southern California ports will enable Mexican ports to capture an increasing percentage of the market servicing freight imports or freight may shift to Gulf Coast or East Coast ports.	• Logistics infrastructure investment by firms • Expansion of Mexican ports and upgrade of related infrastructure • Comparative advantage in manufacturing (imports / exports)
US Government tax, investment and regulatory policy for transportation and infrastructure	Forecasted government actions include: 1) no re-regulation of the trucking or rail industries, 2) increasing regulation of emissions and reductions in CO_2 , 3) investment and incentives in alternate fuels (i.e. natural gas) and 4) fuel tax.	• Logistics infrastructure investment by firms • Expansion of railroad capacity • Availability of "land ferry" intermodal service

With the assumptions behind the 2nd order factors established, the next step relates the 1st order factors to each of the three scenario dimensions highlighted in Figure 61.

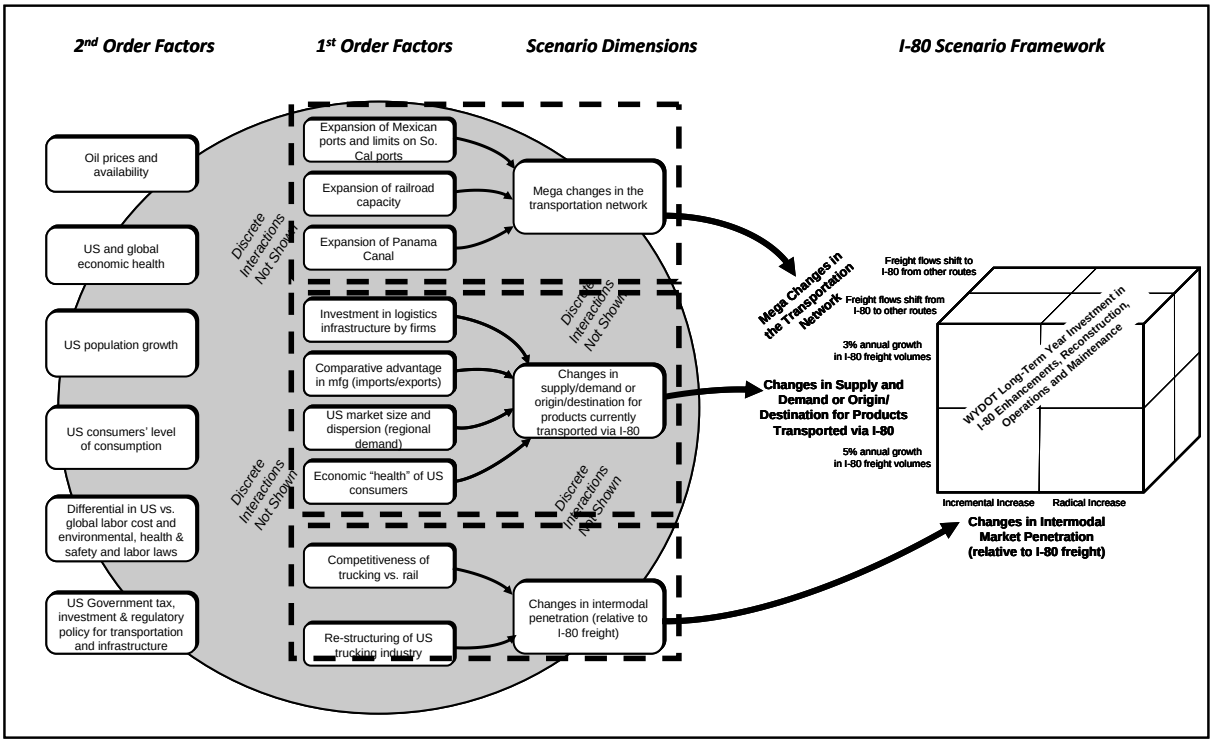


Figure 61. Groupings of 1st Order Factors and their Respective Scenario Dimensions.

To ensure a common understanding of the linkages between the 1st order factors and the scenario dimensions, the next section briefly characterizes the western US freight network. Then each of the three sets of first order factors and their associated influences on the scenario dimension are examined.

Overview -- Basic Facts, Trends and Likely Changes in the Transportation Network that Could Affect Future I-80 Freight Volumes

In this overview particular interest is paid to major changes in the transportation network that could increase or decrease the prominence of the Southern California and SLC/Ogden freight hubs or in other ways change freight flows between these hubs and Chicago (Figure 62).

Analysis of freight survey data in Chapter 3 categorized 41-42% of I-80 freight as food and building materials products, i.e. primarily domestic freight. This limits the amount of freight that can and would shift to or away from I-80. It is unlikely that, barring unprecedented intermodal penetration in the food-related and building materials categories, these freight streams will change since I-80 is the most direct route between Chicago and the upper Midwest and the SLC/Ogden freight hub. Similarly, east-west freight patterns along the southern half of the U.S. for freight streams related to food and agriculture and building materials will continue to traverse the U.S. on Interstate 10 and Interstate 40.

Barring some unforeseen conditions these freight streams would never shift to I-80. For this reason the focus will primarily be on product categories, routes and modes associated with imports and exports which will be more susceptible to shifts to or from I-80.

Surface freight transportation involves two primary modes: trucks and rail. For perspective, trucks move over two thirds of all products (in terms of product value) transported in the U.S. Over 90% of non-commodity domestic freight (i.e. manufactured goods) is transported by trucks. (In the past twenty years as freight volumes have increased, the trucking industries' percentage of products transported (by value) has continued to increase (NCHRP, 2007). Rail networks move the remainder of non-commodity products. In the rail sector, mergers and acquisitions over the past twenty years have created two mega-railroads operating in the western and mid-western states – Union Pacific (UPRR) and Burlington Northern-Santa Fe (BNSF) which are of interest in this study.

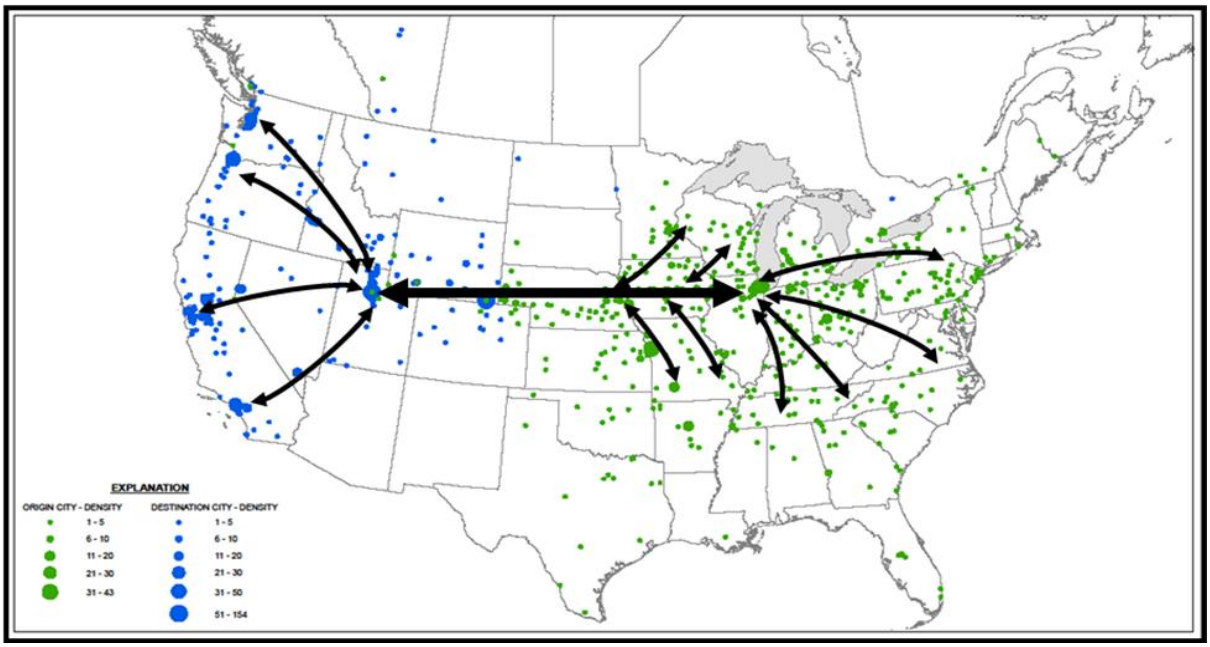


Figure 62. Concentration of Freight Movement through the SLC/Ogden Hub Funnels I-80 Freight Volumes.

Although in general trucking is more expensive than rail, trucks have inherent advantages over rail in almost all categories valued by the market. Several key advantages of trucks are:

- The need to minimize and predict transit times to support lean production systems and other stringent supply chain logistics requirements.
- The need for responsiveness and reliability afforded by trucks and the nation's system of highways, i.e. flexibility in routing and scheduling.
- The large pool of readily available equipment and drivers willing to transport TL, LTL and infrequent shipments.
- Railroads' lack of access, i.e. fixed routes of travel, abandonment of thousands of miles of track, reluctance to service less profitable sectors of the market and high levels of capacity utilization.

As a result, over time trucks have taken an increasingly greater percentage of the freight market. This trend is likely to continue. The trucking and rail industries have segmented the market and

tailored their services, evolved a capital structure, and influenced laws and governmental policies to sustain each mode's strengths and the other mode's weaknesses. Traditional and new intermodal services do begin to blur the distinction between modes and markets and will be discussed later in this chapter. The exception to the trucking industry's dominance of non-commodity freight is for freight streams associated with high volume product shipments with concentrated origins and destinations such as automobiles production facilities, steel plants and ports.

Of particular interest in this study are the predominant east and west highway and rail freight routes that parallel, i.e. compete with I-80.

Starting in the very southern U.S., Interstate 10, a major east-west freight corridor stretches over 2,500 miles from Southern California to Florida. UPRR has an approximate 2,000-mile mainline spanning from California to New Orleans.

North of and parallel to Interstate 10 is Interstate 40 with its west terminus just north of Los Angeles and its east terminus in North Carolina. Interstate 40 (like Interstate 10 and Interstate 80) is one of three major east-west highway freight corridors in the U.S. Running parallel to Interstate 40 from California to Amarillo, Texas is BNSF's main transcontinental corridor; at Amarillo it branches south to Dallas and northeast towards St. Louis and Chicago.

Further north Interstate 70, with its western terminus in central Utah spans over 2,500 miles to Maryland. Interstate 70 has steep grades and mountain passes in central Colorado making winter travel problematic. UPRR has a parallel rail line from St. Louis to Denver and west to SLC and on to Oakland, CA. Like Interstate 70, this line must traverse high mountain passes; there are numerous tunnels and tracks with speed restrictions. BNSF has main line track that run north of Interstate 70 across southern Nebraska between Denver and Kansas City then further east to Chicago.

The focus of this report, Interstate 80, runs from coast to coast – with a western terminus in San Francisco and an eastern terminus at New York City. Interstate 80 through Wyoming and

Nebraska is a favored route by truckers with no high mountain passes, few urban areas and high speed limits. A major UPRR transcontinental rail line (often called the Central Corridor) runs parallel to Interstate 80 between Chicago and San Francisco passing through Omaha, Cheyenne, SLC, Reno and Oakland.

The last major east-west freight corridor is Interstate 90 along the northern US border. Interstate 90 has its western terminus in Seattle/Tacoma and its eastern terminus in Boston. Like Interstate 80, Interstate 90 passes through Chicago. Being over 500 miles further north, Interstate 90 is subject to even more extreme weather than Interstate 80 and has mountainous terrain in western Washington. BNSF has a main line track running from Seattle/Tacoma to Minneapolis and south to Chicago.

In summary, there are three major east-west transcontinental freight corridors (Interstate 90, Interstate 40 and Interstate 10) that parallel I-80. Major rail lines owned by UPRR and BNSF, parallel these east-west Interstate highways for much from the Midwest to the west coast.

Changes in western US railroad capacity, intermodal opportunities and other aspects of the rail mode that could affect future I-80 freight volumes will be addressed later in this chapter. Next, freight trends in truck crossings and rail container crossings post-NAFTA between the U.S. and Mexico and the U.S. and Canada will be briefly described then freight imports and exports and key U.S. ports will be discussed.

Truck and Containerized Train Traffic Volumes between the US and Canada and the U.S. and Mexico

In general containerized freight flows from Canada are more likely to transit I-80 than freight flows from Mexico. Freight flows from Mexico are worth examining because they show a marked increasing trend that may portend a more significant pending shift that could affect the SLC/Ogden freight hub and the I-80 route for imports.

U.S. and Canada Containerized Freight Flows

Containerized freight flows from Canada to the US for trucks and containerized rail shipments are shown in Figure 63 and Figure 64, respectively (USDOT, 2007). Truck volumes are four times higher than rail but have remained relatively flat. Containerized rail crossings more than tripled from 2000 to 2006 (USDOT, 2007). The British Columbia ports continue to grow but there is no major local market. The ports have unused capacity. The Canadian government has made large investments in these ports in the past five years. Nearly all freight moves from these ports east via rail so increasing freight traffic from British Columbian ports should have little impact on future I-80 freight volumes.

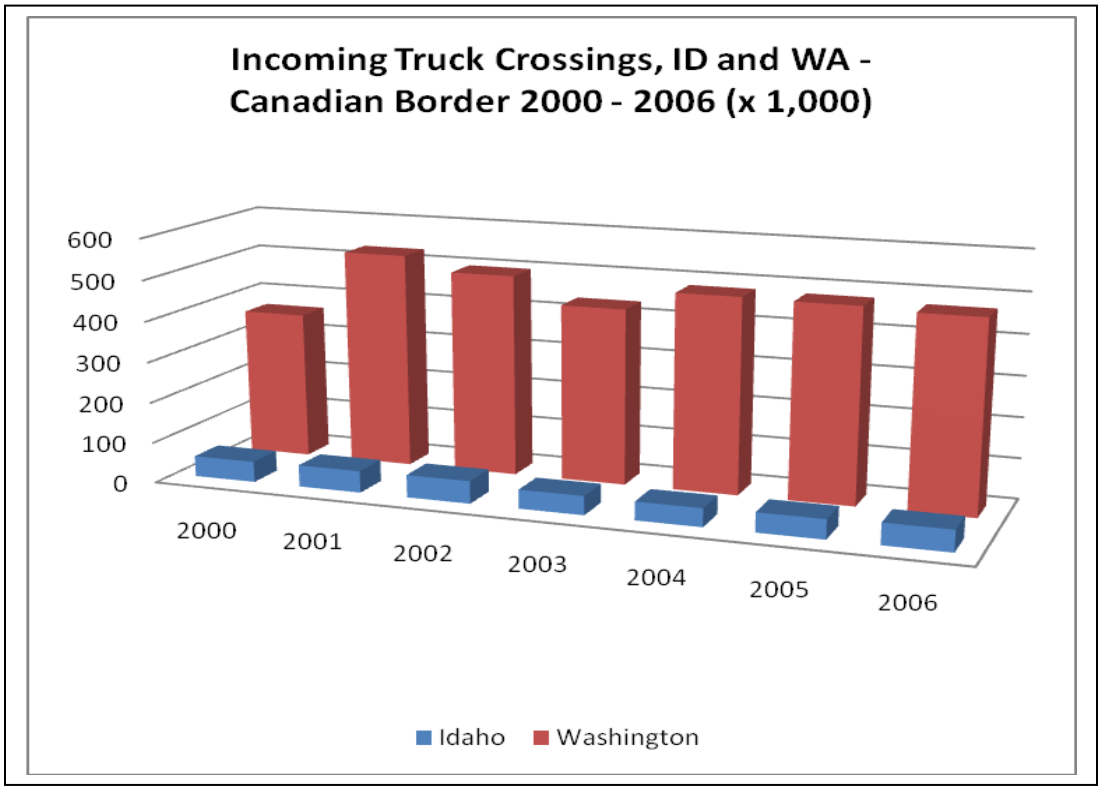


Figure 63. Trucks Entering the U.S. from Canada that May End Up Eastbound on I-80.

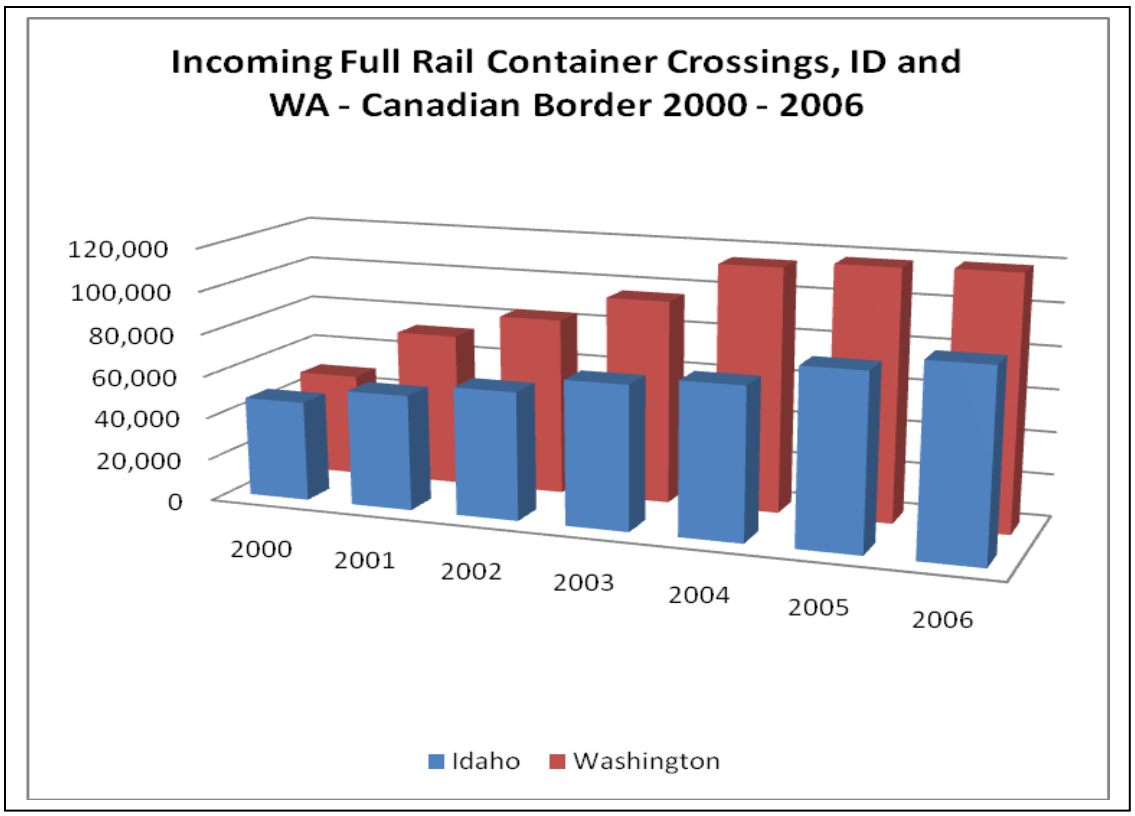


Figure 64. Rail Containers Entering the U.S. from Canada that Could Travel Eastbound on I-80.

U.S. and Mexico Containerized Freight Flows

Containerized freight flows from Mexico to the U.S. on trucks and rail are shown in Figure 65 and Figure 66, respectively (USDOT, 2007). Truck volumes are ten times higher than rail and have steadily increased from 2003 to 2006. Containerized truck shipments grew almost 80% from 2000 to 2006 (USDOT, 2007). Containerized rail crossings have also shown a steady increase from 2003 to 2006. As shown in Figures 67, incoming truck traffic is predominantly through Texas. Based on major east-west and north-south freight patterns, a truck with an origin or destination in Texas (and Mexico for that matter) has a small probability of traveling on Wyoming I-80. This was confirmed in the freight survey. Surprisingly few Texas origins or destinations were identified considering the geographic and economic size of the state. Trade with Mexico continues to grow but predominant freight patterns related to this growth in trade appear to make small contributions to Wyoming I-80 freight streams.

From this it may also be concluded that there should be little impact to I-80 freight streams from federal actions permitting or prohibiting Mexican truck drivers (and Mexican trucking firms) to operate outside of the currently restricted border limitations.

Rail traffic from Mexico, as shown in Figures 68 and 69, has grown. Between 2000 and 2006 container traffic and the number of trains have both steadily increased 69% and 70%, respectively (USDOT, 2007). This rail freight corridor is growing rapidly but, like trucks originating in Mexico, freight traveling by rail out of Mexico contributes little to Wyoming I-80 freight flows whether it is trans-loaded in Texas or not. More importantly, these rail links are developing into the infrastructure assets and critical mass of a major North American freight route. Depending on progress upgrading the west coast Mexican ports, this could portend a shift in freight flows of future Asian imports south and away from I-80. Freight may shift from the southern California ports to Mexico. Hence in the future some imports bound for the Chicago area could move east without passing through the SLC/Ogden area along Wyoming I-80.

In summary, Wyoming I-80 is not a major freight route for trade between the U.S. and Canada and the U.S. and Mexico. Therefore, growth in NAFTA-related commerce is not expected to have a significant impact on future I-80 freight volumes.

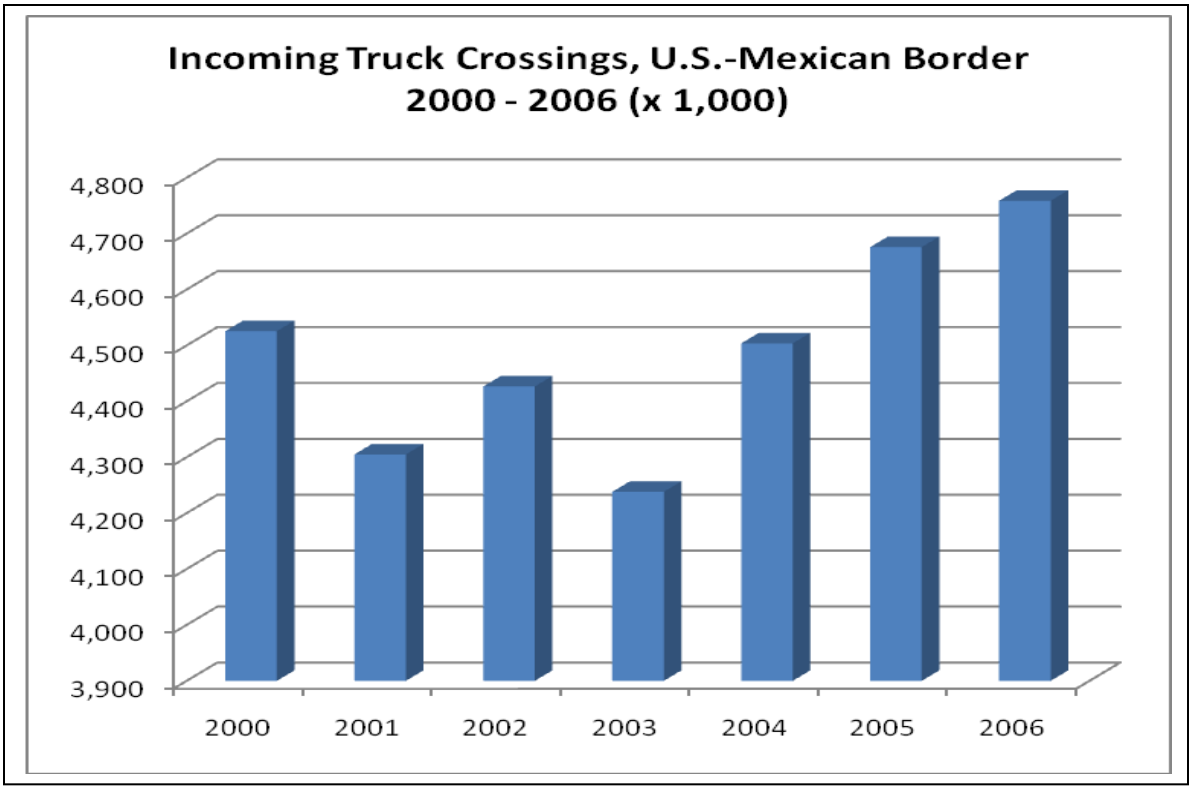


Figure 65. Truck Crossings from Mexico.

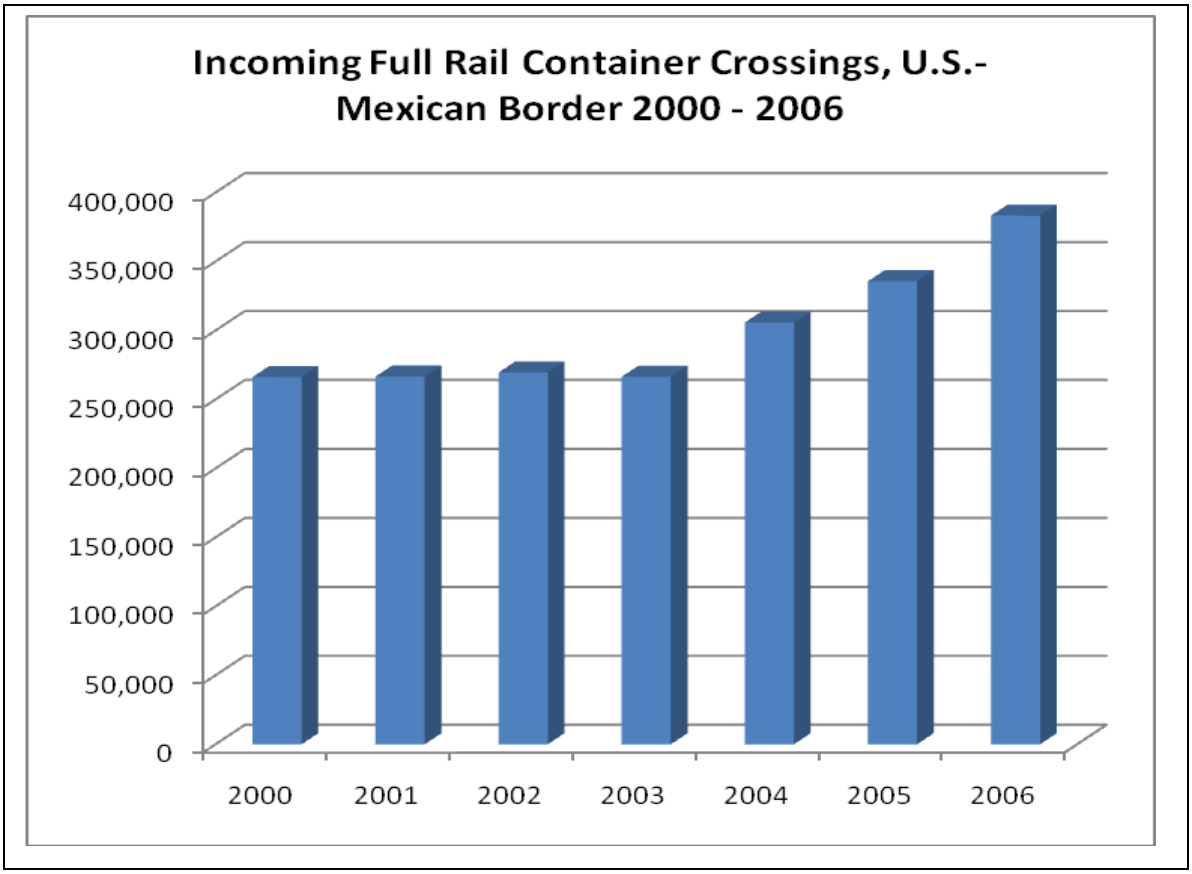


Figure 66. Container Rail Crossings from Mexico.

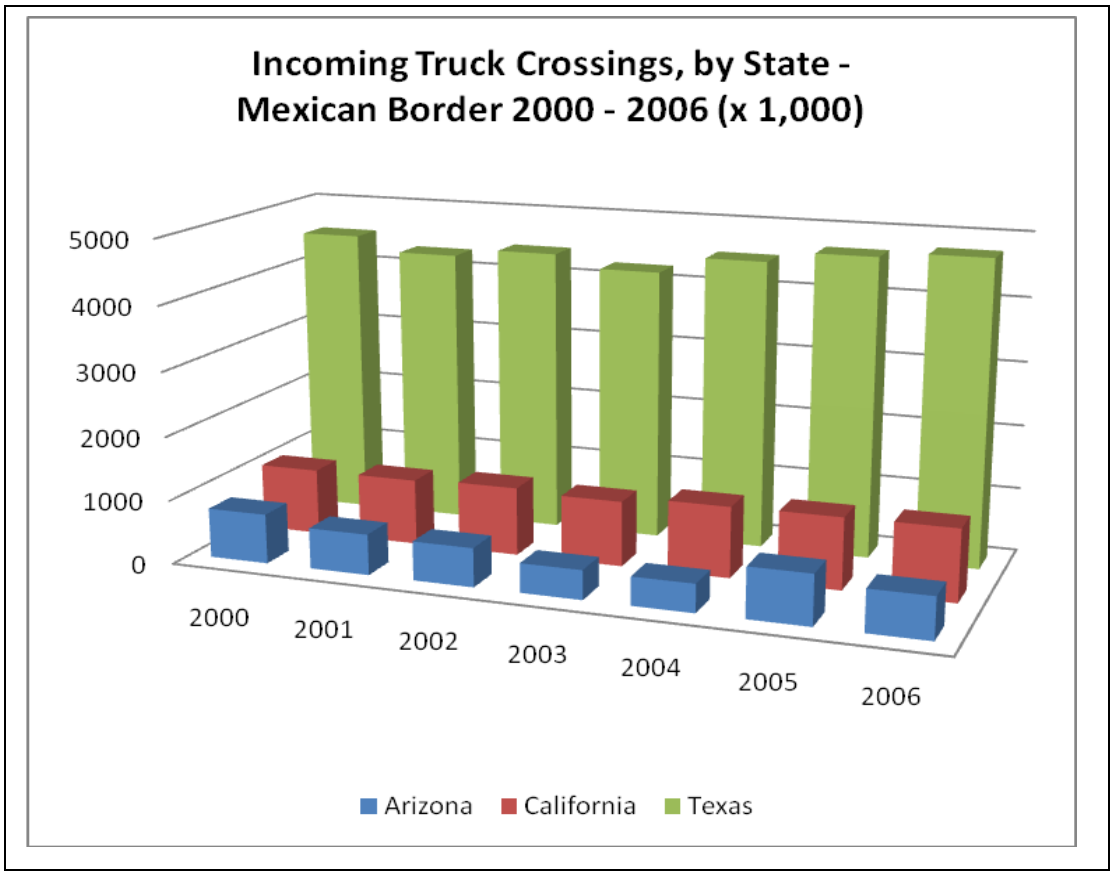


Figure 67. Truck Crossings from Mexico by State.

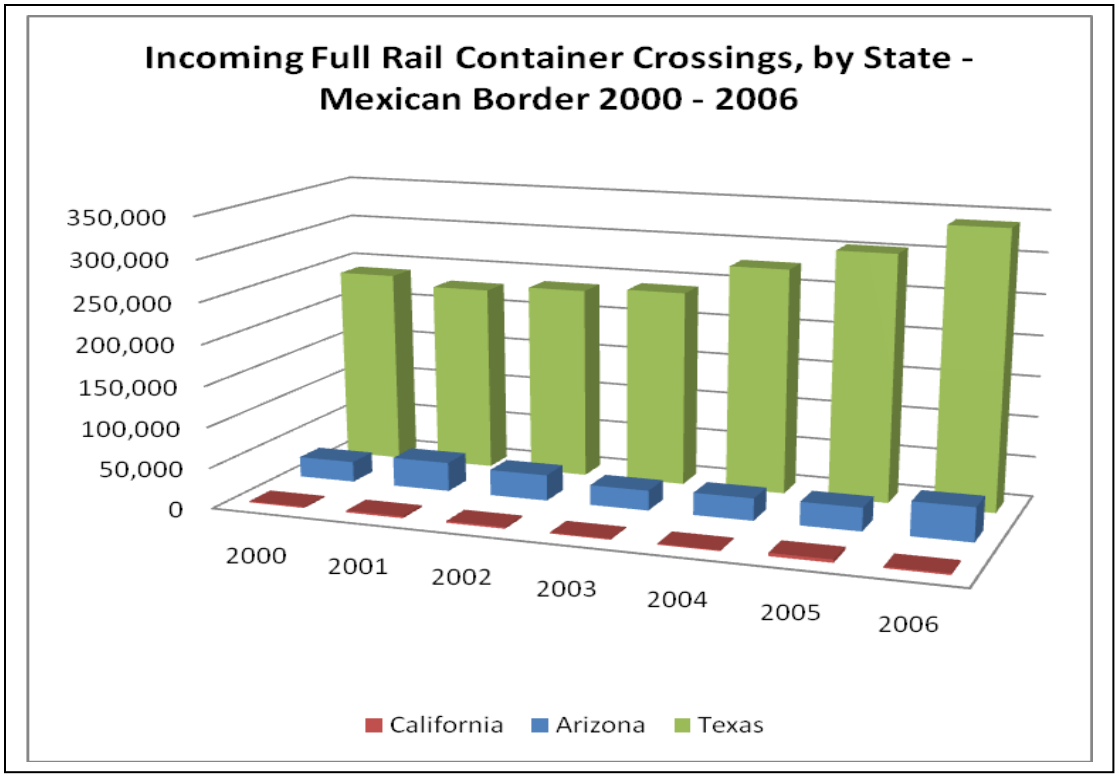


Figure 68. Containerized Rail Crossings from Mexico by State.

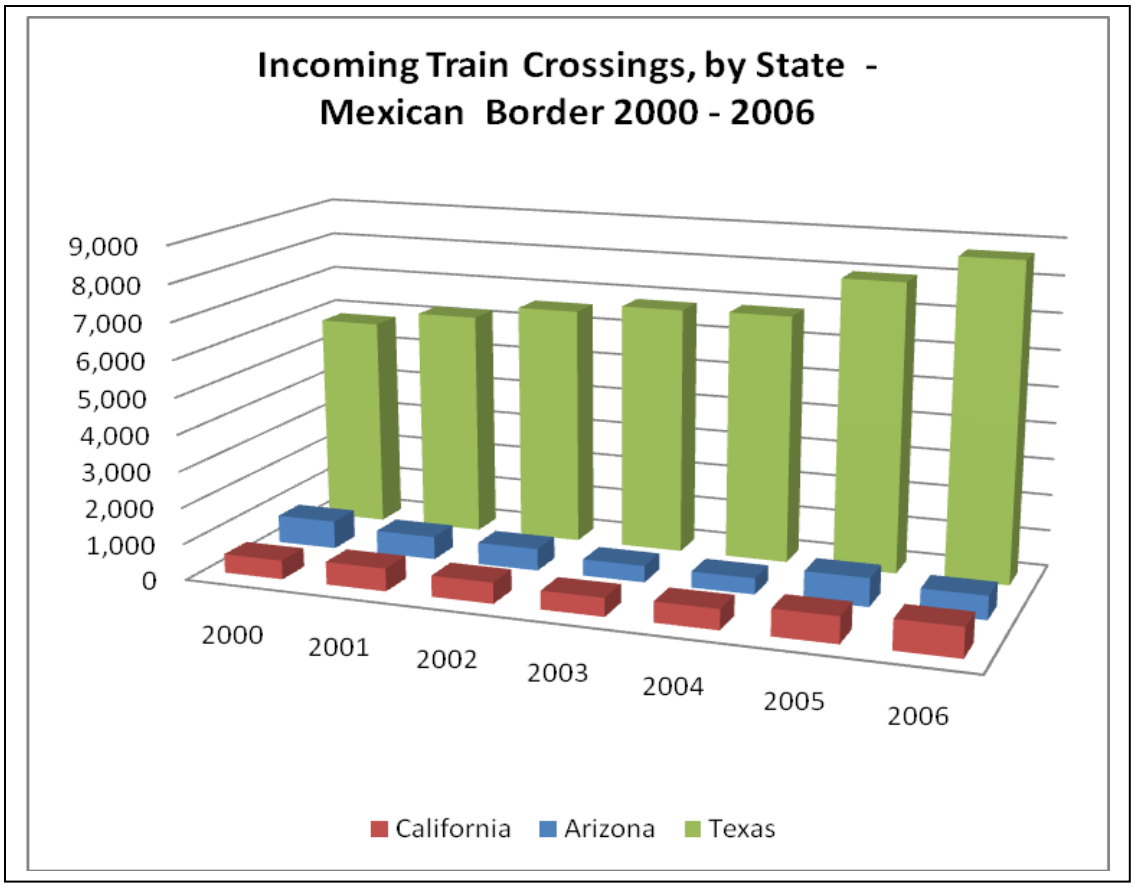


Figure 69. Train Crossings from Mexico by State.

Containerized Asian Imports and the West Coast Ports

Containerized Asian imports arriving at the west coast ports constitute most of the increasing quantity of imports and are the focus here since containerized products are likely to travel east and find their way onto I-80. Major categories of Asian imports arriving in containers include furniture, apparel, auto parts, electronics and toys.

Over 75% of containers are moved out of the ports on double-stack unit trains. This is the most economical and practical mode of transport due to the congestion within and around the ports. The remainder is transported via truck. Some of these container trains travel to locations within 10-20 miles of the ports, a couple hundred miles to inland staging areas or several thousand miles to destinations such as Chicago, St. Louis, Memphis, Kansas City, Dallas, etc., arriving within 2-4 days after offloading at the ports. At rail off-loading facilities such as SLC/Ogden

containers are often hauled relatively short distances to warehouses and distribution centers where products are unloaded from the containers, combined with other products, loaded into semi-trailers and moved east to the next stop in the supply chain, perhaps along I-80.

The pattern for exports is somewhat different with tens of thousands of dispersed origins as shown on the maps in the previous chapter. Destinations are concentrated at five west coast ports. In contrast to imports, a large percentage of U.S. exports are commodities such as agricultural products paper products and scrap steel which predominantly travel to the ports by rail or water.

In 2006 five west coast ports (Los Angeles, Long Beach, Oakland, Seattle and Tacoma) handled over 60% of US import and export TEUs (Figure 70). LA/LB and Oakland account for over 50% of this volume while LA/LB alone account for 44% (USDOT). Figure 71 shows global container volume throughput in relation to the West Coast ports. A brief overview of the West Coast ports is provided below.

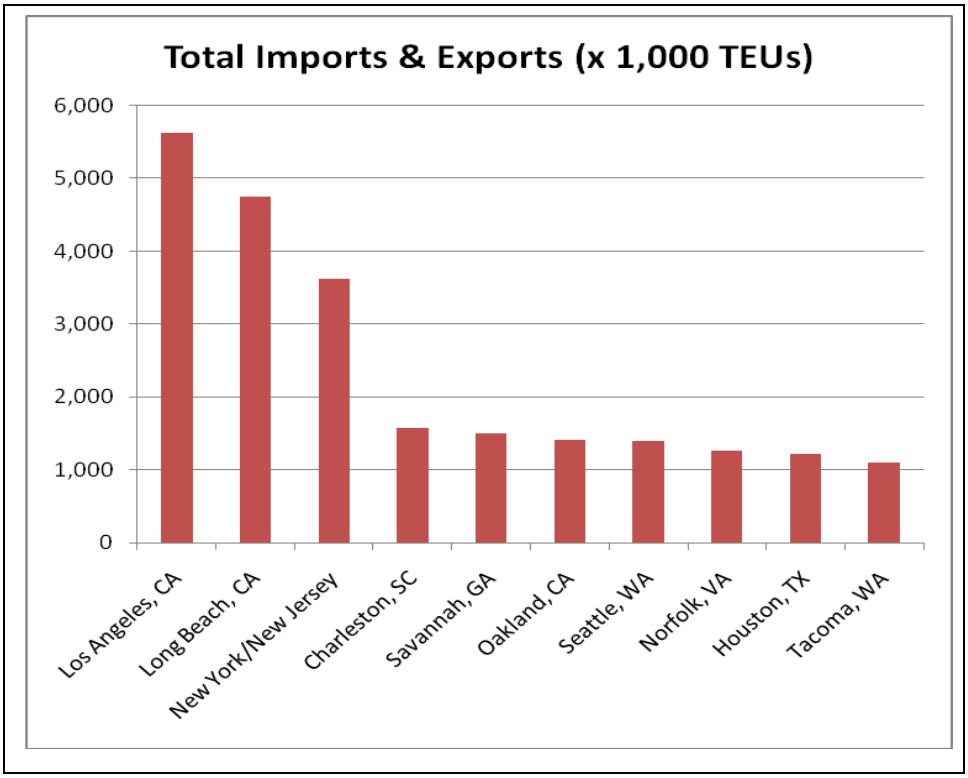


Figure 70. 2006 Containerized Freight Volumes at the Top 10 US Ports.

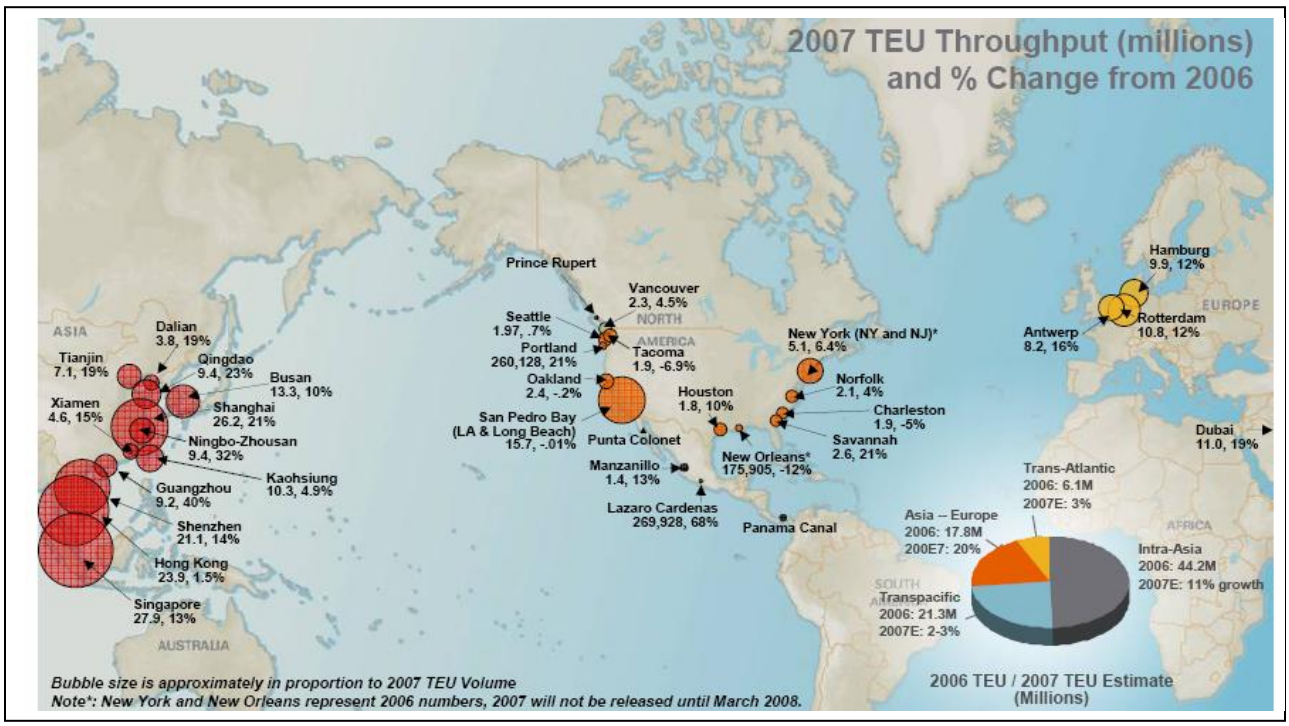


Figure 71. Global Container Port Volumes (Source: BNSF).

Ports of Tacoma and Seattle

The ports of Seattle and Tacoma rank seventh and tenth, respectively in TEUs.

Current capacity at Tacoma is 2MM trailer equivalent units (TEU). The Port has two new 200 acre terminals. According to officials at the Port of Tacoma the Port is planning to double capacity over 5-10 years. The Port expects that this capacity will be servicing new growth rather than cannibalizing freight traffic from other ports. Some of this growth will be to support the population in the Northwest. The approximate percentage of imports leaving the Port by train and truck are 70% and 30%, respectively. More than 50% of containers exported are empty – a major imbalance in freight movement. Rail freight is primarily bound for St. Paul and Chicago. According to a port official, rail capacity has not been an issue and UPRR and BNSF have approximately 30% available capacity (Beckett, 2008).

Given that only 30% of containers arriving at the Port of Tacoma disembark by truck and travel east and south by multiple routes (i.e. not exclusively I-80), the contribution to I-80 freight volumes from future growth of the Port of Tacoma is projected to be low.

The Port of Seattle expects freight volumes to be flat for the next one to two years due to the weak dollar and the weaknesses in the U.S. economy. Figure 72 shows strong growth in container volumes between 2003 and 2005 but flat or declining between 2005 and 2007. Another challenge facing the Port of Seattle (as well as Tacoma) is an increase in competition from both international and domestic Ports. One example is Canadian National's gateway over Prince Rupert, which, like other Canadian ports, will continue to partner with Canadian Class 1 rail carriers to attract U.S. bound intermodal cargo. The Port faces similar competition from ports in Mexico. In addition, U.S. ports on the East and Gulf Coasts are likely to increase their competitive offering once expansion of the Panama Canal is completed in 2014.

Working in the Port's favor, it is closer to Asia than east coast, Gulf, and Mexican ports. The Port has adequate intermodal rail services and fewer weather-related disruptions than Canadian rail options to the north. Also domestic rail operations are more developed, reliable, and secure than Mexican rail options which gives the Port an advantage over Mexican ports. In 2009 China Shipping Lines will begin ports of call under a 30-year lease (Port of Seattle, 2008).

Like the Port of Tacoma, the vast majority of containers leave the Port eastbound via rail. Therefore, it could be concluded that even significant increases in freight volumes at the Port of Seattle will contribute only marginally to future I-80 freight flows.

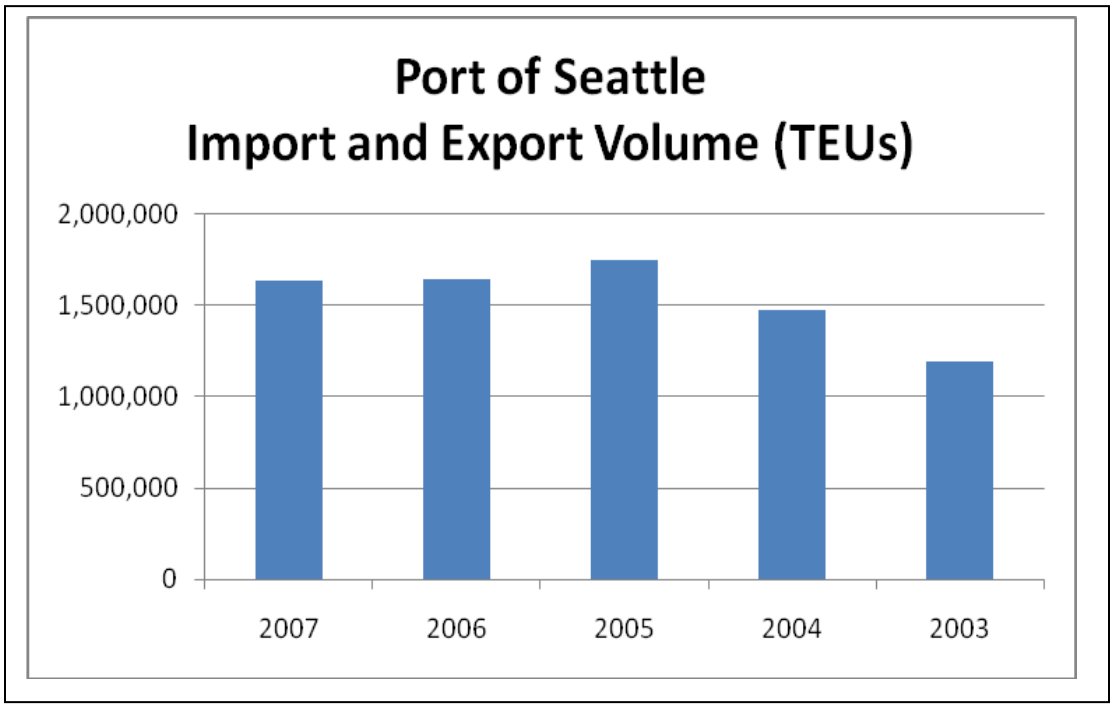


Figure 72. Five-year Trend in Container Freight at the Port of Seattle.

Port of Oakland

The Port of Oakland is the sixth largest U.S. port in terms of container volumes. Over the past ten years the Port has made major investments in renovation of existing facilities and construction of new facilities, dredging and market development. Many of these investments (financed by bonds) have failed to yield expected returns in terms of increased market share. Unlike the Southern California ports, the Port of Oakland has land to expand. The Port is served by intermodal rail facilities operated by BNSF and UPRR.

Volume at the Port has grown significantly while the Port's share of West Coast trade has stabilized at around 9%. Between 1997 and 2006, Oakland containerized cargo activity grew at an average annual compounded growth rate of 5.1%. Asian trade markets continue to grow in importance. From 1997-2006 average annual growth in revenue tons was 4.9%.

Although west coast cargo growth has been dominated by the Southern California ports, for the last five years the Port of Oakland has begun a concerted marketing effort to expand its market share. The Port is well-positioned to take advantage of the growing Asian market with a strong balance between imports and exports. This freight pattern is unique among the west coast ports and is primarily due to exports of raw and processed food products from central California.

In order to capture future business the Port has outlined a strategic plan designed to "boost capacity, improve intermodal rail connections and deepen berths and channels, renovate and expand existing terminals, make rail enhancements and continue collaborative efforts with railroads and carriers to improve rail service and pricing disparities, increase marketing efforts and explore public private partnership funding alternatives" (Port of Oakland).

However despite these initiatives and the fact that the Port of Oakland is the shortest distance to Chicago, there is strong competition among the West Coast ports to capture future additional market share. Another impediment affecting Port growth is rail infrastructure outside of the Port. UPRR cannot move double-stack container trains east over Donner Summit near the California/Nevada border due to inadequate tunnel and snowshed clearances. BNSF does not have a route directly east from the Port but rather moves freight south to southern California before heading east towards Chicago. These are major disadvantages that are not within the control of the Port. Furthermore, it is likely that the Port of Oakland could be among the West coast ports most adversely affected (in terms of reduced future market share) by the rise of deepwater ports in Mexico, expansion of the Panama Canal and TXDOT's Ports-to-Plains initiative.

In summary, perhaps the only set of events under which freight growth from the Port of Oakland will have a significant impact on Wyoming (and Nebraska) I-80 freight volumes is the following: 1) for some unforeseen reason new container freight traffic growth is disproportional at the Port of Oakland or major container volumes (1-2 million TEUs) shift from the southern California ports to Oakland, while 2) this increased volume of freight is trans-loaded to trucks (versus remaining on rail) east of Oakland most likely to Sacramento, Reno or SLC/Ogden where it travels east on I-80 across Wyoming towards Chicago. This should be considered a low probability scenario due factors discussed later in this chapter such as the pending shift in

imports from the west coast to port in the Gulf of Mexico which will affect the critical mass of SLC/Ogden as a freight hub. Therefore, for these and other reasons discussed below, it is unlikely that the Port of Oakland will be a significant driver in increasing future I-80 freight volumes.

Ports of Los Angeles and Long Beach (LA/LB Ports)

Los Angeles, Long Beach and Oakland account for over 50 percent of container volume while the LA/LB ports account for 44%. The port of Los Angeles is the busiest container port in the U.S. and the 10th busiest container port in the world. When combined the Ports of Los Angeles and Long Beach is the fifth busiest container complex in the world (USDOT).

Like the other West Coast Ports, LA/LB's major categories of imported products are furniture, apparel, auto parts, toys and electronics. Major categories of exports include paper, cotton, pet and animal feed and scrap metal. China is the leading country of origin and destination followed by Japan.

Of particular interest are the LA/LB ports in relation to SLC/Ogden and I-80 as shown in Figure 73. Although the product categories differ, in relation to overall freight patterns (i.e. origins, destinations and routes) the map shown in Figure 72 looks similar for westbound and eastbound freight.

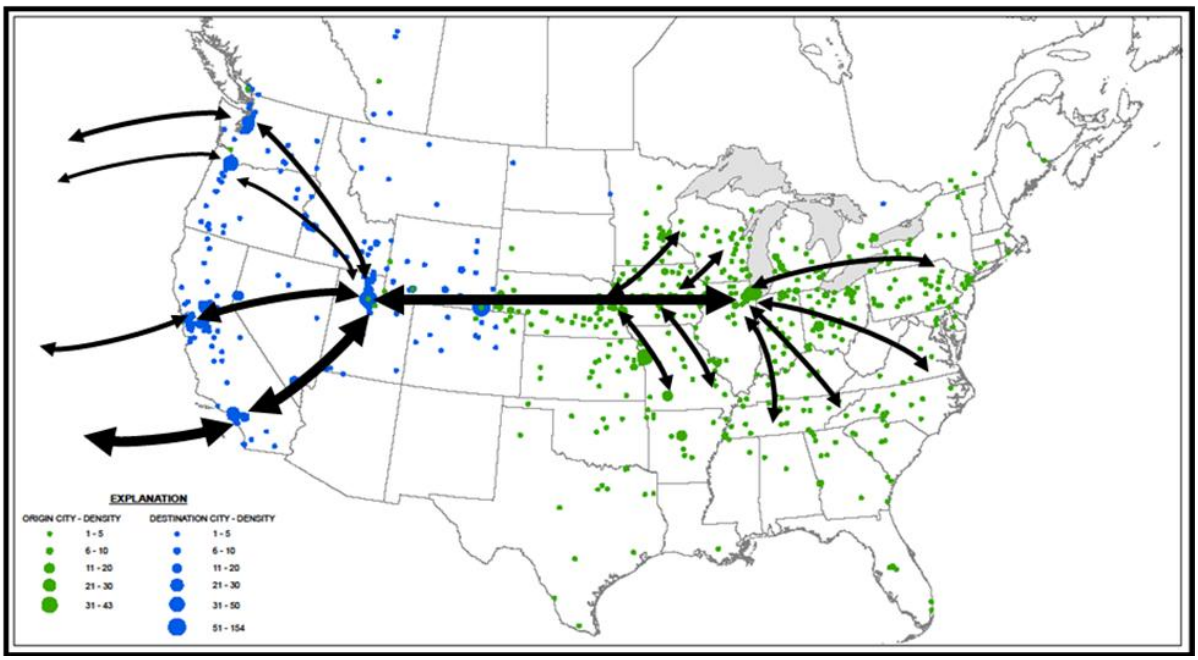


Figure 73. Freight Flow to and from the Ports through SLC/Ogden and along I-80.

Although the LA/LB ports are a major influence in freight movement in Southern California they are not the only one. The sheer size of the area's population and its own manufacturing base contributes to freight movement by creating regional supply and demand. While the focus is on the dynamics of the LA/LB ports it is in the context of overall freight movement to and from Southern California.

In terms of highway infrastructure the Los Angeles area has an extensive network of highways including four major Interstates which link the region to the rest of the U.S. Of these Interstates, it is I-15, the north-south route connecting Los Angeles to Las Vegas and the SLC/Ogden area, that is a major contributor of freight flows on Wyoming I-80 (R&S, 2007). As previously described the western terminus of the two other major east-west Interstate freight corridors that parallel I-80 are Interstate 40 (running from Barstow to Oklahoma, Tennessee, and North Carolina) and Interstate 10 (connecting Los Angeles to Arizona, Texas, and the Southeast). The Southern California area also has perhaps the nation's most extensive network of Interstate connectors and state truck routes for freight movement around the region.

UPRR and BNSF have extensive operations in the region. Both railroads have east-west transcontinental mainlines that begin and end in the region. There are special corridors (public and privately financed) and equipment for shuttling containers between the LA/LB ports and rail

intermodal yards. In addition there are six major rail/truck intermodal transshipment yards in the region and three inland rail yards which serve the ports. At these facilities containers or the contents of containers are unloaded, sorted, switched and re-loaded onto trains or into trucks for transport east.

In terms of overall freight patterns, Figure 74 shows domestic commodity flows by rail between the Los Angeles region and other parts of the U.S. If considered as a surrogate for all freight (i.e. trucks and trains) flowing to and from the region then approximately 40% of freight flows being carried by trucks between Los Angeles and Chicago and the central states are candidates for reaching SLC/Ogden and traveling on Wyoming I-80. Of this volume a large percentage travels east via I-40 – never reaching I-80.

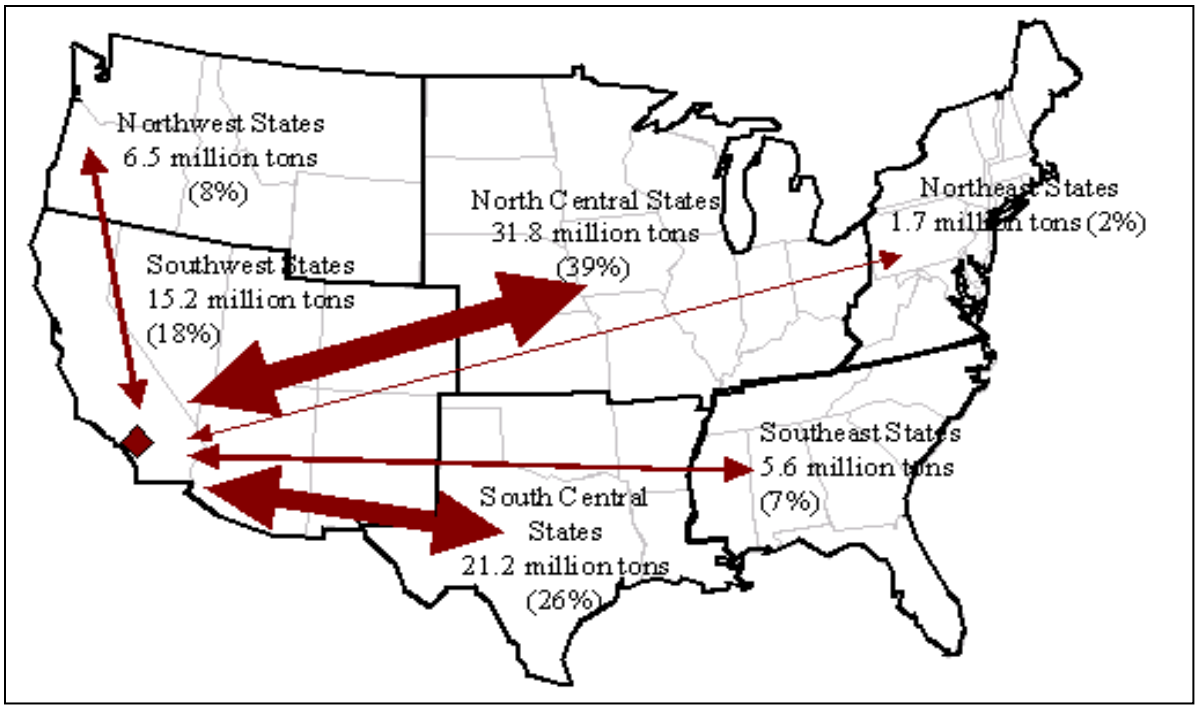


Figure 74. Rail Commodity Flows to and from Los Angeles, 2003 (Source: USDOT).

Regional population growth and changes in regional supply and demand are assumed to continue along their current trends. This establishes a baseline demand for products such as food and household products that constitute almost 50% of Wyoming I-80 westbound freight. In terms of

other dynamics that could affect I-80 freight flows to or from the Los Angeles region, the area's manufacturing base has decreased precipitously in the past five years. On the other hand, since the southern California ports handle 44% of U.S. imports it is worth examining potential changes to freight flows from these two ports (or future freight flows that may go to other ports due to LA/LB ports' limits to growth) that would ultimately flow through SLC/Ogden and east through Wyoming on I-80. Unlike domestic supply and demand, changes in freight flows to and from the region driven by the LA/LB ports is a dynamic that could change and materially affect freight flows on Wyoming I-80 both directly or indirectly. Over time import freight patterns are based on the most reliable and least expensive routes. Competition from other emerging shipping routes could result in a significant re-routing of freight and could create a "tipping point" which reduces the growth of freight in the SLC/Ogden area and the role of SLC/Ogden as the primary western inland freight hub. This would dampen the growth of I-80 freight volumes.

The LA/LB ports handle over nine million TEU's annually and have experienced unparalleled growth in the past ten years. However, these Ports are reaching their "limits to growth." Limits on additional growth in container freight from the LA/LB ports may be inevitable and would reduce future growth in Interstate 15 freight flows and hence contributions to increases in I-80 truck VMT. The ports recognize these limits to growth and have undertaken numerous initiatives to minimize the impact of on-going operations and to enable expansion.

In terms of footprint expansion, there is little undeveloped land available. The impact of trucks hauling containers to and from the ports has impacted local traffic resulting in severe congestion, increased pavement wear and reconstruction costs and degraded air quality. Public outcry against further expansion of Port traffic is strong and has political support.

Going forward, the Ports are going to have to rely on technology, coordinated changes to operations, infrastructure investments and improved public outreach to grow the Ports' business within imposed physical limitations. For example, the LA/LB ports have invested in information technologies to identify ways to reduce the movement of empty containers on highways by matching the locations of empty containers with the locations of loaded containers being delivered. Optical character recognition technology is being used to quickly enter container numbers into computer systems that expedite trucks through terminal gates. Infrastructure

investments include UPRR's initiative to shift international intermodal volume from the downtown Los Angeles rail ramp to the existing intermodal yard four miles from the Port, which could eliminate an estimated 500,000 truck trips a year from an inter-city freeway. Both UPRR and BNSF have been working with the shipping lines and terminal operators to consolidate neighboring terminals' intermodal volume to create larger trains to interior points and eliminate truck transportation to the rail ramps and reduce the number of trucks on the area highways.

The Alameda Corridor (a local rail transportation authority) has implemented a rail shuttle service between the ports' on-dock rail facilities and a nearby rail facility in Colton with a daily train to and from Colton. This will help reduce the number of trucks on the freeways and improve truck driver turn time. The Alameda Corridor is looking for a permanent inland location, added track capacity and the ability to operate five shuttle trains per day.

To improve efficiency restrictions on truck movements around the ports are being voluntarily regulated through programs such as a truck driver appointment system that provides a pre-notification to terminals regarding which containers are planned to be picked up. Under pressure (by the State, region and local residents) to control emissions the ports have instituted tough emissions standards on trucks entering the Ports. Initiatives have been undertaken to include more input from the public and other stakeholders in operational and project planning decisions. Port authorities along with State elected officials have held numerous meetings to identify public-private partnerships in goods movement and environmental programs, with a focus on achieving shared goals. The state unveiled a draft goods movement action plan, which highlights transportation projects, environmental programs, and safety issues. The State of California is keenly aware of the positive economic impacts growth in trade and logistics has brought to the region. The State and the Ports want to preserve these economic gains and position the LA/LB ports to continue to capture growth in foreign trade.

Despite these initiatives, perhaps the key "limits to growth" of the LA/LB ports is the strength of organized labor and its effect on or its potential to affect the ports operations. During 2004, a crippling dockworkers strike severely affected the supply chain shutting down manufacturing operations, impacting retail sales and idling container ships off the Southern California coast. The ability of the union to virtually shut down freight flows struck fear into many shippers, suppliers and businesses (wholesalers, retailers and manufacturers) whose operations were

impacted by the strike. As a result some of the largest companies in the world began looking at alternatives to reduce their vulnerabilities to future LA/LB dockworkers' strikes and slowdowns. As a result major companies involved in transportation and logistics are reconfiguring global operations and investing in alternatives to reduce their dependence on the LA/LB ports. For the most part, these alternatives do not include other West Coast ports since all of these ports are to some degree controlled by organized labor. This will most likely begin to shift or at least skim, i.e. limit, the growth in LA/LB port business over the next five to ten years.

In summary, the LA/LB ports and regional demand and manufacturing will continue to drive tremendous volumes of freight into and out of the region. Since 2000, the Port of Los Angeles has held the number one ranking as the busiest containerport in the U.S. The dominance of the LA/LB ports is projected to continue due to an extensive infrastructure network of transportation logistics assets and a complementary network of businesses. Beyond these ports the Southern California region is a global transportation hub that annually pushes and pulls hundreds of thousands of eastbound and westbound TEUs between the region and SLC/Ogden then along I-80. However, future growth in LA/LB port volumes is limited due to physical, operational and political constraints. It is unlikely that the previous ten years of growth can be maintained. This will have a dampening effect on the growth of freight flows between the Southern California region and the SLC/Ogden area and hence along Wyoming I-80.

From this overview a theme emerged. There are few reasons to predict that freight volumes will increase beyond population growth which is primarily related to immigration. There are few sustainable drivers of growth to expect increases in Wyoming I-80 freight volumes to continue at the 10-year historic rate of 4.4%. These reasons presented in the previous section are summarized below:

- The LA/LB ports are reaching their limits to growth so their contribution to I-80 freight volumes should level off.
- The Port of Oakland could be a major driver of I-80 freight but also has limits to growth.
- NAFTA trade with Canada and Mexico continues to increases but it appears to have little impact on I-80 freight volumes.
- A small percentage of imports arriving at ports in the Pacific Northwest travel on I-80 so if growth at these ports happens at all it should not materially impact I-80.

The next section of this chapter returns to the task of constructing scenarios by analyzing the 1st order factors influencing each of the three I-80 growth scenario dimensions.

Examining 1st order factors will identify under what circumstances which of the two possible outcomes for each scenario dimension will most likely be realized. This will qualitatively link the likelihood (i.e. predictive confidence) of the outcome of each scenario dimension to future observable events and measurable trends associated with the 1st order factors.

A similar approach will be used to present each 1st order factor for each one of the three dimensions of the scenario framework. The approach used is as follows:

- Situation analysis including how a given 1st order factor relates to Wyoming I-80 freight flows; the 1st order factor's current status, pending changes and dynamics; how it is impacted by select 2nd order factors; and its interactions with other 1st order factors.

- The influence of the 1st order factor on the two alternative scenario outcomes and the likelihood of either outcome.

- Indicators (observable and measurable) for the 1st order factor that when tracked over time and "plugged in" to the scenario framework provide a means for WYDOT to validate and update truck VMT growth projections.

Scenario Dimension #1 – Mega Changes in the Transportation Network

Mega changes in the transportation network infrastructure are one of the three axes in the scenario analysis framework (Figure 60a). Mega changes in the transportation network significantly alter I-80 freight flows either by providing alternate sea and/or land routes which divert freight flows from Wyoming I-80 or shift freight flows from other routes onto I-80. Scenarios related to this axis may have one of two discrete outcomes:

1. Freight flow shifts from I-80 to other routes.

or

2. Freight flow shifts to I-80 from other routes.

The following section is intended to clarify under what conditions one of these two outcomes will likely prevail. Three 1st order factors were identified as key drivers in future shifts in freight patterns that would permanently increase or decrease I-80 freight volumes (Figure 75).
The three 1st order factors include: 1) upgrade of Mexican ports and limits on the Southern California ports, 2) impacts from the expansion of the Panama Canal to handle large container ships and associated upgrades in southern and southeastern U.S. ports, and 3) major east-west expansion of western rail capacity that could divert future I-80 freight volumes from I-80 to rail. No significant changes are assumed in the western U.S. Interstate system, i.e. there will be no new east-west Interstate routes and no new major connectors of several hundred miles such as Interstate 76 (connecting I-80 to I-70) that would cause structural shifts in I-80 freight patterns.

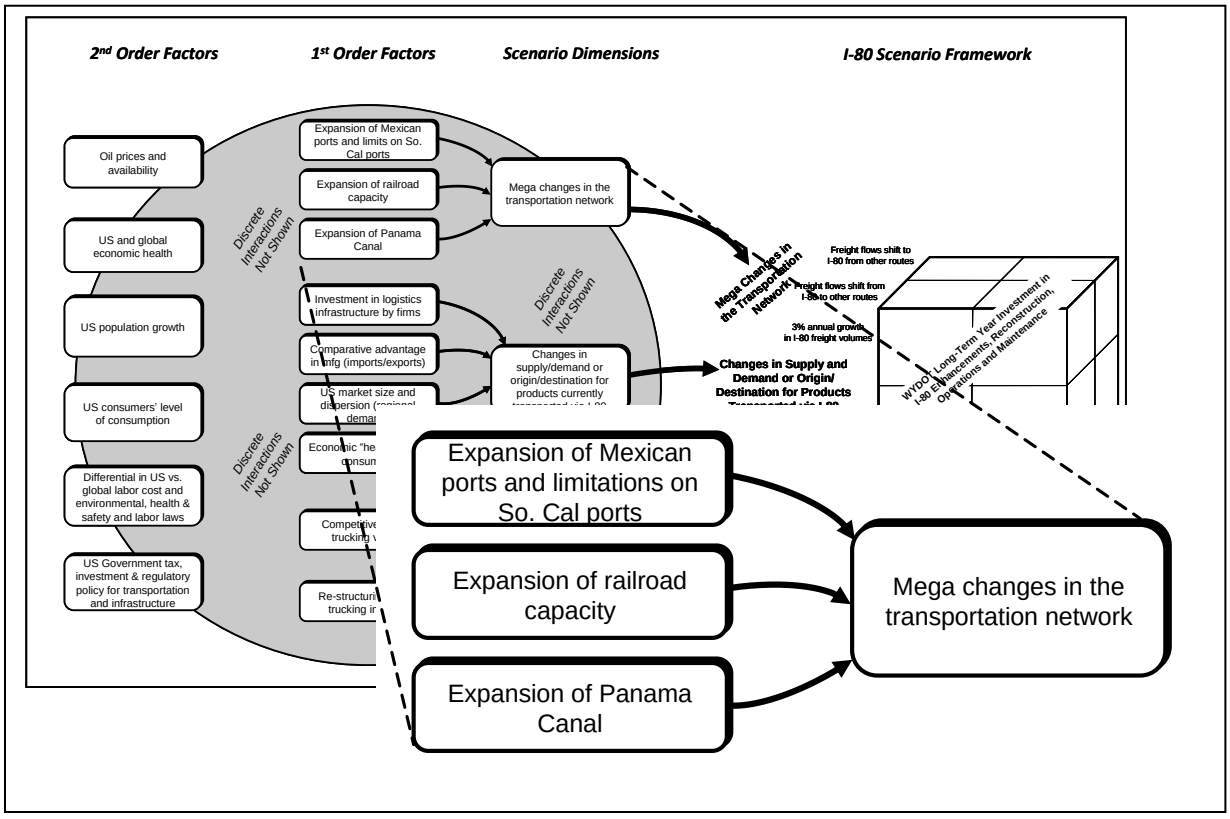


Figure 75. Three 1st Order Factors Driving Mega Changes in the Transportation Network that Will Impact Wyoming I-80 Freight Flows.

It is worth re-stating that a large majority of freight volumes on I-80 is domestic freight with a domestic origin and destination. Much of this freight is associated with food and other basic consumptive products linked to population densities in the upper Mid-west and the West Coast. These freight flows are not directly impacted by imports and exports that originate or terminate at the west coast ports. With that said it is still worth examining these mega factors as they could cumulatively and non-linearly affect I-80 freight growth and as will be shown are most likely to be trending in a negative, i.e. decreasing, direction.

Expansion of Mexican Ports and Limits on Southern California Ports

The expansion of Mexican ports and the limits to growth of the Southern California ports likely point to a shift in future freight patterns related to Asian trade from traveling west to east to traveling south to north. Barring a shift of this international freight to Oakland or the Pacific Northwest ports this freight will likely shift south and away from the SLC/Ogden inland freight hub and Wyoming I-80. Limits to growth of the southern California ports were previously discussed. Suffice to say that each LA/LB port initiative to service growing freight volumes requires a counterbalancing mitigation measure which is expensive and time-consuming. In addition, the 10:1 differential in labor costs between the U.S. and Mexico comes at the expense of increased shipping costs and lost profits. Control of the ports by organized labor is perceived as a serious threat to Just-in-Time business models by all parties along the value chain, i.e. manufacturers, shippers and retailers. These factors are driving the need for alternative freight routes for containerized Asian products to enter the U.S. The Port of Oakland could be an alternative, but as previously discussed it operates under some of the same environmental and labor constraints as LA/LB in addition to its other unique "limits to growth."

As an alternative to the LA/LB ports, the government of Mexico in partnership with a large Asian interest (Hutchison Whampoa Ltd.) and Walmart among others is sponsoring a $300 million expansion of Mexico's Pacific port of Lazaro Cardenas (Reuters, 2006). As shown in Figure 76a, Lazaro Cardenas lies in the southern end of Mexico's Pacific coast.

Figure 76a. Location of Lazaro Cardenas.

The Kansas City Southern railroad has launched a major capital expansion program to invest in track between Lazaro Cardenas and Laredo, Texas. Under this future state, Kansas City could emerge as a new inland freight hub replacing SLC/Ogden as a waypoint for Asian imports bound for the Midwest. This route is 500 miles shorter distance to Houston than from the LA/LB ports. Walmart intends to use this port to supply its Mexican retail operations and other large retailers are sure to follow.

In addition to the expansion of Lazaro Cardenas, the Mexican government is supporting the largest infrastructure project in the nation's history with construction of Punta Colonet – approximately 150 miles south of San Diego (Figure 76). As proposed Punta Colonet will be a privately funded, $4 billion deep-water port that some say may rival the LA/LB port complex. Officials claim that this mega port could eventually handle 10 million containers annually. The Mexican government is requesting construction companies, railroads and terminal operators to team up and bid to earn the concession.

However, the viability of Punta Colonet is seriously threatened by the expansion of the Panama Canal (which will be discussed next). Many transportation experts say retailers in the American heartland would be more efficiently served by Asian ships transiting the Panama Canal and sailing directly to Gulf Coast or East Coast ports. But this is only possible if these U.S. ports can service the larger vessels. Otherwise shipping patterns may continue to favor the West Coast ports, transferring to intermodal for delivery by rail or truck to consumers in the upper Mid-west (White, 2006).

Figure 76b. Location of Proposed Super-port at Punta Colonet (Source: San Diego Union-Tribune).

Whether or not the vision for Punta Colonet is realized, due to the expansion of the Panama Canal, the expansion of Lazaro Cardenas points towards a potential shift in freight patterns for some percentage of future Asian imports south and away from SLC/Ogden and I-80.

Another factor that could influence a shift of freight patterns south is future U.S. government policies restricting travel of Mexican truck drivers and the operations of Mexican trucking firms. If this restriction is lifted the economic advantages of using Mexican truck drivers in the U.S. combined with the economic advantages of a Mexican port will be a strong catalyst towards a shift south of imported freight destined for the upper mid-west.

In summary, the 1st order factor, *Expansion of Mexican Ports and Limits on Southern California Ports,* points towards a likely shift of freight flows of Asian imports south and away from I-80. The probable impacts of this 1st order factor on the two possible outcomes of the scenario

dimension, which will be used in the subsequent scenario analysis, are given below. Also listed below are the indicators which over time will help determine which scenario, i.e. outcome, is materializing.

Probable Impact on Applicable Scenario Dimension:

Freight flows shift from I-80 to other routes – Moderate to High

Expansion of Mexican ports (if successful on even half the scale envisioned) will capture future market share from the LA/LB ports, probably Oakland and the Northwest ports. These all feed I-80 eastbound freight and create export points for westbound freight. This will cause a shift of freight patterns south away from SLC/Ogden and I-80. Even if the Panama Canal expansion adversely impacts the Mexican ports, overall dynamics favor a shift of the freight patterns for Asian imports which will also provide alternate export points to the West Coast ports.

Freight flows shift to I-80 from other routes – Low

Dynamics do not strongly support shifts to I-80 from other routes except under the following set of circumstances: 1) expansion/construction of Mexican ports is suspended or cancelled, 2) over the next 10-15 years the Port of Oakland undergoes growth in the order of four to five times its current volume and 3) containers from the West Coast ports are transported east via rail to SLC/Ogden and trans-loaded to trucks rather than remaining on rail until reaching Chicago or another Midwestern forward staging point.

Indicators:

- Lazaro Cardenas – Progress on expansion; growth in container traffic (currently 34th in North America, handling 100,000 containers annually); as-planned capital investment by KC Southern Railroad.
- Punta Colonet – Progress on development of the port, i.e. planning, bidding, funding.

- Mexican Trucking – Restrictions on Mexican truck drivers and Mexican trucking firms.
- Continued resistance to expansion of LA/LB ports (environmental, health and safety, congestion).
- Continuing disputes and conflicts with organized labor at the LA/LB ports.
- Continuing shift of manufacturing base away from the upper mid-west to foreign countries and to the southern U.S., e.g. automobile manufacturing.
- Continuing shift of U.S. population away from the upper Mid-west to Southern states.

Expansion of the Panama Canal

Like the expansion of the Mexican Pacific ports, expansion of the Panama Canal will likely result in a shift southward of current freight patterns for some future percentage of Asian imports. Currently, the maximum size ship that can transit the canal is called a Panamax. The Panama Canal is being expanded with a third set of locks large enough to service mega container ships called Post-Panamax container ships. The project will double the capacity of the Canal. The project is estimated to cost over $5 billion and will be partly financed with debt. The new locks are expected to be operational in 2014. (Landers, 2008).

It is estimated that after expansion as much as 40 percent of U.S. imports from Asia will pass through the Panama Canal versus less than 10 percent presently (Landers, 2008). This could affect the distribution hub of SLC/Ogden and truck volumes on I-80. Use of the Gulf Coast ports will provide more economical import/export balance (than the West Coast ports) because U.S. manufactured products exported to Asia will travel shorter distances from the upper Midwestern states to Gulf Coast ports versus westbound I-80 to the West Coast ports. As shown in the survey data, a significant number of westbound I-80 truck trips contain U.S. manufactured products bound for export via West Coast ports. Not only are changes in freight flows of Asian imports expected to shift south and slow the growth of eastbound I-80 freight volumes, but westbound I-80 freight flows of exports are also likely to be impacted.

There are concerns whether U.S. Gulf Coast and East Coast ports will be able to handle Post-Panamax class ships. The port channels are not deep enough for these ships, and the timeline to obtain permits and execute large-scale dredging projects can be 10-20 years. The U.S. government may move to accelerate the permitting process so that necessary channel work at U.S. ports could be completed on an accelerated timeline. Depending on this progress shippers may turn to a Caribbean port such as Kingston, Jamaica and trans-load containers to smaller vessels for delivery to Gulf Coast ports such as Houston, Tampa and Mobile. Of course, this inefficiency would reduce some of the savings expected to be gained by the additional sea transport distance.

In summary, the 1st order factor, *Expansion of the Panama Canal*, points towards a likely shift within seven to ten years that a significant quantity of Asian imported freight will move to southern routes and away from LA/LB, SLC/Ogden and Wyoming I-80. Furthermore, freight patterns for U.S. manufactured products for export to Asia which transit I-80 are likely to shift coincidently. The probable impacts of this 1st order factor on the two possible outcomes of the scenario dimension are given below. Also listed below are the indicators which over time will help determine which scenario is materializing.

Probable Impact on Applicable Scenario Dimension:

Freight flows shift from I-80 to other routes – Moderate to High

Expansion of the Panama Canal will shift freight bound for the upper Mid-west and Eastern states from the West Coast ports which feed I-80 eastbound. These Southern ports will also create new destination points for U.S. exports to balance freight. Therefore, this mega change in the transportation network is likely to cause a major shift in freight patterns for Asian imports and U.S. exports south away from SLC/Ogden and I-80.

Freight flows shift to I-80 from other routes – Low

Dynamics do not strongly support shifts to I-80 from other routes except under the following set of circumstances: 1) the Panama Canal expansion is cancelled or

suspended and/or 2) Gulf Coast ports cannot service the larger ships. Under these circumstances increasing quantities of Asian imports bound for the Midwest will continue their current route arriving at LA/LB and traveling through SLC/Ogden and eastward on I-80 via truck.

Indicators:

- Progress on the Panama Canal expansion, i.e. on-schedule, near budget.
- Progress on port enhancement projects (e.g. channel dredging) for Gulf Coast and East Coast ports.
- Private sector investment in logistics and warehouse infrastructure near Gulf Coast and East Coast ports.
- Accelerated Corp of Engineer and Council on Environmental Quality approval of port dredging projects.
- Available debt financing to support dredging and other Gulf Coast and East Coast port expansion projects.

Expansion of Railroad Capacity

As previously discussed in this chapter, UPRR and BNSF are the predominant western railroads. UPRR's central corridor runs parallel to I-80 across much of Nevada, Utah, Wyoming, Nebraska and Iowa. Because railroads are by far the most capital intensive industries, despite large capital investments, capacity is limited on both UPRR and BNSF east-west freight corridors. UPRR and BNSF primarily haul for large customers who can provide consistently high volumes of freight with concentrated origins and destinations – such as Asian imports arriving as containerized freight at the West Coast ports. Transporting containerized freight has become one of the most profitable and fastest growing market segments for UPRR and BNSF. Where lane volume can be concentrated over long distances rail has a significant cost advantage over trucks. In some situations railroads compete with trucks for east-west freight flows but by and large the railroads are selective in choosing their intermodal customers and work with whom they can offer competitive service while generating an acceptable internal rate of return for intermodal services

versus serving other customer segments. Most often railroads cannot offer the service levels afforded by independently-owned and regional trucking firms.

The following section briefly describes current rail capacity improvements of UPRR and BNSF and their potential impacts on future I-80 freight flows and on enabling increased intermodal penetration. A subsequent section will address the competitive dynamics between trucking and rail and structural barriers and opportunities for diversion of more future freight flows from I-80 to rail.

UPRR Capacity Expansion

UPRR's capital spending over the past six years has been approximately $16 billion. Capital spending on new capacity has historically been less than 15% of revenue. UPRR plans to invest approximately $3.1 billion in capital projects in 2008 (UPRR, 2008). According to UPRR, two-thirds of UPRR capital expenditures are related to intermodal. Some of UPRR's more recent investments include:

- An $83 million intermodal facility near SLC open in 2006. This is a 260-acre state-of-the-art intermodal terminal is located within two miles of I-80. The new container terminal increases the railroad's international and domestic container capacity in the Salt Lake City area by three times, while improving traffic efficiencies. The facility will serve dozens of Utah companies that rely on intermodal rail freight to ship and receive containers with various types of materials from around the world. Due to sustained growth in intermodal in the Salt Lake City area over the last several years, the terminal was designed to handle a capacity of 250,000 over-the-road trailers or ocean-going containers annually. The additional capacity allows UPRR to continue to pursue opportunities in the growing intermodal market.

- Upgrading track and adding double track along the Sunset Corridor between the LA Basin and El Paso and construction of a large switching yard between Phoenix and Tucson; improving terminals in Tucson and Yuma.

- Upgrading San Antonio terminal facilities, and other terminal and track upgrades near Shreveport, the San Antonio to Houston Corridor, Houston terminal facilities.

- Installing computerized signal controls in Nebraska and Iowa.

Figure 76 shows major UPRR capital investments to support the growing intermodal market segment.

Given the capital intensity of the industry and increasing demand for intermodal service UPRR is focused on improving intermodal efficiency and productivity. Examples include improving cycle times to create capacity by better utilizing cars, locomotives and crews. Other strategies to increase capacity are maximizing the utilization of existing capacity by leveling shipments by day of week, improving throughput at terminals, increasing the number of containers on each train (train length, slot utilization), and using the "right size" cars and moving to 40-foot double stack cars for marine containers. Other efficiency and productivity enhancements include eliminating light density lanes, closing underutilized ramps, focusing on "point to point" trains even if this means reduced frequency of service and coordinating operations with ocean carriers and the ports to better integrate operations.

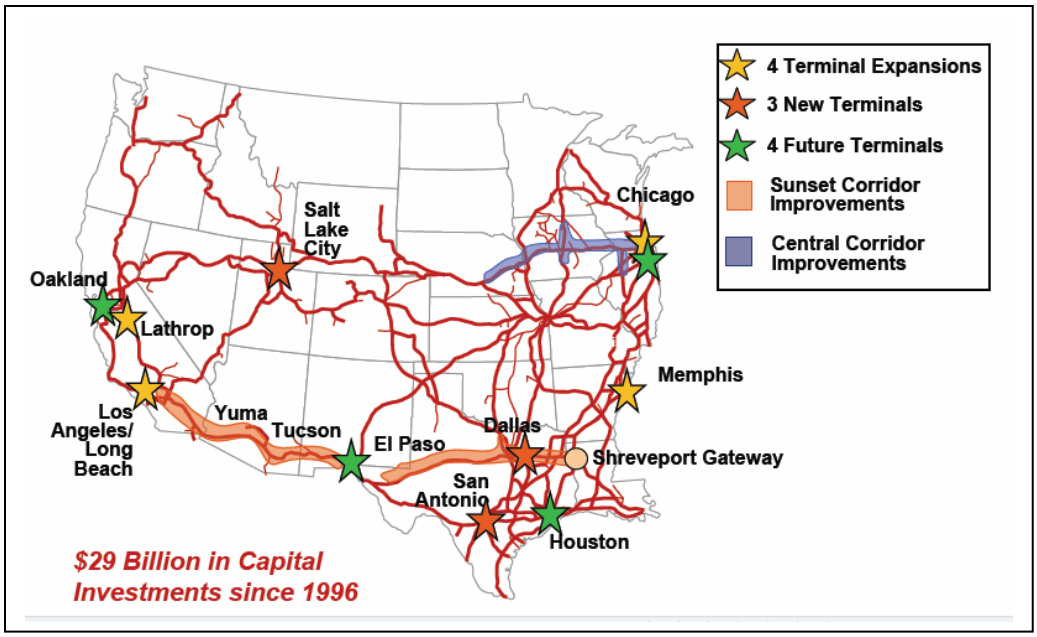


Figure 77. UPRR Capital Investments to Support its Growing Intermodal Business (Source: UPRR).

As evident from these investments, UPRR should be well-positioned to grow its intermodal business whether it is hauling Asian imports from the LA/LB ports or from the Mexican ports or containers brought through the expanded Panama Canal. These investments reinforce movement of freight routes for Asian containerized imports (and most probably containerized U.S. exports from the upper Midwest) south and away from SLC/Ogden, I-80 and UPRR's Central Corridor. This could free up capacity on UPRR's Central Corridor for other types of east-west freight and perhaps service more domestic intermodal freight. This in turn could result in diversion of some I-80 truck trips and thereby reduce some of the projected growth in I-80 truck VMT.

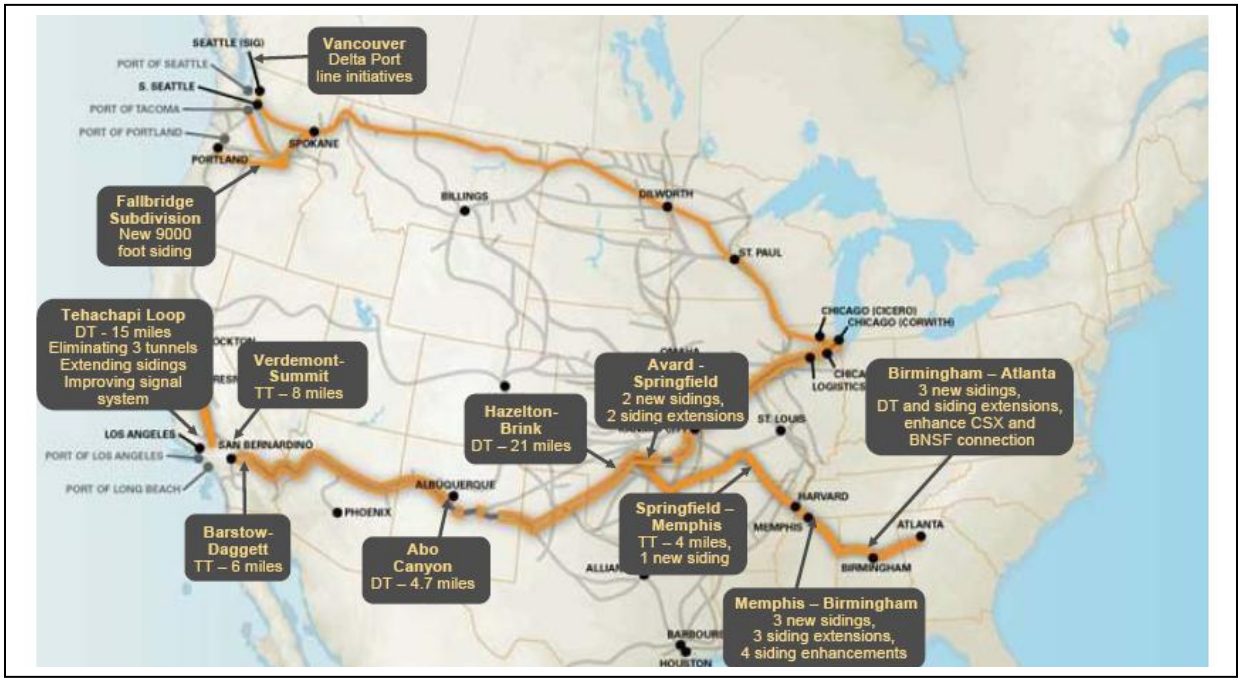
BNSF Capacity Expansion

BNSF's capital spending over the past six years has been approximately $12 billion. Like UPRR, capital spending on new capacity has historically been less than 15%. BNSF plans to invest approximately $2.5 billion in 2008 (BNSF, 2008). Some of BNSF's more recent investments that could have a direct or indirect impact on I-80 freight flows include:

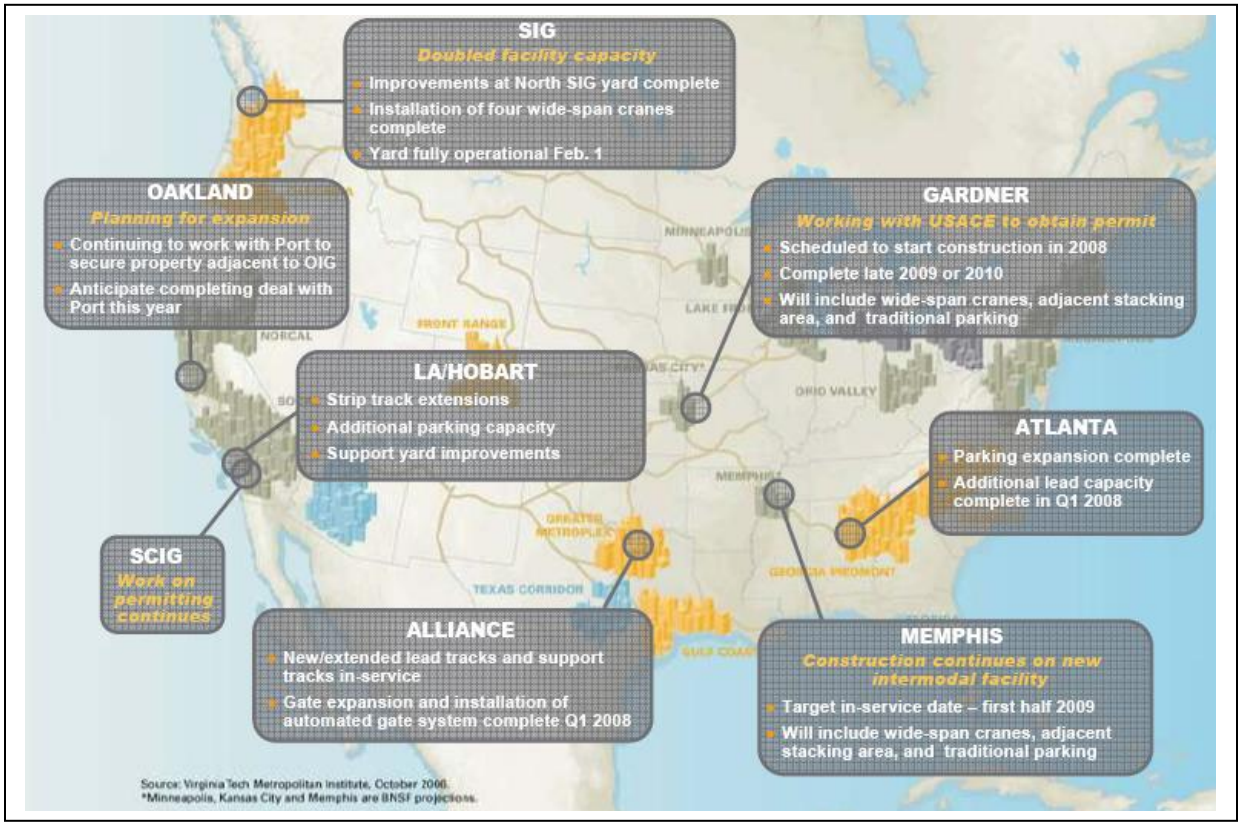
- The Tehachapi Loop (central California) is comprised of 15 miles of double track, elimination of three tunnels, extended sidings and improved signaling which will help expedite the north-south movement of goods and will improve the rail throughput south from the Port of Oakland then east towards destinations such as Chicago, St. Louis and Dallas on BNSF's mainline.
- Adding triple tracking at various bottlenecks throughout southern California.
- Adding double track in Oklahoma and other locations and other improvements along the mainline between Albuquerque and Kansas City.
- Planned expansion of terminal capacity at the Port of Oakland.
- Improvements at several intermodal facilities in southern California.
- Construction of an intermodal facility in Kansas City.

Figure 78a and 78b show BNSF's investment in rail and facilities, respectively. Much of this investment is along its two primary east-west routes and support increases in eastbound container freight. Both routes compete with UPRR (and to a lesser degree trucks) to move containerized freight arriving at the West Coast ports to Chicago.

BNSF is making the investments to grow its intermodal business. Like UPRR, these investments reinforce a change in the status quo. As rail capacity to and from the ports improves, more eastbound containerized freight from Asia (even that arriving at the Port of Oakland) may be forward staged further east, e.g. St. Louis or Kansas City. This will eliminate trans-loading to trucks in the SLC/Ogden area and eastbound travel via I-80. Although not explicitly identified during this study, it is assumed that BNSF has similar operational initiatives to increase capacity by efficiencies and productivity gains that complement and create synergy with capital investments. Depending on how the competitive dynamics play out, BNSF's success in capturing more of the West Coast intermodal market could free up capacity on UPRR's Central Corridor for other types of east-west freight. This could include more domestic intermodal freight and potentially reduce some of the projected growth in I-80 truck VMT. On the other hand, a significant shift in Asian imports to the Gulf Coast could severely impact both railroads' intermodal franchises and perhaps reduce capital investments in these market segments.



Figures 78a and 78b. BNSF Capital Expansion for Rail and Facilities (Source: BNSF)



Both UPRR and BNSF have been publicly criticized for focusing assets and capital investment on their growing and increasingly profitable container business. Given limited system capacity, growth in their container businesses has come at the expense of serving other markets. Critics in various industries (e.g. energy, agriculture, chemicals, forest products) have called for new regulations on railroads to provide greater levels of service and price controls. Both railroads warn that this will affect profitability and force the railroads to decrease capital investments at a time when the U.S. freight infrastructure is already overburdened. At this time any re-regulation of railroad freight operations by the Surface Transportation Board seems unlikely.

Railroads favor tax incentives for investment in capacity expansion and asset replacement in the form of investment tax credits and accelerated depreciation. Also, anti-trust relief clearing the way for potential mergers between BNSF or UPRR and one or both of the two large eastern railroads (CSX and NS) could significantly alter current freight flows are competitive dynamics. However, the impact of this event on Wyoming I-80 freight volumes is beyond the scope of this study.

In summary, the 1st order factor, *Expansion of Railroad Capacity*, reinforces a shift of freight flows of Asian imports to the south and away from LA/LB, SLC/Ogden and Wyoming I-80. The probable impacts of this 1st order factor on the two possible outcomes of the scenario dimension, which will be used in the subsequent scenario analysis, are given below. Also listed below are the indicators which over time will help determine which scenario is materializing.

Probable Impact on Applicable Scenario Dimension:

Freight flows shift from I-80 to other routes – Moderate

Expansion of capacity along UPRR's southern route and focusing capital investment on containerized freight (i.e. freight that could be transported in trucks across I-80) will tend to concentrate more east-west containerized freight south of SLC/Ogden and I-80. Investments by BNSF will expedite containerized freight from Oakland and LA/LB and move it east to Kansas City and Chicago – again adding intermodal capacity and re-routing freight patterns away from SLC/Ogden and I-80. Additional intermodal capacity and associated evolution in the supply chain should enable more freight placed on rail at the ports, to remain on rail all the way to the Midwest. In this case, despite the forecasted

doubling of Asian trade within ten years, the corresponding proportional growth in I-80 truck VMT is projected to be lower. As freight patterns shift south it is possible that some UPRR capacity on the Central Corridor (which parallels I-80 and runs from Chicago to Oakland) could be freed-up and used for more domestic intermodal freight potentially diverting more freight from trucks traveling I-80 to rail further reducing some of the projected growth in truck VMT on the I-80 corridor.

Freight flows shift to I-80 from other routes – Low

Dynamics do not strongly support shifts of freight currently on rail to I-80 except under the following circumstances: 1) if the railroads cannot increase their capacity and capture an increasing share of the growth in Asian imports (e.g. due to disincentives to invest) this freight will travel east to the Midwest via truck as this is the only alternative. Since I-80 is a preferred route from the West Coast to Chicago, I-80 freight volumes could be expected to materially increase. As discussed above, expansion of the Mexican ports and the Panama Canal are expected to move much of the freight flows associated with the growth of Asian trade south and away from I-80.

Indicators:

- Continued capital investment in capacity expansion in track and intermodal facilities which directly or indirectly impact truck VMT on I-80.
- Success in UPRR and BNSF creating new capacity by operational efficiencies and productivity gains.
- Changes in government policies which encourage or discourage railroad capital investment.
- Future mergers of the western railroad(s) with the eastern railroads.

In summary, three 1st order factors were identified as drivers of *mega changes in the transportation network* that could either shift freight flows **from** I-80 to other routes or shift freight flows **to** I-80 from other routes. These three 1st order factors were: 1) expansion of Mexican ports and limits on the Southern California ports, 2) expansion of the Panama Canal, and 3) expansion of railroad capacity. All three 1st order factors strongly indicate a shift in

current U.S. freight patterns. It is likely that increased Asian trade will not correspondingly increase I-80 freight growth. Therefore, **for scenario analysis it is concluded that there is a higher probability of scenarios in which mega changes in the transportation network favor freight flows shifting from I-80 to other routes and modes.**

A similar approach to building and qualifying scenarios is used for the other two dimensions of the scenario framework introduced earlier in this chapter, (i.e. Scenario Dimension #2, *changes in supply and demand or origin/destination for products transported via I-80* and Scenario Dimension #3, *changes in intermodal penetration (relative to I-80 freight)*). Each 1st order factor drives their respective scenario dimension towards one of two possible outcomes that increase or decrease future I-80 freight growth. Again, first order factors for each dimension will be examined and conditions identified under which one of the two proposed outcomes will most likely be realized.

Scenario Dimension #2 – Changes in Supply and Demand

Changes in supply and demand for products currently transported across I-80 and/or changes in the origin or destination of those product categories is the second of the three axes in the scenario analysis framework (Figure 60a). Changes in supply and demand and changes in the origin or destination for products transported across I-80 could significantly alter future I-80 freight flows either by increasing or decreasing demand for transportation along the corridor.

Base lower and upper bound average annual growth rates of 3% and 5%, respectively, were selected because they bracket the 10-year average annual growth rate recorded by WYDOT. The minimum growth rate of 3% represents the baseline growth of freight volumes linked to population growth and GDP. The maximum growth rate of 5% represents a reasonable upper bound. Wyoming has experienced 4.4% annual growth during a time of rapid outsourcing, widespread adoption of JIT manufacturing and retail inventory, unprecedented levels of domestic consumption, growth in imports and exports and significant population gains due to immigration. This combination of factors growing at levels recently experienced is unlikely to be repeated.

Therefore an upper bound of 5% annual growth in Wyoming I-80 freight volumes appears reasonable.

Scenarios related to this axes may have one of two discrete outcomes:

1. 3% base annual growth in I-80 freight volumes.

or

2. 5% base annual growth in I-80 freight volumes.

The following section is intended clarify under what conditions one of these two outcomes will likely prevail. Four 1st order factors were identified (Figure 79). The four 1st order factors include: 1) investment in logistics infrastructure by firms, 2) comparative advantage in manufacturing (imports/exports), 3) U.S. market size and dispersion (regional demand), and 4) economic "health" of U.S. consumers. In this study, changes in origin/destination represent the origin and destination relative to freight corridors – not the actual origin (e.g. factory) or the final destination (e.g. retail location or point of consumption).

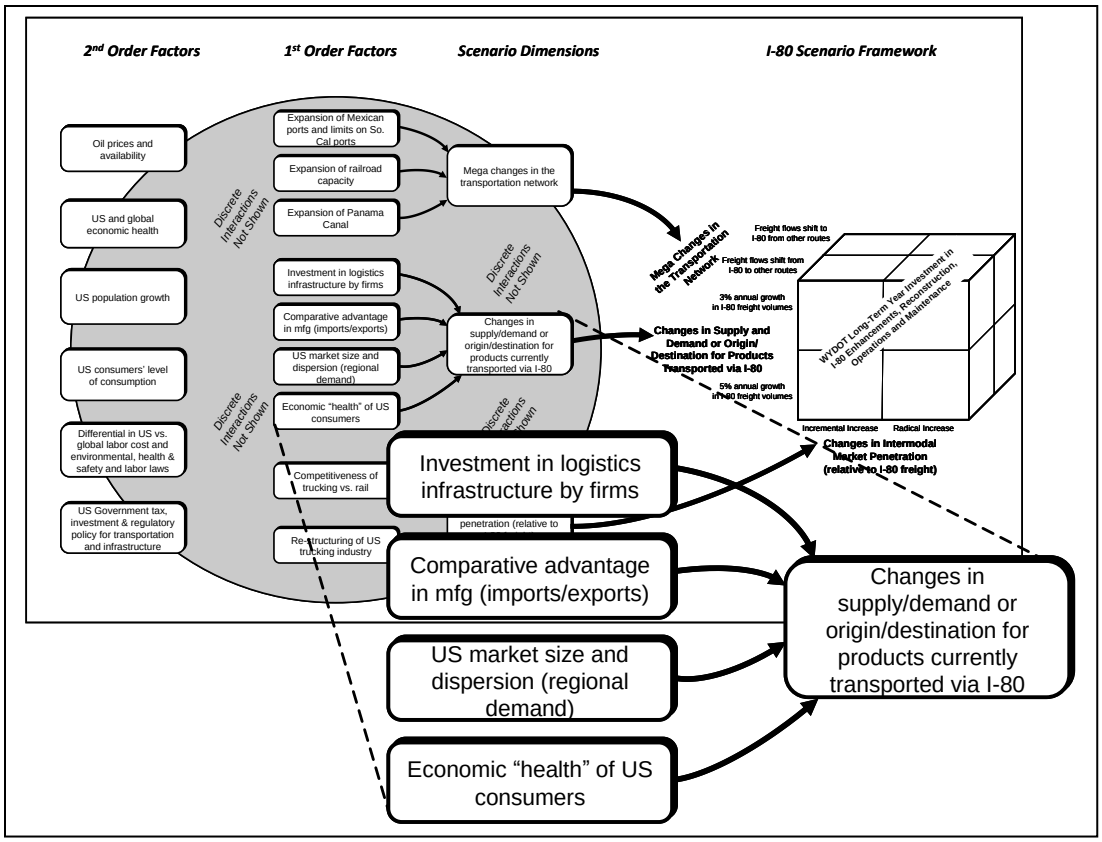


Figure 79. Four 1st Order Factors that Could Alter Freight Volumes and Freight Types Transported on I-80.

Investment in Logistics Infrastructure by Firms

Investment in logistics infrastructure by firms is a good predictor of trends and changes in the transportation sector. Large retailers and shipping companies including Wal-Mart and Home Depot have recently built large distribution centers near the port of Houston. Ikea and Target have similar facilities near the port of Savannah, GA. These investments reinforce a trend of increasing Asian imports arriving at the Gulf Coast and East Coast ports for distribution to population centers in the Southeastern U.S. and the upper Midwest.

Walmart is considered by many to be the leading global logistics firm and a trendsetter so closer examination of their strategy may reveal massive changes in global freight patterns ultimately affecting Wyoming I-80.

When Walmart, the world's largest retailer, launched its new inbound distribution center outside Houston this summer, it signaled a new direct import strategy. Walmart has built a four-million square-foot complex in Baytown, Texas about 25 miles from Houston. The facility is the largest distribution center in the country devoted to a single company. The site is 92 acres indoors and feeds a large supply chain comprised of 20 – 28% of their imported products. Primary reasons cited for this shift are bottlenecks and delays in shipping products through the California ports. With such a tremendous volume of goods it is likely that this will create the critical mass necessary to change shipping patterns since this shift by the world's biggest retailer will attract copy-cat projects propelling more companies to look for alternative ports of entry. Products previously shipped to the West Coast and sent cross-country by rail will now go by sea all the way to Baytown via the Panama Canal. The all-water route is 11 days longer than the water/rail route, but the total trip time will be about the same when delays at California's ports are taken into account (Hoffman, 2005). Of course, capacity freed up on the west coast ports could be filled with expanding trade.

Investments are being made in other regional ports such as a new container port in Mobile, Alabama. Despite a slowdown in business the port of Savannah is undergoing a multi-million dollar expansion.

Trends related to investments in warehousing are another good indicator of changes in freight patterns. Figure 80 shows recent trends in warehouse space. Growth in logistics infrastructure in southern states supports a more prominent role of cities such as Dallas, Houston and Memphis moving from regional to national logistics hubs. Although Chicago continues to grow as a regional distribution point, its role as a national distribution point and as a transcontinental gateway could be changing. Chicago was the number one origin and destination in the I-80 freight survey. A shift in the role of Chicago will have a significant impact on future freight volumes between SLC/Ogden and Chicago on Wyoming I-80.

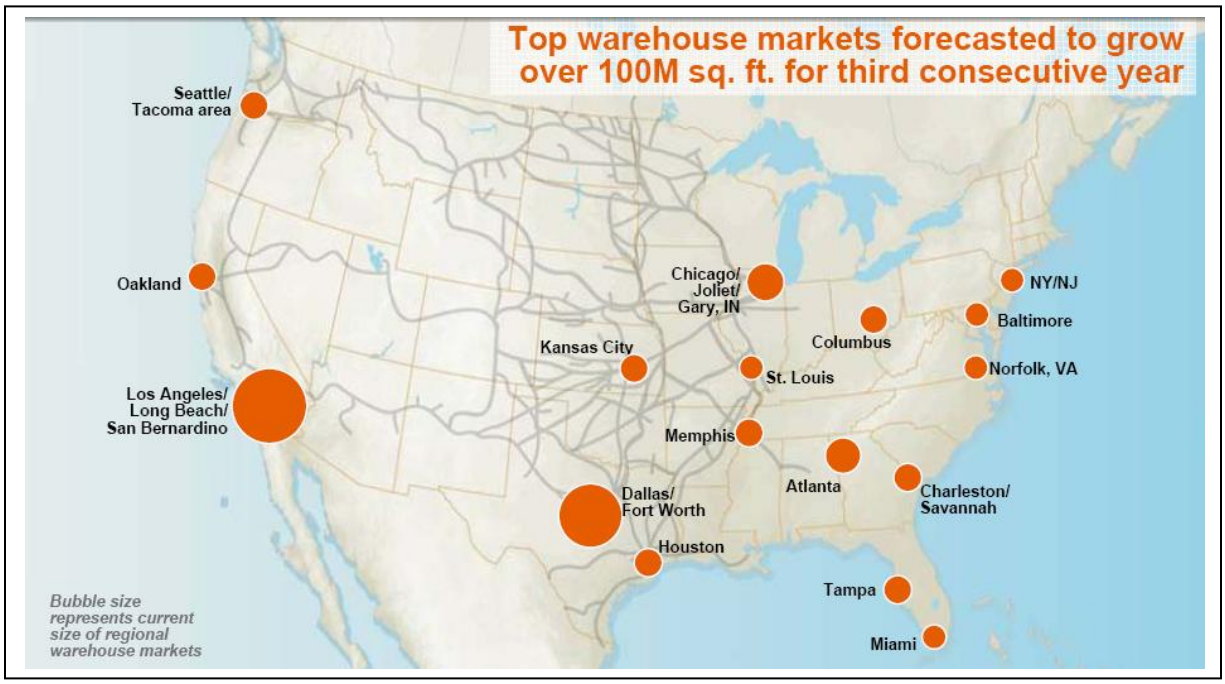


Figure 80. Trends in Warehousing. (Source: BNSF)

In summary, investment in logistics infrastructure by firms is, as expected, following the mega changes in the transportation network cited earlier – moving freight patterns south to service the central region of the U.S. from south to north. Critical mass matters in logistics. Productivity in logistics has economies of scale driven by a synergistic collection of companies, with a network of assets and alignment of motivations within a geographical context. Growth leads to more growth and decline leads to further decline.

3% base annual growth in I-80 Freight Volumes – Moderate

Although logistics investments in areas of the supply chain connecting the west coast with the upper Midwest will continue to grow; growth will be incremental – more on a scale needed to support population growth and associated increased economic activity. Again, since food is the major product transported across I-80 between SLC and Chicago a material percentage (25-35%) of this freight stream is unlikely to change.

5% base annual growth in I-80 Freight Volumes – Low

It is expected that logistics investments in the Southeastern U.S. and locations other than LA/LB and SLC/Ogden portend a material shift of Asian freight flows into the U.S. – from the Gulf Coast and the southern Atlantic Coast ports a large majority of freight will be transported inland to Dallas, Memphis, Chicago, St. Louis, Kansas City and other distribution points rather than originating from the West Coast ports. As a result, Chicago's role as a transcontinental freight hub and its contribution to the growth in I-80 freight volumes lessens.

Indicators:

- Capital investment by firms in areas surrounding the Gulf Coast and Southeastern U.S. ports including warehousing, cranes, rail sidings, etc.
- Increasing trends in container volumes at these ports.
- Closing of warehouse facilities in southern California and/or SLC/Ogden.

Comparative Advantage in Manufacturing (imports/exports)

Comparative advantage in manufacturing is the essence of trade in goods. Comparative advantage derives from one or many factors such as labor costs, know-how, proximity to raw materials or inexpensive energy. For the purpose of this study, comparative advantage can apply

to foreign trade or trade between regions of the U.S. Comparative advantage is enabled by access to transportation assets and services. Without an efficient means to get products to markets the benefits of comparative advantage are consumed in transportation costs and are not available to be shared (i.e. the most efficient producer provides lower prices to the consumer) so the benefits of free trade which could be realized by buyers and sellers dissipate. Most would agree that overall, countries have benefited from free trade. In terms of "wealth creation" U.S. consumers have saved trillions of dollars due to the widespread availability of low-cost apparel, footwear and household items produced in Asia. U.S. consumers are able to purchase low-price, high-quality products such as electronics because of global competition enabled by free trade. This growth in trade has enabled U.S. consumers to increase their buying power or use their "savings" derived from availability of inexpensive goods for other purposes – this is the essence of wealth creation.

Most acknowledge that it is a reliable and inexpensive global transportation system that underpins free trade and enables the benefits of comparative advantage to be shared up and down the value chain. As transportation costs increase comparative advantage decreases and trade becomes more regional.

Despite recent historic increases in transportation costs due to $145 per barrel oil, many experts are predicting continued high growth in Pacific trade. As evident by the survey beyond domestic freight Asian trade is the freight pattern most closely linked to Wyoming I-80 – as opposed to European, Canadian or Mexican freight flows. It is also the freight pattern most susceptible to shifting – unlike I-80 freight flows for food, building materials and other domestically produced products which are linked to population densities and should remain fairly stable. Figure 81 provides estimated growth of Asian imports arriving at the west coast ports. According to BNSF, this freight flow is projected to more than double in the next ten years. This projection appears optimistic given the "limits to growth" on the LA/LB ports previously described.

If this estimate proves correct some of this freight flow will transit I-80 and will be represented in one of the higher I-80 truck VMT growth scenarios. However, the forecasts presented in Figure 81 may be optimistic as there may be limits on how fast and how much more Asian trade can grow.

If long-term transportation costs increase, as was foreshadowed in the summer of 2008 due to $100+ per barrel oil, the cost of shipping goods from China will begin to overwhelm the savings from inexpensive labor. According to a recent study for every 10% increase in transport distance, energy costs rise 4.5% (Aeppel, 2008). This is just one component of manufacturing "inflation". Others include increasing environmental and labor regulations that in totality are degrading Asia's comparative advantage in manufacturing and may slow the growth in Asian trade. When the savings from outsourcing manufacturing to Asia falls to less than 15-20% it can get harder to justify having the work performed in an Asian factory that requires 10-12 weeks to deliver the product.

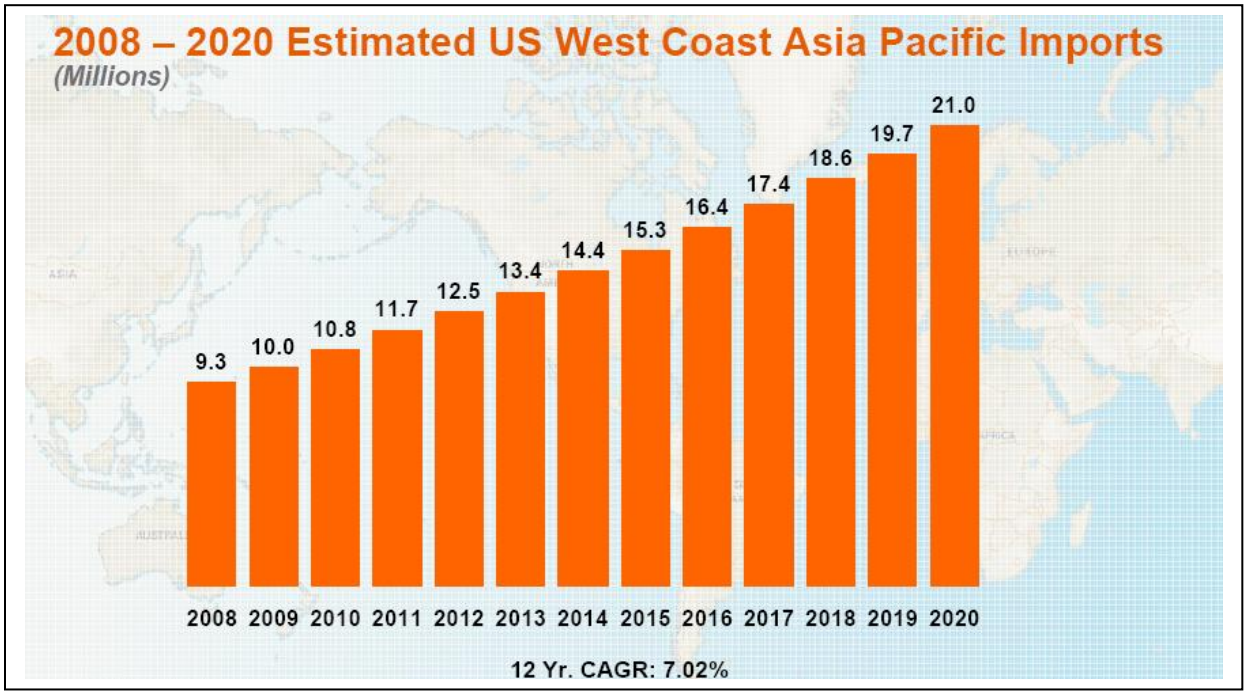


Figure 81. Estimated Growth of Asian Imports at the West Coast Ports. (Source: Burlington Northern Santa Fe Railroad)

Some U.S. companies such as Emerson are shifting production of items such as appliance motors from Asia to Mexico and the U.S. due to high transportation costs. Emerson is regionalizing its manufacturing (rather than consolidating) to more closely link manufacturing with the regional market. Emerson is an exception in terms of manufacturing flowing back to the U.S. (Appel, 2008). Higher transportation costs will slow the outsourcing of goods, not reverse the trend. More likely, certain types of manufacturing will move from Asia to Mexico and new manufacturing capacity will be developed in Mexico especially for lower value goods such as

apparel since the cost to ship goods from China can be 50% higher than from Mexico depending on fuel costs. As was shown earlier in this study freight flows originating in Mexico rarely transit Wyoming I-80. Therefore this possible slowing in outsourcing of U.S. manufacturing to Asia combined with a shift in manufacturing to Mexico due to Asia's eroding comparative advantage would dampen I-80 freight growth projections.

This is not to say that trade with Asia will decline. For many products the comparative advantage is too strong to be overcome by higher transportation costs. In some cases the companies are Asian-owned so manufacturing will remain in Asia. However, there are other macro-economic factors such as the ability of the U.S. and Asian trading partners to sustain large trade imbalances that need to be factored into any sustained growth in Asian import growth projections like those provided by BNSF in Figure 81. Also, the value of the dollar will partly determine whether Asian trade can grow at the rate predicted in Figure 81. Even if it does, as previously discussed there is the likelihood of alternate entry points into the U.S. that will re-orient freight patterns associated with Asian trade from east-west to north-south.

Comparative advantage in manufacturing also extends to regions within the U.S. For example, California has a strong comparative advantage due to weather and irrigation practices for producing agricultural products which are consumed in the Midwest. In this instance, this comparative advantage creates an inter-regional trade pattern and associated freight flow. This is typical of a large percentage of domestic I-80 freight volumes. This study does not presume major changes in these domestic freight flows related to comparative advantage with the exception of the future of the U.S. auto industry which will be addressed in the next section.

In summary, comparative advantage in manufacturing between Asia and the U.S. and Mexico and the U.S. is expected to continue to grow and to continue to propel trade and freight volumes. Asian imports may be lower than the projected doubling that some experts are predicting. More outsourcing may shift to Mexico from the U.S. and from Asia to Mexico depending on long-term transportation costs. Regardless, due to shifts in freight flows associated with these trade patterns it is likely that SLC/Ogden and Wyoming I-80 will realize a disproportionately lower percentage of growth from this freight stream than the overall growth of Asian imports.

3% base annual increase in I-80 Freight Volumes – Moderate

Although Asian trade (bi-directional) is expected to continue to contribute to the growth of I-80 freight volumes it is not expected to increase I-80 freight volumes proportionally. The contribution to positive growth in I-80 freight volumes from Asian trade is expected to be incremental but less than that experienced over the past 10 years.

5% base annual increase in I-80 Freight Volumes – Low

Asian trade could increase I-80 freight volumes if future demand for intermodal transport from the West Coast ports outstrips the capacity of UPRR and BNSF forcing a high percentage of Asian freight on to trucks bound for the Midwest through SLC/Ogden.

Indicators:

- Container traffic at the West Coast ports and percentage leaving the ports via train.
- Throughput of UPRR's SLC intermodal facility.
- Long-term costs of oil in the range of $75-$100 per barrel.
- Shift of manufacturing from Asia to Mexico.
- Increasing or decreasing truck counts northbound on I-15.

U.S. Market Size and Dispersion (regional demand)

U.S. market size in general and regional demand in particular across a spectrum of products is the most important 1st order driver for rationalizing transportation networks and freight flows. All 1st order factors previously discussed or to be discussed in subsequent sections emanate from demand and the location of that demand. A distinction is made between freight to supply manufacturing demand versus consumer demand.

Manufacturing creates demand on the freight network to transport parts and supplies to support production of intermediate or finished goods. If manufacturing facilities in the upper Midwest continue to close, to relocate or to expand operations to the southern U.S. or abroad this will decrease the growth of I-80 freight flows. For example, auto parts accounted for almost five percent of trucks surveyed. Auto parts supply is the number one industrial employer in seven states and one of the top five employers in 12 other states. (Herbert, 2008). At the time of this study the U.S. auto industry was on the brink of bankruptcy and expecting to go through at best a major re-structuring and at worst partial liquidation. Even if the industry does not collapse, it is likely to suffer significant and permanent downsizing and stabilize at perhaps 50-75% of its current output. Although this was not confirmed in this study most likely plants located in the southeastern U.S. owned by the Japanese and Korean automakers, i.e. "transplants", are largely supplied by imported auto parts entering the U.S. through the LA/LB ports which travel directly east to the "transplants" and never transit SLC/Ogden or Wyoming I-80. It is less likely that significant quantities of auto parts destine for the southeastern U.S. arrive in Oakland or Seattle/Tacoma due to the increase distance. Should the U.S. auto industry collapse or appreciably shrink, shipments of nearly all auto parts related freight on I-80 would be cut anywhere from 25-75%. Given the certainty of industry downsizing some reduction in this freight stream is certain.

Despite the situation with the Big Three U.S. automakers, other sectors of U.S. manufacturing such as construction and farming equipment are experiencing strong long-term growth driven domestic as well as global demand. However, for the past 20 years U.S. companies have been relocating or locating new manufacturing facilities outside of the upper Midwest for a variety of reasons (i.e. economic incentives, absence of organized labor, lower taxes energy costs). The exception seems to be food processing. As manufacturing moves south the role of I-80 in the supply chain diminishes. Also, if U.S. products manufactured in the Midwest and exported to Asia can be more efficiently exported via southern ports (versus the West Coast ports and specifically the ports of Oakland, Tacoma and Seattle) freight growth on I-80 will be reduced.

Beyond demand created by business the other part of the demand equation is that driven by consumers.

In this study consumer demand, which directly and indirectly drives the need for transportation, has two components – basic consumable products and discretionary products. Basic consumable products will be addressed next. Discretionary products will be discussed in the following section which will address the 1st order factor *Economic "health" of U.S. consumers*.

U.S. consumer demand for consumable products such as food, clothing, household goods, supplies and some durable goods is closely tied to population density and is somewhat independent of income or geography. To the extent that population densities do not experience a major geographical shift over the next generation, freight flows for these categories of domestically produced products between the upper Midwest and the West Coast should grow close to the rate of population growth. In terms of location, according to the U.S. Census approximately 43 million people or 15 percent of the U.S. population live within 200 miles of Chicago and approximately 48 million people or 16 percent of the U.S. population live in the three Pacific Coast states. Interstate 80 is the primary transcontinental land route for transporting these basic products between these two major regional populations.

According to the Census Bureau between 1990 and 2000, the U.S. experienced the largest population increase in American history. U.S. population grew by 32.7 million people between 1990 and 2000 which represents the largest census-to-census increase in American history. In 2030, U.S. population is projected to be 373,000,000. (U.S. Census). While population growth and associated growth in demand for products and freight services is a given, future population growth in the upper Midwest will probably continue to lag other regions of the U.S. Depending on long-term economic health and energy costs (among other factors) migration from the Midwest could accelerate. Depending on where relocation occurs this could dampen future growth of I-80 freight volumes.

In summary, U.S. market size and regional demand for basic consumable products and hence use of I-80 for transporting these products between population centers containing 30% of the U.S. population should grow at close to or slightly below population growth. To the extent that overall upper Midwest manufacturing continues to decline or relocate, I-80 freight growth

associated with supply and demand should be static even with normal GDP growth. It should be noted that for the most part these freight patterns are stable and perhaps provide the basis for 2-3% of the recent historical average annual I-80 truck traffic growth rate of 4.4%

3% base annual increase in I-80 Freight Volumes – High

Growth in I-80 freight volumes are linked to population densities, population growth and economic growth in the upper Midwest and West Coast states. Related growth should remain stable due to the volume of freight related to basic consumptive needs such as food, household products and building materials.

5% base annual increase in I-80 Freight Volumes – Low

Normal or below average growth in population and economic activity in the upper Midwest should contribute to declining growth rates in I-80 freight volumes. This decline may be offset by increases in freight due to growing populations and economies of the West Coast states. It is likely that the U.S. automotive industry will reduce output by perhaps 25-50% over the next five years which will affect I-80 freight volumes. In the survey, auto parts accounted for 4% of I-80 freight volumes; however, it is beyond the scope of this study to correlate reductions in auto manufacturing to I-80 freight volume.

Indicators:

- Viability of the U.S. auto manufacturing industry.
- Changes in population growth of the upper Midwest and the West Coast states.
- Decline or growth of upper Midwest manufacturing operations and migration of manufacturing overseas and to Southern States.

Economic "Health" of U.S. Consumers

The 1st order factor *U.S. market size and dispersion (regional demand)*, addressed consumer demand for basic products that could be considered non-discretionary (food, clothing, household goods, etc.) and relatively immune from changes in personal income and economic growth. However, the 1st order factor *Economic "health" of U.S. consumer* represents consumers discretionary spending on products and product-related services whose demand is a function of individuals' personal income and future prospects for personal income. Many but not all of these discretionary product categories are imported, and based on the survey data these products make up less than five percent of freight on I-80.

According to economists, for over 10 years household consumption has consistently outstripped gains in household income. While asset values such as homes were rising and easy credit was available the U.S. consumer and the U.S. economy could absorb that imbalance. In 2007, household debt hit a record of 133% of disposable personal income. (Roach, 2008).

At the time of this study the U.S. economy in general, and the average U.S. consumer in particular is suffering through a severe economic crisis which could have a material and long-term impact on U.S. consumers' level of consumption and hence the need for freight movement for discretionary products. For over one year home foreclosures have been higher than in recent memory. Home values have plunged 30% or more. Retirement funds have been decimated by declines in the stock market. Consumers are being denied access to credit. Unemployment has reached eight percent in numerous states and may exceed 10% in 2009. Although a major government stimulus plan is being implemented the long-term impact on the economy is uncertain.

Consumptive growth, which is one of the primary drivers of the growth in freight volumes, averaged 4% annually over the past 14 years. This could slow to 1-2% for the next three to five years. (Roach, 2008). This in turn could have the long-term effects on U.S. consumers' savings and consumptive habits – and perhaps create a consumptive "plateau." After three to five years of paying down debt and "doing without" a material percentage of U.S. consumers may be transformed – focusing less on acquiring "things". In this case consumption may never again

average 4%. On the other hand after three to five years of sacrifice, U.S. consumers may have pent up demand and drive consumption growth back to near historic highs.

A final consideration is the overall transformation of the consumptive aspects of the U.S. consumer economy. Today, an increasing percentage of consumers' market wallet goes to discretionary services such as spa treatments and experiences such as sporting events and vacations rather than physical goods. Consumers have other areas where spending will be reduced that has little impact on freight volumes.

In summary, since the U.S. consumer is the focal point in generating demand for freight movement it could be expected that freight volumes associated with discretionary product categories will level off or decline in the near-term (i.e. 3-5 years). Over the next 10-15 years absent large gains in U.S. productivity and distribution of these gains as higher income to a larger section of the U.S. workforce, the ability of a large percentage of U.S. consumers to resume their pre-2007 levels of consumption may not be attained in the foreseeable future. In addition other macro-economic factors such as inflation and the value of the U.S. dollar will affect the "health" of U.S. consumers and their ability to purchase discretionary goods.

3% base annual increase in I-80 Freight Volumes – High

Due to the current economic climate and numerous forecasts, for the next 3-5 years significant declines in consumption of discretionary consumer products and product-related services could be expected. This will have a corresponding impact on freight movement associated with these products. Over a longer time horizon, the U.S. economy is expected to recover and discretionary consumer spending rise, but not repeat 4% annual growth for a sustained 10-year period.

5% base annual increase in I-80 Freight Volumes – Low

Absent a rapid economic turn-around and real long-term, sustainable gains in employment and income across a large percentage of the lower and middle-class it is unlikely that freight volumes associated discretionary consumer spending will attain their former levels.

Indicators:

- U.S. unemployment rate especially states in the upper Midwest and on the West Coast.
- Gains in productivity and income for members of the middle-class.
- Home price appreciation.
- Deflationary pressures which motivate consumers to defer purchases.
- Large-scale shifts in consumer sentiment that eschews "excessive" consumption of material goods.
- Purchasing power of the U.S. dollar relative to the currencies of imported consumer discretionary products.

In summary, four 1st order factors were identified as drivers of C*hanges in supply/demand or origin/destination for products currently transported via I-80* that could either increase or decrease I-80 freight volumes. These four 1st order factors were: 1) investment in logistics infrastructure by firms, 2) comparative advantage in manufacturing (imports/exports), 3) U.S. market size and dispersion (regional demand), and 4) economic "health" of U.S. consumers. Growth of basic consumable products (which is approximately 45–50% of I-80 freight) is expected to continue as this freight is linked to population centers and therefore is somewhat immune from changes in personal income and growth in the U.S. economy. Three of the four 1st order factors influencing I-80 freight volume growth indicate decline in the near-term, but the expectation of resuming long-term growth, albeit below the ten-year average of four percent annual increase in consumption. Therefore, **for scenario analysis it is concluded that there is a high probability of scenarios in which I-80 freight increases due to changes in demand at 3% (the lower bound of the base forecasted growth range) rather than the upper bound of 5%.**

Scenario Dimension #3 – Changes in Intermodal Penetration

Changes in intermodal penetration consider the percentage of shipments that could shift from highway to rail over time. Truck-load shipments (versus less-than-truckload shipments) of domestic freight traveling 1,000 miles or more are candidates for modal shift. (Imports traveling 1,000 miles or more are generally transported by rail so this freight stream is not a candidate for modal shift.) Changes in use of intermodal by shippers is the third axes in the scenario analysis framework (Figure 60a). The health of the trucking industry and railroad capacity and service are key factors that will influence whether more freight could be diverted from I-80 to rail and thereby reduce the growth in I-80 truck volumes.

Scenarios related to this axes may have one of two discrete outcomes:

1. Incremental increase (in intermodal penetration).

or

2. Radical increase (in intermodal penetration).

The following section is intended clarify under what conditions one of these two outcomes will likely prevail. Three 1st order factors were identified that will influence the degree of intermodal penetration relative to I-80. As shown in Figure 82, the four 1st order factors include: 1) competitiveness of trucking versus rail and 2) re-structuring of the trucking industry.

Competitiveness of Trucking versus Rail

The 1st order factor *competitiveness of trucking versus rail* defines the nature of competition between these two modes. This is based on the strengths and weakness of each mode in serving various segments of the transportation market. Although several aspects of the competitiveness of trucking versus rail were enunciated earlier in this chapter these are worth re-stating and expanding upon – keeping in mind that the goal is to characterize the degree of likelihood of incremental or radical intermodal penetration and the subsequent shift of freight volumes from I-80 to rail.

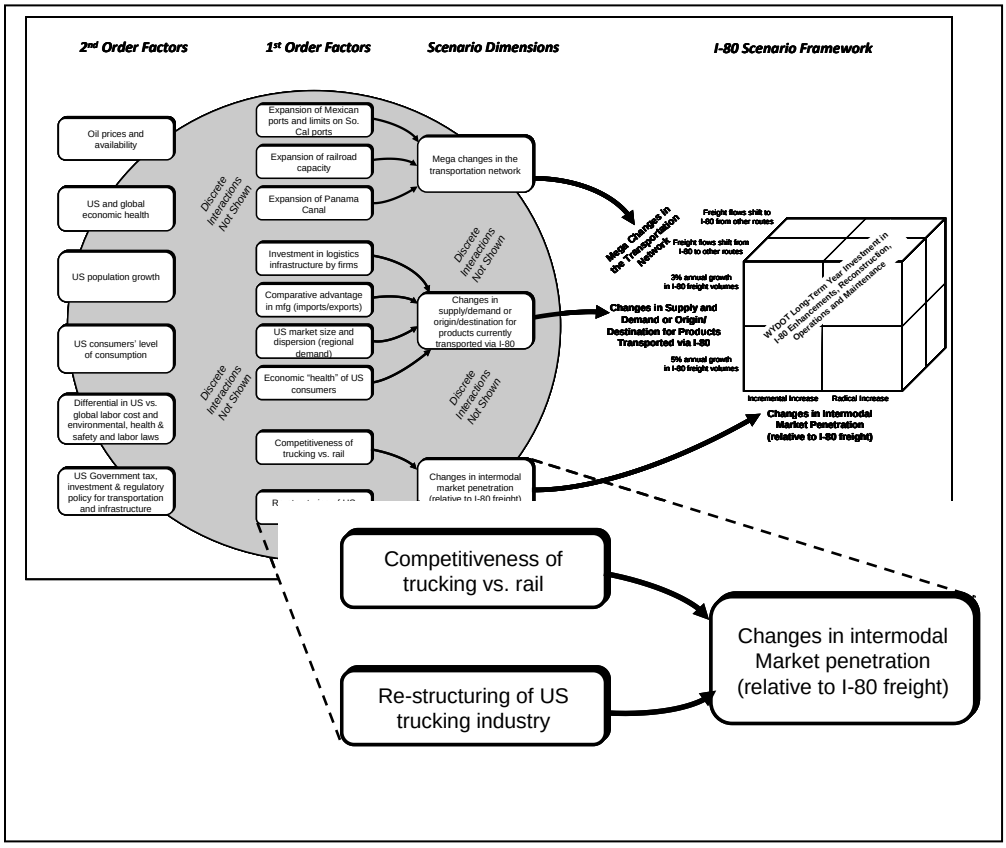


Figure 82. Three 1st Order Factors Potentially Driving Changes in Intermodal Market Penetration.

In general trucking is more expensive than rail, but trucks have inherent advantages over trains in almost all other aspects of transportation valued by the market. With trucks transit times are minimal and predictable. The system is reliable due to the extensive National Highway System. Truck transport provides a large pool of readily available equipment and drivers willing to transport almost any quantity of TL, LTL on a regular basis, an infrequent basis or on-demand. Trucks are capable of moving virtually all types of freight from any point in the 4 + million miles of the nation's roadway. Trucks can use almost the entire system without having to transfer loads from equipment or among carriers. Railroads can complete direct movements on only about 100,000 miles of network and must sometimes transfer loads or cars between railroads. Most often freight must be transferred from rail to truck for final delivery. These transfers take time and cost money. Trucks also have more operating flexibility in terms of passing and detours that in general result in greater average speeds and better performance than trains.

Much of the U.S. transportation system has evolved around trucking, i.e. modern tractor-trailer rigs, warehouse management, tracking technologies and distributed ownership of assets. Innovations around trucking have greatly increased the productivity of the transportation system. These productivity improvements have resulted in reduced costs for delivery of goods and services and faster and more reliable transportation. Lower transportation costs have decreased the cost of obtaining manufacturing inputs resulting in lower costs of production. A more efficient transportation system has resulted in better utilization of drivers and equipment and increased transportation reliability that in turn enables reductions in inventories of both inputs and finished goods. This smoothing up and down the supply chain has greatly contributed to micro and macro-economic growth (i.e. tens of thousands of individual firms in the overall economy) by wringing unnecessary logistics costs out of the transport system. Savings on logistics results in one or more of the following: 1) decrease in the cost of a product or service, 2) increased profits to business owners, 3) increased capital available for re-investment in further logistics efficiencies, R&D, or other corporate growth strategies such as acquisitions. Much of the productivity gains and the absence of cost growth in transportation services over the past 10-20 years are attributable to the growth of the trucking sector.

Meanwhile, railroads have abandon thousands of miles of track and access points, and in an era of capacity constraints railroads are no longer willing to service less profitable sectors of the market. Railroads have evolved their business model to serve a concentration of a few large-scale customers.

Due to the inherent advantages of trucks and the limitations of rail service, FHWA projects a further dependence on freight movement via highways (Figure 83). FHWA projects a widening gap between the value of domestic freight transported via highways versus rail from approximately 10 times to 20 times by the year 2020 (FHWA, 2004).

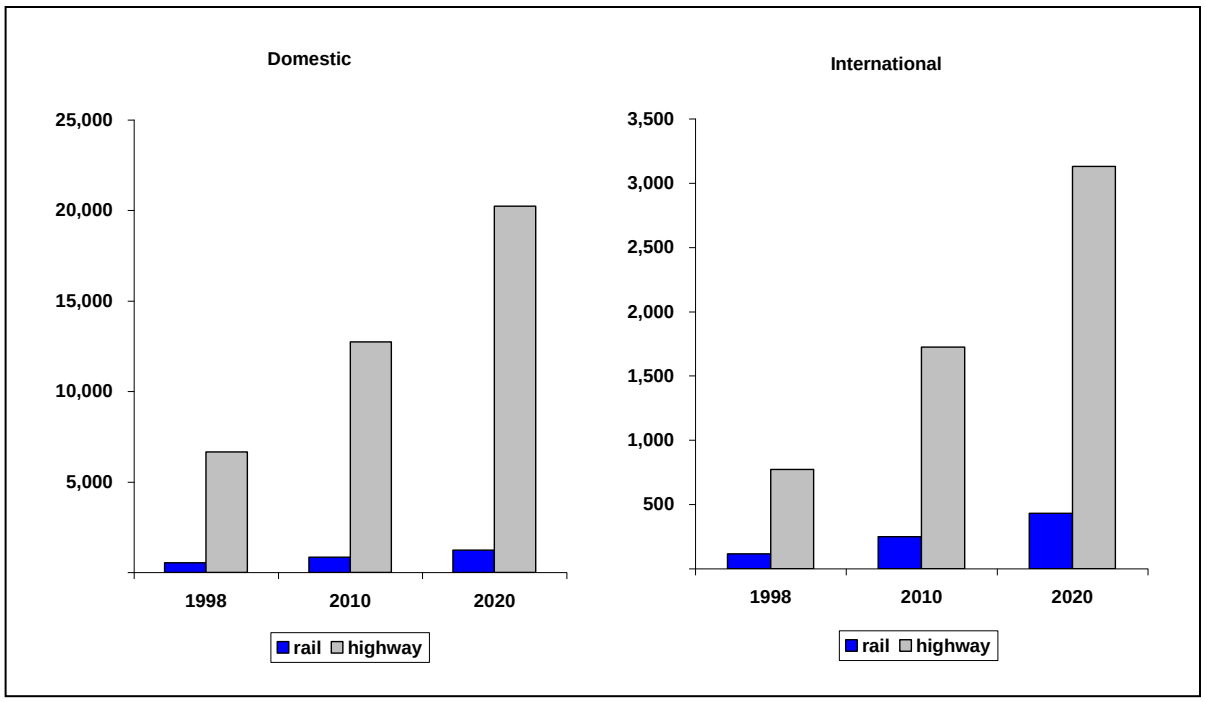


Figure 83. FHWA Projections for Highway Freight Growth vs. Rail.

For these reasons, both domestic and international freight are projected to increase faster than GDP. The end result is increased dependence on the continued performance of the highway system due to the U.S. economy's reliance on efficient transport as a key input factor of production directly linked to business profitability.

However, improvements in freight transport efficiency appear to be reaching the point of diminishing returns. Truck transportation productivity (decreases in transportation cost per dollar value of goods and service times) is decreasing as interstate congestion grows, fuel prices rise and driver shortages increase. So opportunities for increased use of intermodal services for domestic freight continue to gain traction.

Although rail intermodal service usually moves goods more slowly than trucking, as trucking costs increase economics begin to dominate modal selection for many firms.

However, only certain freight corridors have the lane density and concentrated origins and destinations for the railroads and intermediaries to offer new domestic intermodal service.

Certainly one of those routes is the 1,500-mile stretch between Chicago and SLC/Ogden where I-80 runs parallel to UPRR's Central Corridor.

Unfortunately this route, which is double-tracked across Wyoming, is severely capacity constrained. Nevertheless, based on the survey on any given day approximately 17% (of the 5,000 – 7,000 eastbound and westbound) trucks are traveling at least 1,500 miles on I-80 between Chicago and SLC/Ogden.

If UPRR (either directly or through an intermediary) was willing and able to provide acceptable service and capture 10% of this freight and maintain that market share on a go-forward basis it would have an incremental impact on reducing the projected increase of I-80 freight volumes. Expectations regarding UPRR's willingness and ability to increase intermodal service along the I-80 Central Corridor and capture an increasing percentage of that freight that would otherwise be transported by truck may be optimistic. UPRR deploys capital based on competing needs and their respective returns on investment across their entire network. The impact of UPRR's investments on I-80 truck volumes cannot be analyzed without details around its business strategy (which are not publicly disclosed). For example, as previously mentioned UPRR recently opened a state-of-the-art intermodal facility in SLC, but without more operational knowledge of the facility and its customers it is uncertain whether this facility is increasing or decreasing the net number of trucks on Wyoming I-80.

If UPRR was successful in capturing an additional 10% of intermodal freight, perhaps through its SLC intermodal facility and its partnerships with several national trucking companies and was able to add a couple of trains per day this could relieve I-80 of over 500-1,000 truck trips per day. While UPRR capacity is limited, this additional capacity may be attainable through UPRR's operational efficiencies and productivity initiatives. Therefore an incremental increase in intermodal penetration that would divert future I-80 truck traffic to rail is possible but the probability is uncertain. Greater certainty cannot be attained without additional information from UPRR, e.g. any gains made in capacity may already be allocated to UPRR's other business sectors such as coal, agricultural products or containerized imports – in which case an incremental increase in intermodal penetration on the Central corridor may not be possible.

If the trucking business continues to consolidate as will be discussed in the next section, more I-80 freight volume will be captured by large carriers such as Schneider and JB Hunt. These large entities already utilize UPRR's intermodal services along the I-80 corridor so there could be more opportunities, incentives and synergies to utilize intermodal services. This would divert a significant volume of freight from I-80 to rail. However, unless UPRR is able to create significantly more capacity the full potential of this opportunity may not be realized. As shown in Figure 84, it would require a step function in UPRR capital expenditures to construct a third track on this corridor to gain sufficient capacity to enable a radical increase in intermodal penetration and to divert an increasing percentage of trucks traveling I-80 to rail. Absent this significant infrastructure investment, it is more likely that in terms of the two potential outcomes intermodal penetration relative to I-80 will be incremental at best.

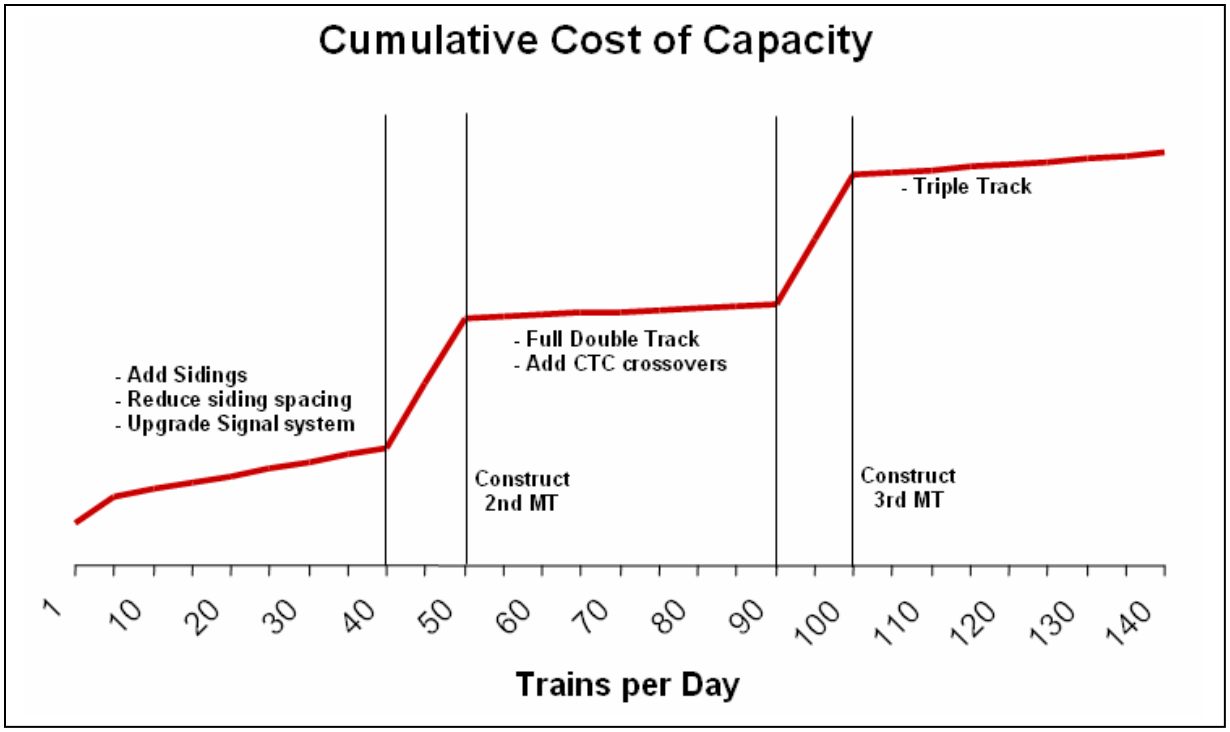


Figure 84. Step Function in Capacity and Number of Tracks; MT is a mainline track and CTC are automated switching systems. (Source: UPRR)

In summary, I-80 truck traffic will continue to grow due to its many inherent advantages and its predominance in the transportation sector. Absent a compelling business case coupled with a willingness to take on significant investment risk in capacity expansion, the most realistic expectation is for an incremental increase in intermodal penetration. However, more information

is required to understand UPRR's business intentions to provide intermodal service (quality and quantity) between Chicago and SLC/Ogden, their customers and whether the freight would be new freight, diversion of existing freight, etc.

Incremental increase in intermodal penetration – Low to Moderate

UPRR intermodal penetration on the Central corridor may increase and divert some freight volume from I-80 to rail. However, relative to 10-year forecast for increases in domestic freight volumes it is doubtful that any increase in intermodal penetration will keep pace with the overall increase in future I-80 freight volumes.

Radical increase in intermodal penetration – Low

Given current UPRR capacity constraints, without a major capital investment (perhaps in the order of $3-5 billion) in an additional track, UPRR will not have the capacity nor the business inclination to capture an increasing share of the freight volumes traveling between Chicago and SLC/Ogden.

Indicators:

- UPRR investment in additional track along the Central Corridor especially in Wyoming and other states where capacity bottlenecks exist.
- Type of intermodal activity at UPRR's SLC facility, i.e. car loadings/unloading, trucks entering/leaving facility and whether they are loaded or empty and their direction of travel.
- Strategic relationships between major trucking companies and UPRR to increase intermodal freight volumes.
- See *Expansion of Railroad Capacity* indicators delineated earlier in this chapter.

Re-structuring of the U.S. Trucking Industry

Re-structuring of the U.S. trucking industry is another 1st order factor that could significantly impact future penetration of intermodal and diversion of freight from I-80 to rail.

The trucking industry has been undergoing restructure (i.e. evolving) since de-regulation in 1977. Post de-regulation has seen a proliferation in the number of trucking entities including owner-operators, small and regional firms and national carriers – all driven by the growing demand for freight services. De-regulation resulted in overcapacity which while it has been good for shippers, consumers and the overall economy it has been hard on much of the trucking industry. Table 13 shows the distribution of trucking companies based on their number of trucks. There are several other ways to segregate the trucking industry in addition to the size of the firm, i.e. geography and customer focus (which is characterized by the customer base [regular or random] and truck-load versus less-than-truckload).

Table 13. Number and Size of U.S. Trucking Companies in 2007 (Source: Americaslists.com)

Number of Trucks	Number of Entities
1	179,361
2-3	95,019
4-20	81,509
21-100	13,361
101-999	2,456
1,000-4,000	136
>4,000	22

The trucking industry is labor and fuel intensive but the business is not capital intensive. Beyond a minimum level of service, competitive advantage is primarily based controlling variable costs and the ability to be a low-cost provider. Size is an advantage, not from economies of scale in the traditional sense, but economies of network density. This provides larger firms with the ability to maintain sufficient supply of freight to keep trucks loaded and productive (Belzer, 2000). When network size and density converge, trucking firms can better optimize time, labor and equipment. While some competitive advantage is derived by volume alone, strategic location of that volume for pickup and delivery is a major competitive advantage that in and of itself will gradually consolidate more of the industry.

For an owner-operator the only fixed costs are the rig. If a person can borrow the money for a tractor and obtain a CDL license he can become an owner-operator. This creates low barriers to

entry especially for individuals who are independent-minded with blue collar backgrounds – many of whom have lost their blue collar job and could not readily transfer their skills to other occupations. Many of the national, regional and even small trucking companies hire independent owner-operators to haul their freight. At the beginning of 2008, there were 350,000 owner-operators (Uchitelle, 2008). Approximately 25% of the non-PrePass truckers surveyed on I-80 were owner-operators.

Small and regional firms make up the next category of trucking firms. A small firm may be an owner-operator that has a couple more rigs and pays the drivers or a much larger regional firm with trans-loading facilities, hubs and a large fleet of tractor-trailers. It could be assumed that small and regional firms serve approximately 50% of the market. From the survey data approximately 50% of non-PrePass truckers surveyed were driving for small or regional firms. The third category is the large national trucking companies such as J.B. Hunt, Schneider and UPS. These companies are publicly traded which provides access to capital. They are able to utilize technology to increase efficiencies. They are able to hire top-tier management and they are able to provide the volumes and concentrated origins and destinations to utilize intermodal services.

Re-structuring essentially entails how each of these three segments of the trucking industry will fare in the future. Over the past twelve months diesel prices reached a record of over $4.50 per gallon across much of the U.S. Coupled with over-capacity this has had a devastating effect on several parts of the trucking industry, especially smaller entities who have had difficulty passing fuel surcharges on to customers or in the case of independent owner-operators collecting fuel surcharges from their brokers. More than 1,900 trucking companies failed in 2008 – the highest level of industry bankruptcies in more than seven years. Analysts estimate 4.5% of the U.S. trucking fleet was idled in the first three quarters of 2008. According to America's Commercial Transportation Research, since early 2007 45,000 vehicles or 3% of the fleet is no longer on the highway. For comparative purposes the last downsizing in the early 1980's (driven by recession, high interest rates, the oil embargo) removed 33,000 tractors from the fleet (Uchitelle, 2008). Most publicly traded trucking firms have seen major declines in their stock price.

However, some trucking companies such as J.B. Hunt have maintained profitability even with fuel costs reaching records and may have created a business model with sustainable competitive advantage that will be a harbinger of a re-structured trucking industry. Due to their size, nationwide firms such as J.B. Hunt and Schneider have been able to utilize rail services to a larger degree than most shippers. This has had the effect of mitigating some of the increased cost of fuel on their customers which in turn has given them a significant competitive advantage by utilizing the higher fuel efficiency of rail. In the case of J.B. Hunt, railroad services account for about 45 percent of J.B. Hunt's revenue of $3.5 billion and nearly two-thirds of its $369 million in operating profit. The company recently announced record third quarter 2008 net earnings of $60.3 million, compared to earnings of $50.8 million a year previous. (Kapadia, 2008). "In this remarkable time of economic uncertainty and capital markets turmoil, we are delighted to report not only a record third quarter, but the highest earnings per share for any quarter in our history," said Kirk Thompson, JBHT President and CEO. "We continue to make significant progress toward the transformation of our company from the asset-based truckload company of the past, to a diversified transportation solutions business with far less cyclicality, capital intensity and earnings volatility that is frequently associated with trucking businesses." J.B. Hunt's containers and trailers grew from 58,802 to 61,406 over the same period. The growth in the fleet of containers and trailers was primarily to support additional intermodal business. Their combined tractor fleet declined from 11,723 in the third quarter 2007 to 10,029 in the third quarter 2008, primarily due to actions to reduce the size of the asset-based truck segment fleet. Perhaps J.B. Hunt signifies the future of the truckload long-haul trucking industry – dominated by large firms able to use their economies of scale to contract for rail services – reducing the use of trucking along 1,000-2,000-mile corridors and deploying their equipment and drivers for only the first and/or last 50-200-mile legs for door-to-door service. The lower cost of rail transport gives these large companies pricing advantage as well as higher profitability. This in turn enables expansion which further enables the capture of additional market share and greater economies of scale to leverage more business with the railroads. Owing to the freight volumes traveling the 1,500-mile lane between Chicago and SLC/Ogden, within the next five to ten years this competitive advantage could result in diverting more freight to intermodal rail that otherwise would travel Wyoming I-80 – again the potential depends on available rail capacity.

By contrast other segments of the trucking industry such as owner-operators and small and regional firms are not faring as well. These segments face several inter-related challenges: driver shortages, the inability to quickly align rates with higher fuel prices and access to capital and relentless competition. In a recent annual survey of trucking companies taken by Motor Freight Market Insight Survey trucking companies overwhelmingly cite rising fuel costs (91%) and price pressures from customers and competitors (70%) as their two greatest challenges. Last year, price pressures (79%) and rising driver-related costs (74%) were top concerns for carriers. Also increasing consumer and regulatory influences have resulted in new laws and regulations forcing the trucking industry to comply with tougher environmental standards. Forty-one percent of carriers report environmental mandates – including new equipment, speed restrictions, idling protocol, and bio-fuel usage – as a challenge, and 38% cite equipment costs as an obstacle to their businesses. Insurance and liability costs (39%), driver-related costs (35%), and taxes, fees, environmental, regulatory, and compliance cost increases (2%) round out top concerns. Regarding fuel prices, smaller companies have far less critical mass and resources to absorb or pass along price hikes compared to larger operators. During 2008, regional and local haulers had to internalize much of these fuel costs and profits simply to keep customers. (O'Reilly, 2008).

According to Steve Russell, chairman & CEO of Indianapolis-based truckload carrier Celadon Group, there is a capacity shortage, largely the result of an overall shortage of competent drivers, partly the result of the hours of service changes and partly due to the demographic characteristics of the industry. The aging driver population is not being replaced by young people, and the industry is likely to face an almost alarming shortage of drivers in the years ahead. He cites that it does not appear to be a pay issue, but more of a lifestyle one. The American Trucking Association indicates that driver turnover among large fleets is now averaging approximately 125% and about 90% in the smaller fleet segment. Finance companies that finance the industry, such as GE Capital, are indicating that they are seeing no growth among existing fleets and virtually no start-ups. Higher fuel prices have impacted owners' investment decisions but the core issue still appears to be a lack of drivers. (Fleet Owner, 2005). Given the severity of the 2008-2009 economic downturn the shortage of drivers may be mitigated.

The national carriers have identified the lack of drivers as a "limit to growth." This is another reason why intermodal operations have become a key component in their future business strategy.

Independent owner-operators have been especially impacted by high fuel prices and access to credit. They are often dependent upon brokers who charge shippers fuel surcharges but brokers do not always pass fuel surcharges on to the trucker. Traditionally independents, lacking management expertise, have managed their business homogeneously combining capital and operating costs to attain "profitability." Given increasing cost factors such as fuel in a competitive environment, more often than not independents sacrifice return on their labor to offset increases in equipment, fuel and other costs and remain in the business. Many independents may be able to remain in the business but the result is shifting returns from capital to labor. For independents as the price per mile they receive remains static and operating costs increase the only way to survive is to reduce their labor costs. As a result, many independents are working for extremely low (and perhaps unsustainable) wages. Even in good times personal annual income can be $40,000 for being on the road 80 hours per week. Although independents perceive themselves as their own bosses, at $10 per hour this profession is marginal at best for providing a lower middle-class income. Should independents exit the industry in large numbers due to economics, age and lifestyle decisions, (assuming an absence of new independent owner-operators entering the business due to lack of credit) this freight will shift to national and regional carriers. There should be no doubt that if the era of independent owner-operators comes to an end and the industry undergoes significant consolidation, the cost of transporting goods will likely rise, perhaps significantly.

Technology is helping all sectors of the industry but to differing degrees. According to the Motor Freight Market Insight Survey for connecting fleets and drivers in the field or brokers and independents, cell phones remain the option of choice, with 77% of carriers using them for voice communication and 49% for text messaging. Satellite messaging is gaining in popularity 67% of respondents reporting its use, compared to 61% one year ago, while satellite voice communication is less utilized (19%). To capture data and track shipments, 66% of carriers employ satellite devices such as GPS units, while 45% rely on cellular phones, and 12% and 4%,

respectively, use bar codes and radio frequency identification. Trucking companies are improving their Web portals to give shippers and consignees greater control and visibility into transportation decision-making; 87% of carriers provide Web track-and-trace and 80% offer email alert capabilities, empowering customers to be preemptive and proactive in dealing with exceptions or conveying shipment information to consignees. Sixty-six percent (66%) of survey respondents give users logistics Web tools such as activity management reports and online claims filing, while 40% offer online pricing/routing capabilities. Compared to last year's data there has been a considerable increase in the number of carriers offering SKU/pallet-level RFID support, with 20% acknowledging such capabilities. (O'Reilly, 2008). While some technology such as cell phones are "size neutral" the benefits of many other technologies increase as the size of the operation increases furthering the competitive advantages of larger firms. This combined with the other factors cited above could further accelerate consolidation.

In summary, consolidation of the trucking industry will likely accelerate due to a host of factors with small and regional firms and independent owner-operators continuing to exit the industry. However, increasing volumes of freight will still need to be hauled. Assets such as equipment and drivers will be redeployed to better capitalized and organized firms especially the national and stronger regional carriers. Mergers and acquisitions should also accelerate consolidation. In general, consolidation should enable increased intermodal penetration and diversion of some indeterminate percentage of future truck VMT from I-80 to rail.

Incremental increase in intermodal penetration – Moderate

Moderate consolidation of the trucking industry will provide opportunities for diversion of a greater percentage of freight from I-80 to rail. A larger percentage of freight will be hauled by large carriers who are able to utilize UPRR's and BNSF's intermodal services.

Radical increase in intermodal penetration – Low to Moderate

Extreme consolidation of the trucking industry would provide even greater opportunities for intermodal services. Depending on capacity limitations and availability of intermodal

services in terms of quality and quantity and the price differential between intermodal and pure highway transport, the projected number of trucks traveling I-80 between Chicago and SLC/Ogden in the future could be reduced by 10% - 20%.

Indicators:

- Continued consolidation of the trucking industry including reductions in the number of independent owner-operators and small and regional firms as well as mergers and acquisitions.
- Changes in the volume of intermodal business as it relates to the Central Corridor and the announcement of new and expanded business partnerships between UPRR and BNSF and the national carriers.
- Future availability (and shortages) of long-haul drivers.
- Changes in trucking costs, i.e. fuel.

Table 14 summarizes each of the ten first order factors and their impact on future I-80 freight growth through their respective scenario dimensions. Table 14 also includes the likelihood of the outcomes associated with each 1st order factor as well as indicators that if monitored will provide WYDOT with insight as to which scenario is unfolding and which ones are not being realized.

Table 14. Summary of 1st Order Factors on Scenario Dimensions, Likelihoods and Indicators.

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Mega changes in the transportation network	**Expansion of Mexican ports and upgrade of related infrastructure**	Investment of private sector in logistics infrastructure relative to one or more of the Ports Availability and quality of intermodal service and increasing pricing pressure by UPRR and BNSF U.S. government policy on operations of Mexican drivers and Mexican firms' equipment	**Freight flows shift from I-80 to other routes –** Expansion of Mexican ports (if successful on even half the scale envisioned) will capture future market share from the LA/LB ports, probably Oakland and perhaps the Northwest ports. These all feed I-80 eastbound freight and create export points for westbound freight. This will cause a shift of freight patterns south away from SLC/Ogden and I-80. Even if the Panama Canal expansion adversely impacts the Mexican ports, overall dynamics favor a shift of the freight patterns for Asian imports which will also provide alternate export points to the West Coast ports. **Freight flows shift to I-80 from other routes –** Dynamics do not strongly support shifts to I-80 from other routes except under the following set of circumstances: 1) expansion/construction of Mexican ports is suspended or cancelled, 2) over the next 10-15 years the Port of Oakland undergoes growth in the order of four to five times its current volume and 3) containers from the West Coast ports are transported east via rail to SLC/Ogden and trans-loaded to trucks rather than remaining on rail until reaching Chicago or another Midwestern forward staging point.	Moderate – High Low	Lazaro Cardenas – Progress on expansion; growth in container traffic (currently 34th in North America, 100,000 containers annually), Capital investment by KC Southern RR Punta Colonet **–** Progress on development of the port, i.e. planning, bidding, funding Restrictions on Mexican truck drivers and Mexican trucking firms Continued resistance to expansion of LA/LB ports (environmental, health and safety, congestion) Continuing disputes and conflicts with organized labor at the LA/LB ports Continuing shift of manufacturing base away from the upper Mid-west overseas or to the southern U.S., e.g. automobile manufacturing Continuing shift of U.S. population away from the upper Mid-west to southern states

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Mega changes in the transportation network	**Expansion of Panama Canal**	Increasing oil prices drives use of sea transport (most economical and energy efficient) Continued growing demand due to population growth, available wealth and high levels of consumption Transporting Asian imports into the U.S. heartland and exporting U.S. products to Asian shifts from east-west to north-south U.S. government policy on streamlining permitting for dredging projects Available capacity may open up; and pricing power of UPRR and BNSF for intermodal service may decline	**Freight flows shift from I-80 to other routes –** Expansion of the Panama Canal will shift freight bound for the upper Mid-west and Eastern states from the West Coast ports which feed I-80 eastbound. This also creates destination export points for westbound freight. Therefore, this mega change in the transportation network is likely to cause a major shift in freight patterns for Asian exports and U.S. exports) south away from SLC/Ogden and I-80. **Freight flows shift to I-80 from other routes –** Dynamics do not strongly support shifts to I-80 from other routes except under the following set of circumstances: 1) the Panama Canal expansion is cancelled or suspended and/or 2) Gulf Coast ports cannot service the larger ships. Under these circumstances increasing quantities of Asian imports bound for the Midwest will continue their current route arriving at LA/LB and traveling through SLC/Ogden and eastward on I-80 via truck.	Moderate – High Low	Progress on the Panama Canal expansion, i.e. on-schedule, on-budget. Progress on port enhancement projects (e.g. channel dredging) for Gulf Coast and East Coast ports. Private sector investment in logistics and warehouse infrastructure near Gulf Coast and East Coast ports. Accelerated Corp of Engineer and CEQ approval of U.S. port dredging projects. Available debt financing to support dredging and other Gulf Coast and East Coast port expansion projects.

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Mega changes in the transportation network	**Expansion of railroad capacity**	Continued increasing consumer demand for Asian products U.S. government policy on rail re-regulation, incentives for railroads to make greater capital investments	**Freight flows shift from I-80 to other routes –** Expansion of capacity along UPRR's southern route and focusing capital investment on containerized freight (i.e. freight that could be transported in trucks across I-80) will tend to concentrate more east-west containerized freight south of SLC/Ogden and I-80. Investments by BNSF will expedite containerized freight from Oakland and LA/LB and move it east to Kansas City and Chicago – again adding intermodal capacity and re-routing freight patterns away from SLC/Ogden and I-80. Additional intermodal capacity and associated evolution in the supply chain should enable more freight placed on rail at the ports, to remain on rail all the way to the Midwest. In this case, despite the forecasted doubling of Asian trade within ten years, the corresponding proportional growth in I-80 truck VMT is projected to be lower. As freight patterns shift south it is possible that some UPRR capacity on the Central Corridor (which parallels I-80 and runs from Chicago to Oakland) could be freed-up and used for more domestic intermodal freight potentially diverting more freight from trucks traveling I-80 to rail further reducing some of the projected growth in truck VMT on the I-80 corridor. **Freight flows shift to I-80 from other routes –** Dynamics do not strongly support shifts of freight currently on rail to I-80 except under the following circumstances: 1) if the railroads cannot increase their capacity and capture an increasing share of the growth in Asian imports (e.g. due to disincentives to invest) this freight will travel east to the Midwest via truck as this is the only alternative. Since I-80 is a preferred route from the West Coast to Chicago, I-80 freight volumes could be expected to materially increase. As discussed above, expansion of the Mexican ports and the Panama Canal are expected to move much of the freight flows associated with the growth of Asian trade south and away from I-80.	Moderate Low	Continued capital investment in capacity expansion in track and intermodal facilities which directly or indirectly impact truck VMT on I-80. Success of UPRR and BNSF in creating new capacity by operational efficiencies and productivity gains. Changes in government policies which encourage or discourage capital railroad investments. Future mergers of the western railroad(s) with the eastern railroads.

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Changes in Supply and Demand or Origin/ Destination for Products Transported via I-80	**Logistics infrastructure investment by firms**	Oil prices and availability U.S. and global economic health U.S. population growth U.S. consumer level of consumption Differential in U.S. versus global labor costs and environmental, health & safety and labor laws	**3% annual increase in I-80 Freight Volumes –** Although logistics investments in areas of the supply chain connecting the West Coast with the upper Midwest will continue to grow, growth will be incremental and more on a scale needed to support population growth and associated increased economic activity. Again, since food is the major product transported across I-80 between SLC and Chicago a large percentage of this freight stream is unlikely to change. **5% annual increase in I-80 Freight Volumes –** It is expected that logistics investments in the Southeastern U.S. and locations other than LA/LB and SLC/Ogden portend a material shift of Asian freight flows into the U.S. – from the Gulf Coast and the southern Atlantic Coast ports a large majority of freight will be transported inland to Dallas, Memphis, Chicago, St. Louis, Kansas City and other distribution points rather than originating from the West Coast ports. Chicago's role as a transcontinental freight hub and its contribution to the growth in I-80 freight volumes may be reduced.	Moderate Low	Capital investment by firms in areas surrounding the Gulf Coast and Southeastern U.S. ports including warehousing, cranes, rail sidings, etc. Increasing trends in container unloadings at these ports. Closing of warehouse facilities or absence of growth in new facilities in southern California and/or SLC/Ogden.
	Comparative advantage in manufacturing (imports/ exports)	Differential in U.S. versus global labor costs and environmental, health & safety and labor laws	**3% increase in I-80 Freight Volumes –** Although Asian trade (bi-directional) is expected to continue to contribute to the growth of I-80 freight volumes it is not expected to increase I-80 freight volumes proportionally. Therefore, the contribution to the growth in I-80 freight volumes from Asian trade is expected to be incremental but less than that experienced over the past 10 years. **5% increase in I-80 Freight Volumes –** Asian trade could increase I-80 freight volumes if future demand for intermodal transport from the West Coast ports outstrips the capacity of UPRR and BNSF forcing a high percentage of Asian freight on trucks bound for the Midwest through SLC/Ogden.	Moderate Low	Container traffic at the West Coast ports and percentage leaving the ports via train. Throughput of UPRR's SLC intermodal facility. Long-term costs of oil in the range of $75 $100 per barrel. Shift of manufacturing from Asia to Mexico. Increase or decrease in truck counts northbound on I-15.

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Changes in Supply and Demand or Origin/ Destination for Products Transported via I-80	**U.S. market size (demand)**	U.S. population U.S. and global economic "health"	**3% increase in annual I-80 Freight Volumes –** Growth in I-80 freight volumes are linked to population densities, population growth and economic growth in the upper Midwest and West Coast states. Related growth should remain stable due to the volume of freight related to basic consumptive needs such as food, household products and building materials. **5% annual increase in I-80 Freight Volumes –** Normal or below average growth in population and economic activity in the upper Midwest should contribute to declining growth rates in I-80 freight volumes. This decline may be offset by increases in freight due to growing populations and economies of the West Coast states. It is likely that the U.S. automotive industry will reduce output by perhaps 50% over the next five years which will affect I-80 freight volumes. Should the U.S. auto industry suffer bankruptcy and liquidation I-80 related freight would likely decline by approximately five percent.	High Low	Viability of the U.S. auto manufacturing industry. Changes in population growth of the upper Midwest and the West Coast states. Decline or growth of upper Midwest manufacturing operations or migration overseas and to southern states.

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Changes in Supply and Demand or Origin/ Destination for Products Transported via I-80	**Economic "health" of U.S. consumers**	U.S. and global economic "health" U.S. consumer level of consumption	**3% annual increase in I-80 Freight Volumes –** Due to the current economic climate and numerous forecasts, for the next 3-5 years significant declines in consumption of discretionary consumer products and product-related services could be expected. This will have a corresponding impact on freight movement associated with these products in the near-term. Over a longer time horizon, the U.S. economy is expected to recover and discretionary consumer spending rise, but not repeat 4% annual growth for a sustained 10-year period. **5% annual increase in I-80 Freight Volumes –** Absent a rapid economic turn-around and real long-term, sustainable gains in employment and income across a large percentage of the lower and middle-class it is unlikely that freight volumes associated discretionary consumer spending will attain their former levels.	High Low	U.S. unemployment rate especially states in the upper Midwest and on the West Coast. Gains in productivity and income for members of the middle-class. Home price appreciation. Deflationary pressures which motivate consumers to defer purchases. Large-scale shifts in consumer sentiment that eschews "excessive" consumption of material goods. Purchasing power of the U.S. dollar relative to the currencies of imported consumer discretionary products.
Changes in Intermodal Market Penetration (relative to I-80 freight)	**Competitive-ness of trucking vs. rail**	Oil prices and availability U.S. government policy on rail re-regulation, incentives for railroads to make greater capital investments Re-structuring of U.S. trucking industry	**Incremental increase in intermodal penetration –** UPRR intermodal penetration on the Central corridor may increase and divert some freight volume from I-80 to rail. However, relative to 10-year forecast for increases in domestic freight volumes it is doubtful that any increase in intermodal penetration will keep pace with the overall increase in future I-80 freight volumes. **Radical increase in intermodal penetration –** Given current UPRR capacity constraints, without a major capital investment (perhaps in the order of $3-5 billion) in an additional track, UPRR will not have the capacity nor the business inclination to capture an increasing share of the freight volumes traveling between Chicago and SLC/Ogden.	Low to Moderate Low	UPRR investment in additional track along the Central Corridor especially in Wyoming and other states where capacity bottlenecks exist. Type of intermodal activity at UPRR's SLC facility, i.e. car loadings/unloading, trucks entering/leaving facility and whether they are loaded or empty and their direction of travel. Strategic relationships between major trucking companies and UPRR to

Scenario Dimension	1st Order Factors	Relevant 2nd Order Factors and Assumptions, Other 1st Order Factors	Impacts to Position on Scenario Dimensions	Likelihood	Indicators
Changes in Intermodal Market Penetration (relative to I-80 freight)					increase intermodal freight volumes. See *Expansion of Railroad Capacity* indicators delineated above.
	Re-structuring of U.S. trucking industry	Oil prices and availability Expansion of Mexican ports and upgrade of related infrastructure Expansion of railroad capacity Expansion of Panama Canal Competitiveness of rail vs. trucking Availability of "land ferry" service	**Incremental increase in intermodal penetration –** Moderate consolidation of the trucking industry will provide opportunities for diversion of a greater percentage of freight from I-80 to rail. A larger percentage of freight will be hauled by large carriers who are able to utilize UPRR's and BNSF's intermodal services. **Radical increase in intermodal penetration –** Extreme consolidation of the trucking industry would provide even greater opportunities for intermodal services. Depending on capacity limitations and availability of intermodal services in terms of quality and quantity and the price differential between intermodal and pure highway transport, the projected number of trucks traveling I-80 between Chicago and SLC/Ogden in the future could be reduced by 10% - 20%.	Moderate Low – Moderate	Continued consolidation of the trucking industry including reductions in the number of independent owner-operators and small and regional firms as well as mergers and acquisitions. Changes in the volume of intermodal business as it relates to the Central Corridor and the announcement of new and expanded business partnerships between UPRR and BNSF and the national carriers. Future availability (and shortages) of long-haul drivers. Changes in trucking costs, i.e. fuel costs.

The three scenario dimensions and the two outcomes for each dimension which make up the eight I-80 truck growth scenarios are depicted in Figure 85.

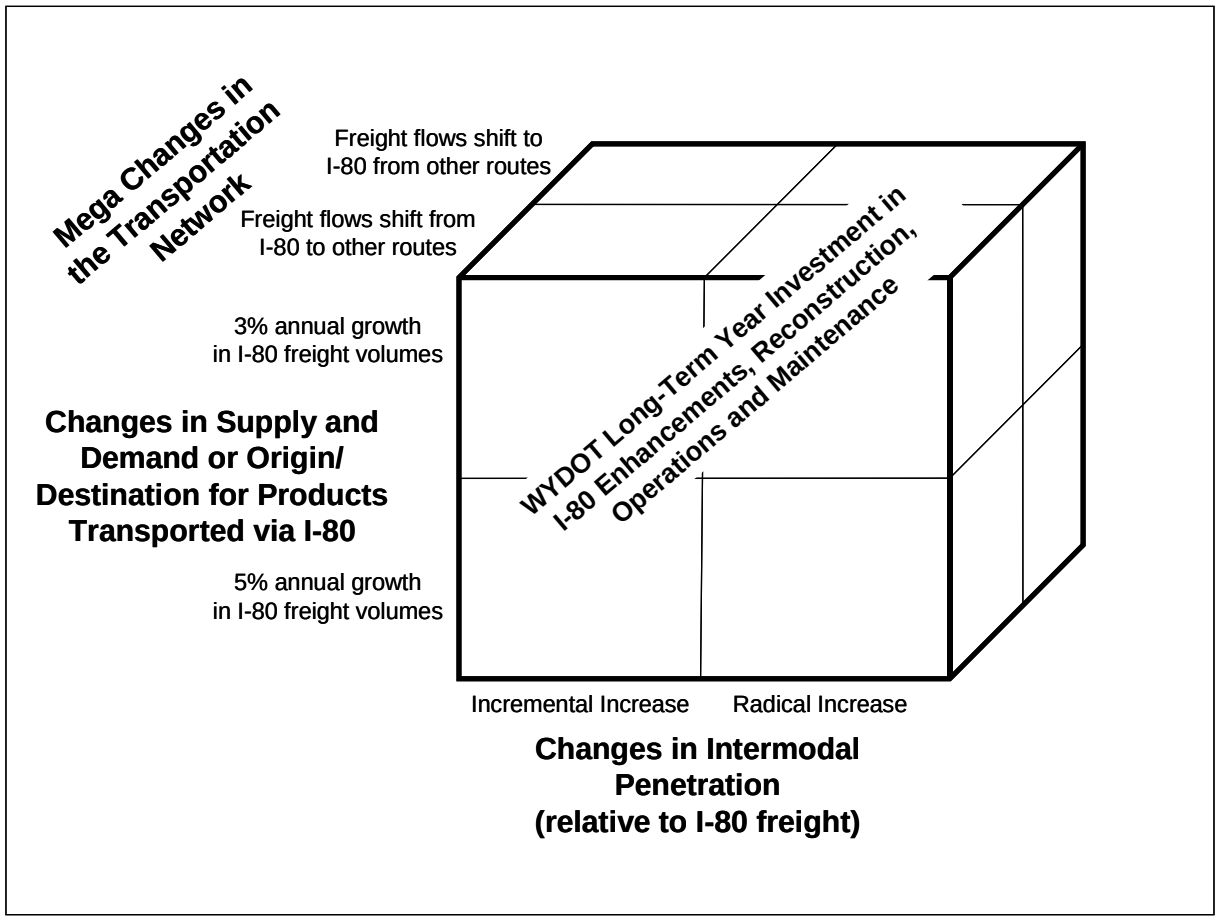


Figure 85. I-80 Freight Growth Scenario Framework.

Table 15 summarizes the eight scenarios in terms of one scenario dimension, *Changes in Supply/Demand or Origin/Destination for Products Currently Transported via I-80* and the cumulative likelihood of each scenario based on Table 14.

This concludes development of the eight I-80 growth scenarios. Synthesis of the information contained in this table will used in subsequent scenario analysis in the next chapter.

Table 15. Forecasted Range and Cumulative Likelihood for Each I-80 Freight Growth Scenario.

Scenario	Changes in Supply/Demand or Origin/Destination for Products Currently Transported via I-80	Cumulative Likelihood for the Scenario
1	3% Increase in annual I-80 freight volume 3%	Moderate to High
2	3% Increase in annual I-80 freight volume 3%	Low to Moderate
3	5% Increase in I-80 Freight Volumes 5%	Low
4	5% increase in I-80 Freight Volumes 5%	Low
5	3% Increase in annual I-80 freight volume 3%	Low to Moderate
6	3% Increase in annual I-80 freight volume 3%	Low to Moderate
7	5% increase in I-80 Freight Volumes 5%	Low
8	5% increase in I-80 Freight Volumes 5%	Low

Chapter 6 – Scenario Analysis

This chapter analyzes the eight truck traffic growth scenarios constructed in the previous chapter. Each scenario or groups of scenarios are examined with respect to average growth in freight volumes (i.e. truck VMT), relative likelihood of the scenario being realized and the estimated cost to maintain the I-80 facility in its current capacity and condition given these growth projections.

Expected Value Approach to Derive I-80 Growth Forecasts

An Expected Value approach was used to with a simple model was used to derive forecasted I-80 growth rates for each of the eight scenarios. Expected values are the mathematical product of outcome (i.e. the estimated increase or decrease on future I-80 truck growth rates) and probability (i.e. the likelihood of the outcome being realized). The model has three elements: 1) a base growth rate of 3% or 5%, 2) which is increased or decreased due to mega changes in the transportation network and 3) decreased based on the extent (radical or incremental) of future intermodal market penetration. Each of these three elements has a likelihood associated with each of the two possible outcomes.

For each of the three scenario dimensions, Table 16 maps each 1st order factor to the likely and unlikely outcomes. These were used to derive aggregate likelihoods for each expected outcome for the three dimensions. These aggregate likelihoods are quantified using a 3-point scale. **Low** likelihood was assigned a 33% chance of occurrence. **Moderate** likelihood was given a 66% chance of occurrence. A **moderate – high** likelihood was given an 82% chance of occurrence. There were no outcomes with 0% chance of occurrence in any of the scenarios since by nature something that has no probability of occurring is infeasible. Similarly, no potential scenario outcomes were given a 100% chance of occurrence, i.e. there were no purely *high* likelihoods assigned; a 100% likelihood would imply certainty and therefore, would be constant across scenarios. For each of the three scenario dimensions these likelihoods were multiplied by values representing percentage contribution to I-80 freight growth.

The model for forecasting truck growth rates incorporates three elements. Each element is associated with one of the three axes of the scenario dimension framework. These three elements are:

1. **Changes in Supply and Demand or Origin/Destination for Products Transported via I-80 -** Annual growth in I-80 freight volumes of 3% and 5% serve as the two base values. These base growth rates are modified by adding or subtracting percentage growth based on values derived for the other two axes. In terms of likelihoods, based on analysis in the preceding chapter, a 3% base growth rate has a likelihood of **moderate to high** due to the linkage to population growth while a 5% base growth rate has a likelihood of **low** due to east-west freight patterns shifting to north-south, trends to regional manufacturing and distribution and limits on additional freight driven by just-in-time practices.

2. **Mega Changes in the Transportation Network –** This has two components – probability and impact. It is assumed that changes in the overall transportation network as described in the previous chapter could increase or decrease annual growth in I-80 freight volume by 1%. Again, as much as 50% of the freight that travels I-80 is linked to west coast and upper Midwest population and manufacturing centers; this is domestic freight that cannot or will not easily shift regardless of changes in the global transportation network. This is strictly an assumption that in the future freight volumes equivalent to one in four or five trucks could be re-routed onto or away from I-80 due to mega changes in the transportation network; this assumed contribution would have to be further analyzed. As shown in Table 16, the two outcomes for this scenario dimension are a **moderate-high** likelihood that freight volumes will shift from I-80 to other routes and a **low** likelihood that freight volumes will shift to I-80 from other routes.

   The model equation for the **moderate-high** likelihood outcome is:
   -1% * 0.82 = - 0.82%.

   The model equation for the **low** likelihood outcome is:
   +1% * 0.33 = 0.33%.

3. **Changes Intermodal Penetration (relative to I-80 freight) –** This also has two components – probability and impact. As shown in Table 16, there are two outcomes: incremental and radical intermodal penetration. It is assumed that changes in incremental intermodal penetration reduce I-80 freight growth by 0.5% or approximately 100 truck trips per day and continue to capture that growth in freight volume. This seems reasonable given that 17% of the 5-7,000 trucks per day (i.e. 850 to 1,190 trucks per day) are presently traveling at least 1,500 miles on I-80. Radical intermodal penetration is assumed to reduce I-80 freight growth by 2%, the equivalent of 400 truck trips per day. This represents a potentially significant and direct impact for diverting a large number of trucks from I-80. Table 16 shows the two outcomes for this scenario dimension is **moderate** likelihood of incremental intermodal penetration and **low** likelihood of radical intermodal penetration.

   The model equation for the **moderate** likelihood of incremental intermodal penetration is: -0.5% * 0.66 = -0.33%.

   The model equation for the **low** likelihood of radical intermodal penetration is: -2% * 0.33 = -0.66%.

After the forecast for growth rates were calculated, a forecast range was established by adding and subtracting 0.5%. Using this approach the forecasted growth rate for I-80 under Scenario #1 is: 3% - (1%*0.82) – (0.5% *0.66) = 1.85%. Adding and subtracting 0.5% gives a projected growth range for Scenario #1 between 1.3% and 2.4%. A similar calculation was performed for all eight scenarios. The results are shown in Table 17.

Sensitivity analysis was performed to validate the approach over extreme values for low and high growth rates. Values for average growth rate across the eight scenarios varied from a low of 1.5% (3%-.82%-.66%) to a high of 5.5 (5%+.82%-.33%)

All scenarios with a baseline growth rate of 5% are assumed to have a low likelihood of occurrence since the 1st order factors do not support high growth beyond population growth (i.e.

2%-3%) given the stated assumptions. Also, scenarios showing a shift of freight volumes to I-80 from other routes have a low probability of occurrence. From this, a cumulative likelihood for each scenario was derived and is shown in Table 17.

Table 16. Expected Impact and Likelihood of 1st Order Factors on Their Respective Dimensions of the Scenario Framework.

Scenario Framework Dimension	1st Order Factor of Scenario Framework Dimension	Expected impact of 1st Order Factor, i.e. position on the Scenario Framework Dimension	Likelihood of Expected Impact	Overall Likelihood of Position on Scenario Framework Dimension
Changes in supply/demand or origin/destination for products currently transported via I-80	**Logistics infrastructure investment by firms**	**3% increase** in I-80 freight volumes	Moderate	**High** likelihood of a **3%** annual increase in I-80 freight volumes **Low** likelihood of a **5%** annual increase in I-80 freight volumes
		5% increase in I-80 freight volumes	Low	
	Comparative advantage in manufacturing (imports/exports)	**3% increase** in I-80 freight volumes	Moderate	
		5% increase in I-80 freight volumes	Low	
	U.S. market size(demand)	**3% increase** in I-80 freight volumes	High	
		5% increase in I-80 freight volumes	Low	
	Economic "health" of U.S. consumers	**3% increase** in I-80 freight volumes	High	

Scenario Framework Dimension	1st Order Factor of Scenario Framework Dimension	Expected impact of 1st Order Factor, i.e. position on the Scenario Framework Dimension	Likelihood of Expected Impact	Overall Likelihood of Position on Scenario Framework Dimension
Mega Changes to the transportation network	**Expansion of Mexican ports and upgrade of related infrastructure**	Freight flows shift **<u>from</u>** I-80 to other routes	Moderate - High	**Moderate – High** likelihood that freight will shift **<u>from</u>** I-80 to other routes **Low** likelihood that freight will shift **<u>to</u>** I-80 from other routes
		Freight flows shift **<u>to</u>** I-80 from other routes	Low	
	Expansion of Panama Canal	Freight flows shift **<u>from</u>** I-80 to other routes	Moderate – High	
		Freight flows shift **<u>to</u>** I-80 from other routes	Low	
	Expansion of Railroad Capacity	Freight flows shift **<u>from</u>** I-80 to other routes	Moderate	
		Freight flows shift **<u>to</u>** I-80 from other routes	Low	

Scenario Framework Dimension	1st Order Factor of Scenario Framework Dimension	Expected impact of 1st Order Factor, i.e. position on the Scenario Framework Dimension	Likelihood of Expected Impact	Overall Likelihood of Position on Scenario Framework Dimension
Changes in intermodal penetration (relative to I-80 freight)	**Competitiveness of trucking vs. rail**	Incremental increase in intermodal penetration	Moderate	**Moderate** likelihood of **<u>incremental</u>** increase in intermodal penetration **Low** likelihood of **<u>radical</u>** increase in intermodal penetration
		Radical increase in intermodal penetration	Low	
	Restructuring of U.S. trucking industry	Incremental increase in intermodal penetration	High	
		Radical increase in intermodal penetration	Low-Moderate	
	Availability of "land ferry" intermodal service	Incremental increase in intermodal penetration	Low	
		Radical increase in intermodal penetration	Low	

Table 17. Forecasted Range and Cumulative Likelihood for Each I-80 Freight Growth Scenario

Scenario	Changes in Supply/Demand or Origin/Destination for Products Currently Transported via I-80	Mega Changes in the Transportation Network	Changes in Intermodal Penetration (relative to I-80 freight)	Calculated Truck VMT Growth Rate	Forecast Range for Truck VMT Growth Rate(+/- 0.5%)	Cumulative Likelihood for the Scenario
1	3% Increase in annual I-80 freight volume 3%	Shift from I-80 to Other Routes = -1% * 0.82 = -0.82% -0.82%	Incremental Increase = -0.5% * 0.66 = -0.33% -0.33%	1.8%	1.3% - 2.4%	Moderate to High
2	3% Increase in annual I-80 freight volume 3%	Shift from I-80 to Other Routes = -1% * 0.82 = -0.82% -0.82%	Radical Increase = -2% * 0.33 = -0.66% -0.66%	1.5%	1.0% - 2%	Low to Moderate
3	5% Increase in I-80 Freight Volumes 5%	Shift from I-80 to Other Routes = -1% * 0.82 = -0.82% -0.82%	Incremental Increase = -0.5% * 0.66 = -0.33% -0.33%	3.8%	3.3% - 4.3%	Low
4	5% increase in I-80 Freight Volumes 5%	Shift from I-80 to Other Routes = -1% * 0.82 = -0.82% -0.82%	Radical Increase = -2% * 0.33 = -0.66% -0.66%	3.5%	3.0% - 4.0%	Low
5	3% Increase in annual I-80 freight volume 3%	Shift to I-80 from Other Routes = 1% * 0.33 = 0.33% 0.33%	Incremental Increase = -0.5% * 0.66 = -0.33% -0.33%	3.0%	2.5% - 3.5%	Low to Moderate
6	3% Increase in annual I-80 freight volume 3%	Shift to I-80 from Other Routes = 1% * 0.33 = 0.33% 0.33%	Radical Increase = -2% * 0.33 = -0.66% -0.66%	2.7%	2.2% - 3.2%	Low to Moderate
7	5% increase in I-80 Freight Volumes 5%	Shift to I-80 from Other Routes = 1% * 0.33 = 0.33% 0.33%	Incremental Increase = -0.5% * 0.66 = -0.33% -0.33%	5.0%	4.5% - 5.5%	Low
8	5% increase in I-80 Freight Volumes 5%	Shift to I-80 from Other Routes = 1% * 0.33 = 0.33% 0.33%	Radical Increase = -2% * 0.33 = -0.66% -0.66%	4.7%	4.2% - 5.2%	Low

Forecasted I-80 Growth Rates for Each Scenario

The cumulative likelihood for each scenario growth rate shown in Table 16 was determined as follows:

- Scenarios #3, #4, #7 and #8 were assigned a *Low* likelihood because the baseline growth assumption of 5% is not strongly supported by qualitative analysis of the ten 1st order factors. Scenarios #7 and #8 appear to most closely align with projections from USDOT's Freight Analysis Framework. Structural dynamics such as changes in the transportation network creating alternate routes for growing imports (and exports), regionalization of manufacturing and distribution driven by higher long-term fuel costs and continual reductions in manufacturing in the Midwest and location of new manufacturing shifting to Southern states, indicate that growth of I-80 truck volumes over 5% are highly unlikely under the stated assumptions. Given these dynamics continuation of I-80's 10-year historic growth rate of 4.4%, while possible, is also forecast as unlikely since 4.4% growth is within the range of only two Scenarios #7 and #8 – which are a low probability.

- Scenarios #5 and #6 were assigned a *Low to Moderate* likelihood. These two scenarios have a 3% growth rate but also include a shift of freight to I-80 from other routes which is not supported by qualitative analysis of the ten 1st order factors. On the contrary, it is highly likely that emerging freight patterns will shift freight away from I-80 as some freight patterns shift from east-west to north-south.

- Scenario #2 was assigned a *Low to Moderate* likelihood since it is comprised of a 3% baseline growth rate and freight shifting away from I-80 but includes a radical increase in intermodal penetration. Scenario #2 forecasts the lowest growth rate – between one and two percent. A growth rate of less than 2% is highly unlikely given the dominant role of SLC/Ogden with its convergent Interstates, railroads, land space, pro-growth climate, existing transportation assets and critical mass of companies (in addition to the fact that a sizeable number of I-80 freight shipments are related to food and household

products). In addition, the structural dynamics of population growth (on the West Coast and the upper Midwest) and the percentage of products shipped on I-80 that are directly linked to these population densities make growth in freight below the expected growth in population unlikely. However, it is worth monitoring. If Scenario #2 is realized it will have a significant impact on allocation of future WYDOT expenditures as well as revenue projections.

- Scenario #1 was assigned a *Moderate to High* likelihood since qualitative analysis of the ten 1st order factors support all three outcomes: 1) a 3% baseline growth rate, 2) expected shift of freight from I-80 and 3) incremental increase in intermodal penetration. Scenario #1 with its 1.3% to 2.4% forecasted growth rate is judged to be the most likely of all eight scenarios.

Forecasted I-80 Growth Rates and Associated 30-Year Cost to Maintain I-80 for Each Scenario

One of the most important outputs of this study is to better bound WYDOT's expected future costs to maintain I-80. These costs are largely driven by pavement wear caused by truck traffic. To accomplish this, the strategic simulation model developed for WYDOT in a previous I-80 study was used to quantify estimated future costs to maintain I-80 for the eight freight growth scenarios. The model assumes WYDOT would maintain I-80 in its current configuration (in terms of lane miles and materials). WYDOT provided reconstruction costs for asphalt and concrete as well as construction inflation estimates. (Schneider and Redd, 2006.) The simulation model was run to determine the 30-year estimated costs to maintain I-80 given truck traffic growth rates of 2%, 3%, 4%, 5% and 6%.

Table 18 shows the estimated 30-year cost to maintain I-80 for each scenario. The scenarios bound the expected future costs to a lower range of approximately $4 billion and an upper range of $6.5 billion. Scenario #1 has the second lowest forecasted growth rate of truck volumes; consequently it has the second lowest estimated 30-year cost.

Figure 86 shows the cost of each scenario. Six of the eight scenarios forecast that the growth in I-80 truck traffic will be below the 4.4% average of the past ten years. The two extreme scenarios, Scenario #2 and Scenario #7, bound the estimates and have relatively low likelihoods. Figure 87 shows likelihood of each scenario, forecasted growth range and the estimated 30-year cost to maintain I-80 given the forecasted growth rate. Scenarios with the highest estimated costs have the lowest likelihood. Figure 88 shows the scenario framework with each of the eight scenario cubes populated with the expected growth rate, estimated 30-year costs to maintain I-80 and likelihood.

Table 18. Estimated 30-Year Cost to Maintain I-80 for Each Scenario.

Scenario #	Forecast Range for Truck VMT Growth Rate	Estimated 30-year Cost to Maintain I-80 Current Capacity and Condition (x $1,000,000,000)	Likelihood
1	1.3% - 2.4%	4.3	Moderate to High
2	1.0% - 2%	< 4.3	Low to Moderate
3	3.3% - 4.3%	5.7	Low
4	3.0% - 4.0%	5.5	Low
5	2.5% - 3.5%	4.7	Low to Moderate
6	2.2% - 3.2%	4.4	Low to Moderate
7	4.5% - 5.5%	6.5	Low
8	4.2% - 5.2%	6.2	Low

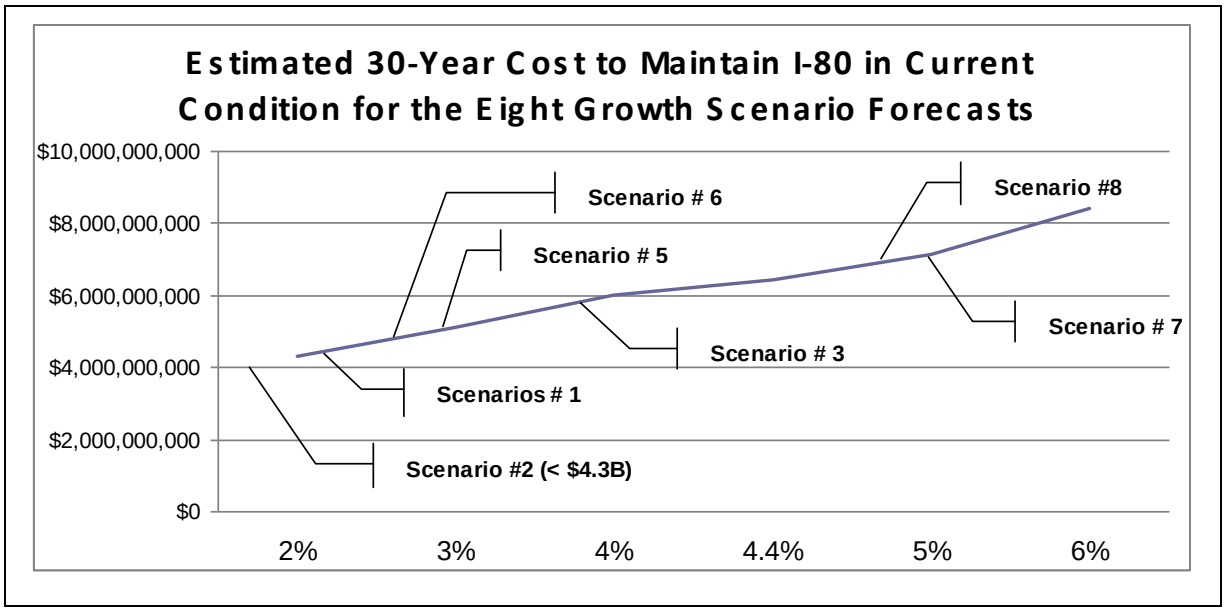


Figure 86. Estimated 30-Year Cost to Maintain I-80 for Each Scenario.

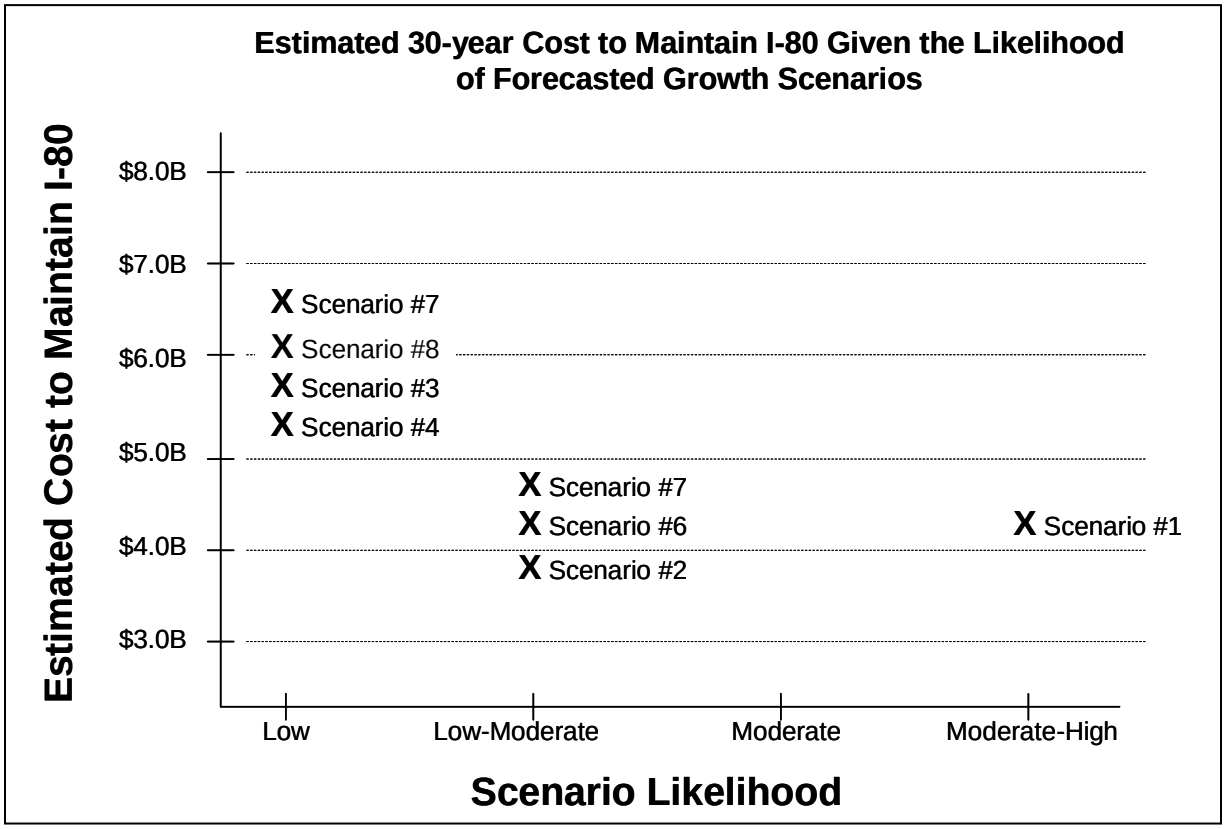


Figure 87. Estimated 30-Year Cost to Maintain I-80 for Each Scenario and Likelihood.

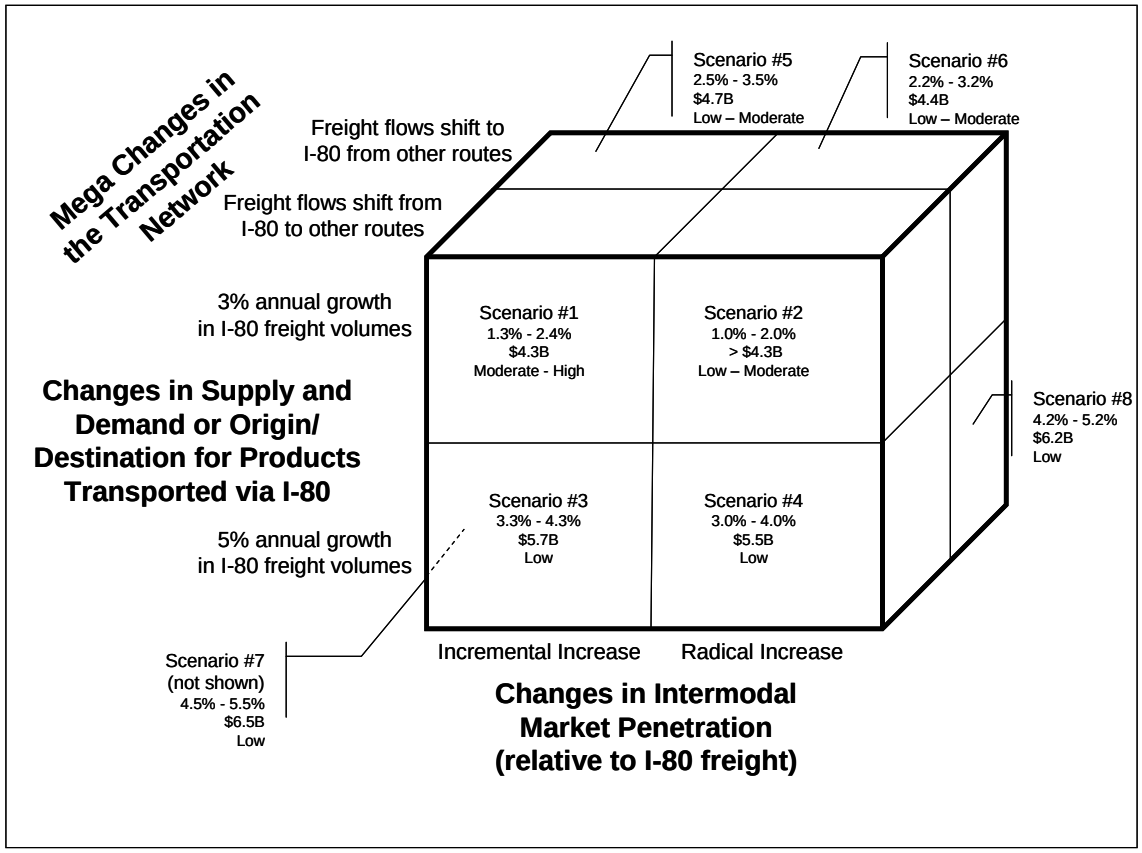


Figure 88. Scenario Framework Showing for each Scenario Expected Growth Rates, Estimated 30-Year Costs to Maintain I-80 and Likelihood.

Scenario Indicators

Sets of indicators for each scenario are given in Table 14. Using these indicators a scenario scorecard could be developed. The scorecard could be used for monitoring these indicators based on on-going events and trends along with traffic counts to gain insight into which scenario is materializing. The scenario framework can be used for developing new scenarios based on future events and trends. These tools should provide WYDOT with improved forecasting for strategic planning, programming and budgeting purposes.

Conclusion

With an average of over 6,000 trucks per day currently traveling Wyoming Interstate 80 and truck traffic expected to double over the next 15 years, assumptions in truck traffic growth may drive major WYDOT investment decisions. In a previous study WYDOT was presented with the ramifications, (i.e. expected pavement costs, and impacts on congestion, mobility, safety and emissions) from increasing truck traffic (Schneider and Redd, 2006). The study assumed a 4.4% annual growth rate in truck VMT. Required 30-year funding for these scenarios varied several billion dollars for a "stay the course" strategy versus a "material changeover" (from asphalt to concrete) and additional capacity. The proposed "stay the course" strategy maintained the same materials and capacity. The "material changeover" strategy provided the benefit of reducing the amount of reconstruction and adverse impacts on mobility and safety. These represent two very different investment strategies.

The best strategy is driven by sound forecasts in the growth of truck traffic which also accounts for "known unknowns" using focused contingency planning. In this study only two scenarios (each with low probability) forecasts that freight volumes will increase at an average annual rate of 4.4% or more. This study suggests that due to mega changes in the transportation network, changes in supply and demand or origin/destination for products transported via I-80, and changes in intermodal penetration, I-80 will not experience the expected increase in truck traffic growth forecasted by USDOT's FAF and a linear extrapolation of the previous 10 years of growth. Truck volumes are not projected to decrease, rather the annual rate of growth in truck volumes is forecasted to decrease from its most recent ten-year 4.4% average to somewhere closer to 2%. Based on this study and under the most likely scenario and the most likely set of scenarios, if a WYDOT asset management strategy of "stay the course" versus materials changes is being contemplated variations of truck growth rate forecasts with attention to the lower bound growth forecasts should be used in the planning calculations.

Like Wyoming other I-80 corridor states (Nevada, Utah, Nebraska and Iowa) must continue to invest in operating and maintaining this freight corridor despite the disproportionate amount of pavement damage done by trucks traveling I-80 between Chicago and SLC/Ogden. Corridor states also bear the burden of keeping I-80 open in severe weather even though the primary

beneficiary of most of this interstate commerce and the related economic interests are far removed from these states. In the absence of any mega changes in the transportation network, diversion of northern U.S. east-west freight from Interstate 80 to UPRR's Central Corridor holds the only hope of slowing the growth in the number of trucks on western and mid-western the I-80 corridor.

As a result of this study planners have a better understanding of freight flows along the I-80 corridor. Data generated from this study will be available for use by other practitioners. Key factors influencing possible changes in these patterns have been identified and a set of primary indicators have been developed which can be periodically updated and monitored by WYDOT freight planners and others across the corridor. This should provide planners with a more consistent and accurate set of information to factor into planning efforts such as their STIP and long-range programming and revenue sourcing strategies.

Given the similarities with the other two major east-west corridors (I-40/BNSF and I-10/UPRR) the outcome of this research could serve as a model for similar studies on these two major east-west freight corridors. If this approach and results prove useful the extensibility of this effort to these corridors should positively impact most of the transportation agencies and their constituents across much of the Western and Midwestern United States.

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Appendix A – I-80 Freight Survey

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WYDOT/USDOT I-80

Survey Taker: MA
Location: Evanston POE
Date/Time: _____

Name of Respondent: _____
Phone #: _____ Age: _____
Home: _____, _____
City/town State

☐ Independent Owner-Operator Name of Firm: _____

☐ Non-owner-operator Name of Firm: _____

Origin: _____ _____ _____
City State Start Date/Time

Destination: _____ _____ _____
City State Delivery Date/Time

Will you get penalized if your load is not delivered on-time? ☐ Yes ☐ No

Is your truck: ☐ Loaded ☐ Empty

What type of trailer are you hauling: ☐ Van ☐ Reefer ☐ Flatbed ☐ Tanker
☐ Hopper ☐ Other: _____

What are you hauling: _____ , _____,
_____, _____

How often do you drive this section of I-80? _____

How could I-80 be improved?

☐ more rest areas/truck parking areas ☐ more passing lanes
☐ more dynamic messaging signs ☐ more effective use of messaging signs

Other:_____
_____

How long have you been driving? _____years

How long do you plan to continue driving? _____years

Are you satisfied with your profession? ☐ Yes ☐ No

If not, why not:

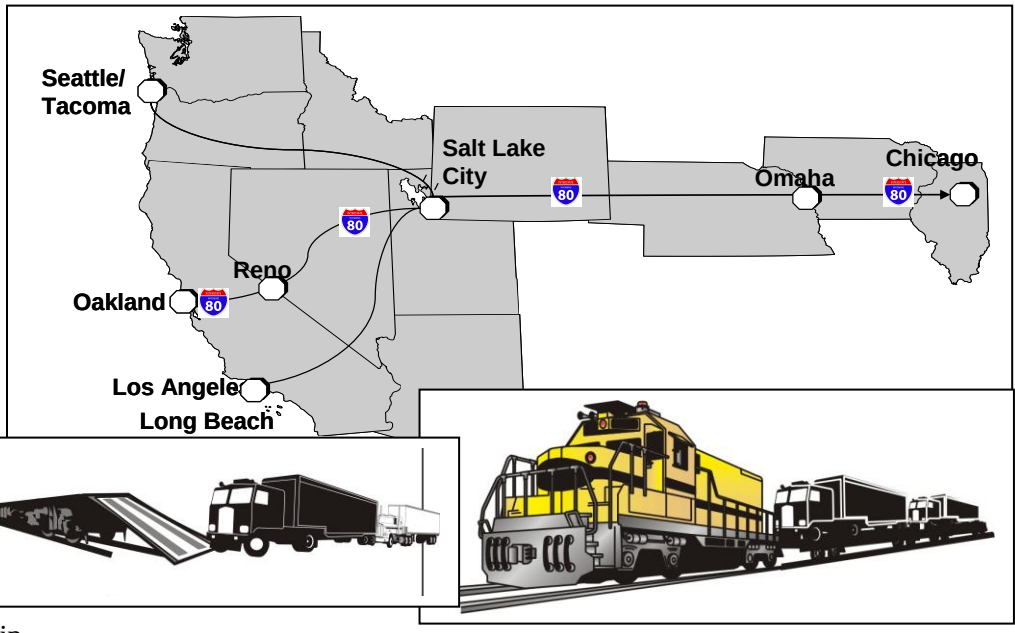
_____

_____

_____

Describe a New Type of Transport Service

A new type of service, called the land ferry, is being studied. The service would serve truckers by transporting their rigs most of the length of I-80 – about 1,400 miles from Ogden, UT to Chicago. The service would operate 24/7 in nearly any weather. There would be 6-12 departures per day. Truckers would drive their rigs onto the train and accompany their rigs by riding in a sleeper passenger car on the train (or a bus). The 1,400-mile trip would take about 28 hours. At the destination, the drivers drive their rigs off the train and make the final-leg of the trip.



Would you be interested in this land ferry service if it gets you to your destination:

☐ In the same time
☐ 12 hours faster
☐ 24 hours faster

Based on charging shippers $2.00 per mile, what would you be willing to pay for this land ferry service? ☐ $1.10 per mile ☐ $0.90 per mile ☐ $0.70 per mile

Assuming you were using the land ferry service, would you prefer to be transported in:

☐ railroad sleeper car with my rig ☐ chartered bus ☐ no preference

If not interested, why? ☐ will lose my job ☐ like driving ☐ will never work
Other: _____
_____

Appendix B – Walmart Freight Information and Data

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Walmart Freight Information and Data

1. Freight Volume

According to data provided by Walmart, on average 534 trucks per day traverse I-80 across Wyoming. This is approximately 5.8% of Walmart's daily truck volume.
Of these the 534 trucks per day 181 (34%) are Walmart owned and 353 and (66%) are contract carriers.
Eastbound and westbound volume for the past year is provided in the table below.
Cheyenne to Pine Bluffs 23.2%
Cheyenne to Evanston 69.3%
Cheyenne to Laramie 7.4%
Evanston to Cheyenne 29.7%
Evanston to Pine Bluffs 70.3%

2. Use of Intermodal

Walmart does not use intermodal along the I-80 corridor. Intermodal is used primarily for imports arriving at the port of Tacoma, WA for shipment to the Midwest and Savannah, GA for shipment to along the East coast.
Walmart does not foresee an increase in the use of intermodal in the near future.
Most truck trips are less than 400 miles with the drivers leaving and returning in the same day. Contract carriers are used for longer hauls.

3. Changes in Freight Patterns

Walmart has deliberately diversified its freight patterns to manage risk. Imports arrive at five major ports (LA/Long Beach, Oakland, Tacoma, Houston and Savannah). Walmart does not expect a major shift in freight patterns when the capacity of the Panama Canal increases.

4. Alternative Fuels

Walmart is not testing CNG in its truck fleet and has no plans to convert any tractors to CNG at this time.