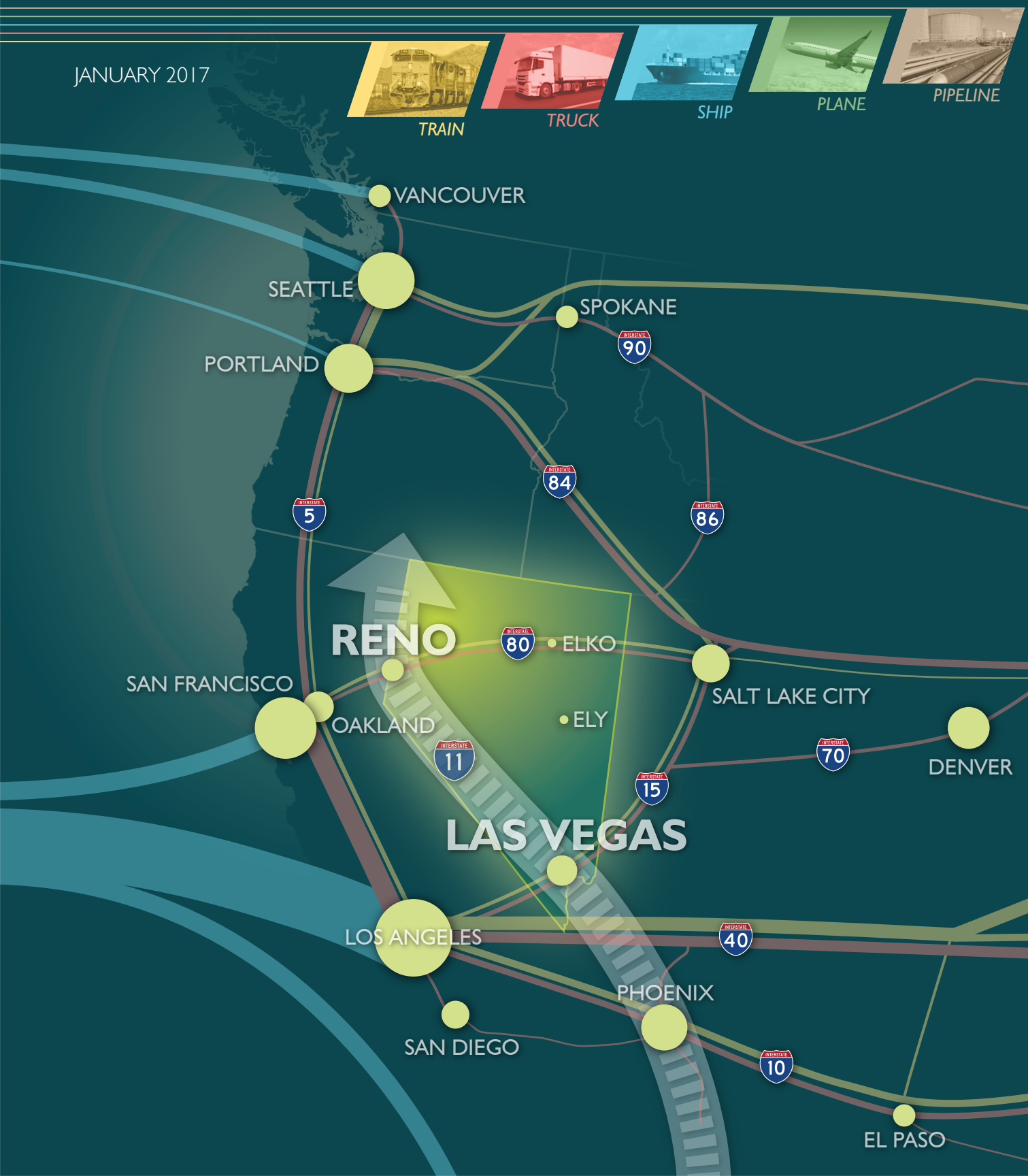
NEVADA STATE FREIGHT PLAN

A strategic framework for freight mobility and economic competitiveness

JANUARY 2017



Nevada State Freight Plan

A Strategic Framework for Freight Mobility and Economic Competitiveness

Prepared for

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Preface

In July 2014, the Nevada Department of Transportation (NDOT) issued a request for proposal (RFP) to develop the first Nevada State Freight Plan (the Freight Plan). The objective of the Freight Plan was to "provide a strategic framework enhancing freight mobility and a statewide economy with a collective benefit when implemented and integrated with economic development strategies." The Consultant Team of Michael Gallis & Associates, CH2M, Cambridge Systematics, and Morse Associates Consulting was retained to develop the Freight Plan. The Freight Plan was to be developed in close collaboration with NDOT and a State Freight Advisory Committee (FAC) that would be created as part of the planning process. The focus of the Consultant Team was to produce a plan that, when fully implemented, would provide Nevada with a competitive economic advantage and transform its role and began on January 28, 2015, and was to be completed in the summer of 2016.

The Freight Plan builds on previous work completed by the state of Nevada in assessing and planning its freight infrastructure. A significant amount of work has already been completed in the assessments and planning of various modes and components of the state's transportation and freight logistics infrastructure. In preparation of the Freight Plan, the Consultant Team reviewed and evaluated existing reports, maps, and other materials regarding freight, updated data, and sought out numerous other sources of information to develop the current context and potential competitive position for the state.

Introduction

Stakeholder Involvement

Significant stakeholder involvement, including meetings and interviews with more than 100 participants from approximately 75 public agencies and private organizations, provided important input during development of the Freight Plan. Stakeholders included truckers, railroads, manufacturers, ports, airports, third-party logistics providers, real estate brokers, industrial developers, economic development agencies, freight policy institutes, and planning agencies, not only within the state but also in California and throughout the western United States. Particularly important outcomes of this outreach effort included the formation of the FAC, the Western States Freight Coalition (WSFC), and regional focus groups, shown on Figure P-1. The FAC recommends projects, policies, and services that NDOT presents to the Nevada State Transportation Board for approval or further consideration. The Federal Highway Administration

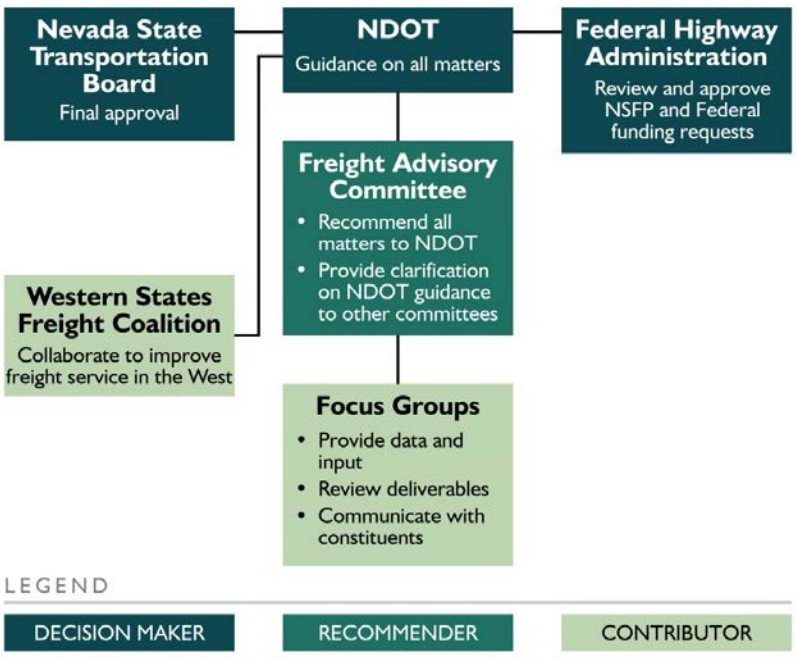

Figure P-1. Organizational Chart

(FHWA) certifies that this Freight Plan is compliant with the Fixing America's Surface Transportation (FAST) Act.

The FAC consists of a representative cross section of public and private freight stakeholders within Nevada. The FAC met at key milestones to provide insight and perspective to ensure the Freight Plan is relevant to the needs, goals, and objectives of their respective constituencies as well as help to build local and industry support for the process and the resultant planning document. The FAC will continue after completion and adoption of the Freight Plan as the primary forum for stakeholders to provide guidance on the implementation and future evolution of the Freight Plan.

Figure P-2. The Western States Freight Coalition

This map depicts the 11 states that currently belong to the Western States Freight Coalition (Source: MG&A, 2016 based on ESRI 2014, NTAD 2014, NDOT 2015).

The WSFC was formed by NDOT leadership recognizing that economic and transportation networks do not follow political geographies. Efforts within a single state have implications on other surrounding states that are best addressed by greater interaction among the various state Departments of Transportation (DOTs) during planning and implementation. At the onset of this project, one of the early efforts was outreach to other partnering states to form a quasi-coalition (referred to as the WSFC) and collaborate on a strategic freight vision for the Western states. As a result of this effort, the coalition has evolved as a valuable forum for peer exchange between the DOT freight program leads in each of the 11 states, including Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The WSFC representatives will continue to meet bimonthly following completion and adoption of this Freight Plan. The main purpose of these ongoing meetings will be to share, discuss, support, and learn from each other about important items issues in each state. This will provide a better understanding of common freight issues, and a forum to collaborate on the management of all freight services and facilities in the region in a concentrated effort to significantly enhance the freight environment in the western United States and secure a competitive advantage in global trade.

The FAST Act

In December 2015, Congress passed the FAST Act, the first long-term surface transportation bill in a decade (AASHTO, 2016). The legislation provides 5 years of Federal funding certainty for highway, highway safety, and transit programs; a modest increase in federal funding levels; reforms supporting more efficient project delivery; focused resources for highway freight infrastructure investments; and a continuation of performance-based program implementation (AASHTO, 2016). Apportionments to Nevada total $1.923 billion over 5 years, as well as the potential to utilize the Discretionary Grant Program's $4.5 billion for nationally significant freight and highway projects. The FAST Act also extends the Interstate 11 (I-11) designation from Mexico to Interstate 80 (I-80), a facility of particular significance and freight importance for Nevada.

The Global Connection

In an increasingly integrated global economy, it is important to look at the state of Nevada as a component of the global economy and its transportation system as a component of the global trading and distribution network. Creating a competitive advantage for Nevada required looking beyond the internal dynamics of the freight transportation system to better understand how this system affects economic activity and how changes in the composition of the economy will create new demands on the freight system.

Changing patterns of global economic activity have resulted in a changing pattern of trade corridors and hubs. Along with rapidly evolving technologies and the merging and alliances of various businesses, these changing patterns offer great opportunities and present significant challenges for the state of Nevada to reposition itself within the global, national, and western U.S. freight network.

Leadership and Economic Diversity

Nevada is currently undertaking tremendous efforts to grow and diversify its economy. Part of this effort has been to take initiative and leadership in studying, testing, and implementing progressive legislation for various freight-related technologies and advancements, including automated and connected vehicles and trucks (AV/CV), longer combination vehicles, truck platooning, aviation drones, and the hyperloop.

Triple Trailer Combination Vehicle in Nevada
Source: NDOT, 2015.

The Freight Plan

The Freight Plan makes specific recommendations on improving the state's freight infrastructure to strengthen and diversify its economy. Developing these recommendations necessitated research, analysis, and an understanding of the state's freight system, its economic structure, and the relationship between the two.

The Freight Plan is organized into three major sections:

1. **Vision and Solutions** – Outlines the vision and framework; summarizes the strategic goals, objectives, and performance measures; details the recommended strategies and implementation plan; and describes the funding and financing.

2. **Nevada's Freight Transportation System** – Describes the statewide freight assets and conditions; presents a preliminary natural disaster risk management assessment; details existing and forecasted commodity flows; and presents a supply chain analysis of key industries.
3. **Context and Competitive Market Analysis** – Provides the economic and urban context for assessing Nevada's freight transportation system; outlines a freight system for economic development; details Nevada's freight logistics, economic, and industrial real estate relationships by region; assesses employment and earnings by major trade area; and details critical issues, trends, and drivers, and illustrates their implications for Nevada.

Supplementing the Freight Plan are appendixes containing numerous technical memorandums and white papers completed throughout the planning process. For ease of reference, the appendixes are divided into three parts corresponding with the three sections of the Freight Plan, and provide more in-depth information for readers that want additional background data and analysis on a particular topic.

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Acronyms and Abbreviations

3D	three-dimensional
3PL	third-party logistics
AADT	annual average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
AC/CV	automated and connected vehicles and trucks
ACEC	area of critical environmental concern
AFB	Air Force Base
ASCE	American Society of Civil Engineers
ASEAN	Association of Southeast Asian Nations
BLM	Bureau of Land Management
BTR	Beyond the Rack
CBER	Center for Business & Economic Research
CFS	Commodity Flow Survey
CRFC	Critical Rural Freight Corridor
CSA	combined statistical area
CSA	Compliance, Safety, Accountability Program
CUFC	Critical Urban Freight Corridor
DOT	Department of Transportation
EDI	electronic data information systems
EPA	U.S. Environmental Protection Agency
EU	European Union
EV	electric vehicle
FAC	Freight Advisory Committee
FAF	Freight Analysis Framework
FAST	Fixing America's Surface Transportation Act
FASTLANE	Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FL	full load
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
Freight Plan	Nevada State Freight Plan
ft^2	square feet
GARVEE	Grant Anticipation Revenue Vehicle
GDP	gross domestic product

GHG	greenhouse gas
GMP	good manufacturing practice
GOED	Governor's Office of Economic Development
GPS	global positioning system
GSP	gross state product
HOS	hours of service
I-11	Interstate 11
I-5	Interstate 5
I-580	Interstate 580
I-80	Interstate 80
IANA	Intermodal Association of North America Statistics
ITS	intelligent transportation system
LAS	McCarran International Airport
LAX	Los Angeles International Airport
LCV	longer combination vehicle
LDV	light-duty vehicle
LRTP	Long-Range Transportation Plan
LTL	less-than-truckload
LVGEA	Las Vegas Global Economic Alliance
M&A	mergers and acquisitions
MODA	Multiple-Objective Decision Analysis
MPO	metropolitan planning organization
MSA	metropolitan statistical area
MTA	Major Trade Area
NAFTA	North American Free Trade Agreement
NAICS	North American Industry Classification System
NCA	National Conservation Area
NDOT	Nevada Department of Transportation
NHFN	National Highway Freight Network
NHFP	National Highway Freight Program
NHS	National Highway System
NHTSA	National Traffic Safety Administration
NRA	National Recreational Area
NSFHP	Nationally Significant Freight and Highway Projects
NSFP	Nationally State Freight Plan
O&D	origin and destination
O&M	operations and maintenance
ODV	over-dimensional vehicle
P3	public-private partnership

PHFS	Primary Highway Freight System
PPP	public-private partnerships
PTC	Positive Train Control
RFID	radio frequency identification
RNO	Reno-Tahoe International Airport
ROW	right-of-way
RPA	Regional Plan Association
RRIF	Railroad Rehabilitations and Improvement
RTP	Regional Transportation Plans
SCTG	Standard Classification of Transported Goods
SFO	San Francisco International Airport
SR 318	State Route 318
SR 99	State Route 99
STIP	State Transportation Improvement Program
TEU	20-foot equivalent unit
TRIC	Tahoe-Reno Industrial Center
U.S.C.	United States Code
UAV	unmanned aerial vehicle
UNLV	University of Las Vegas
UPRR	Union Pacific Railroad
US 395	U.S. Route 395
US 50	U.S. Route 50
US 93	U.S. Route 93
US 95	U.S. Route 95
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
VMT	vehicle-miles travelled
WSFC	Western States Freight Coalition
YOY	year-over-year

Section 1: Vision and Solutions

Nevada has an opportunity to improve in three ways in order to develop a competitive advantage and fulfill its vision for a new freight logistics model:

1. *Add strong crossroads connections to gain broader access to more markets from all major points on the compass.*
2. *Increase Nevada's capacity and efficiency for intermodal rail–truck and air–truck transfers through a more integrated multimodal configuration.*
3. *Improve capacity and performance of our freight network in order for Nevada to realize its full potential.*

The Freight Plan identifies eight strategic goals and related objectives to guide current and ongoing freight-related planning efforts to meet the state's freight transportation needs. Together, these goals address the areas of economic competitiveness, mobility and reliability, safety, infrastructure preservation, technology, environmental sustainability and livability, funding, and collaboration. Objectives with performance measures and targets are identified for each goal.

Accomplishment of these objectives—through a suite of strategies, supported by a series of implementation actions—will make concrete, measureable progress toward the attainment of the freight transportation system goals and ultimate realization of our shared vision for Nevada's freight transportation system.

1.1 The NSFP Vision: A New Freight Logistics Model for Nevada

Nevada State Freight Plan Vision

The Nevada State Freight Plan (Freight Plan) is a strategic framework intended to strengthen the state's freight infrastructure to provide the competitive advantage necessary to grow and diversify its economy. The cost and time required for the transportation of goods are embedded in every economic activity and are no longer separate functions. The Freight Plan provides an actionable blueprint to help ensure that Nevada's freight infrastructure and policies bolster the efficiency and growth of its service modes and the industries they serve. It aims to provide a long-term framework for identifying and capturing new and emerging opportunities to strengthen Nevada's freight logistics network. In order to grow Nevada's current and emerging industries, the state will need robust multimodal connections to regional, national, and global supply chains. By focusing on essential connections, the Freight Plan can contribute to maximizing Nevada's commercial advantages that will attract new business and otherwise strengthen the state's economic base. The Freight Plan could contribute to the construct of building a New Nevada envisioned by Gov. Brian Sandoval in his January 2015 State of the State Address.

A vision statement describes an optimal desired future state; in this case, of Nevada's freight system and economy. The best visions are aspirational, memorable, and succinct. This vision was established to guide the development of the Freight Plan and to define the desired future of Nevada's freight transportation system. It was developed in a collaborative effort with the Nevada Department of Transportation (NDOT) and the Freight Advisory Committee (FAC).

VISION

Establishing a competitive advantage by creating crossroads of national commerce within a multimodal system of superior safety, condition, and performance.

The vision statement is consistent with themes established in several planning and policy documents prepared, as part of separate efforts, by various economic development, land use, and transportation planning agencies within the state. It reflects the state's tremendous efforts to diversify and grow its economy. It also recognizes that safety is a topriority for both the state and the nation and that a multimodal approach is necessary.

A Broader Competitive Focus: Repositioning Nevada in the Western United States

Traditionally, state freight plans tend to focus solely on the freight transportation system and within state boundaries, and, thereby, lose the connection to the economy and the larger context within which opportunities to strengthen their competitive positions are found. Instead, this Freight Plan focuses not only on the network elements within state boundaries, but also on the broader analysis of Nevada's role and function within the regional, national, continental, and global economic and freight logistics network.

Political boundaries do not reflect economic realities; thus, economic regions or Major Trade Areas (MTAs) outline the boundaries within which a higher level of interaction occurs between metro hubs (Figure 1-1). Nevada does not have its own economic region, but rather is part of three MTAs: northern Nevada in the San Francisco MTA, southern Nevada as part of the Los Angeles MTA, and eastern Nevada in the Salt Lake City MTA. This forms a framework for understanding Nevada's economic and freight logistics pattern in the context of the greater economic trade areas in which they are located and especially in Nevada's metro relationships to California and the West Coast ports.

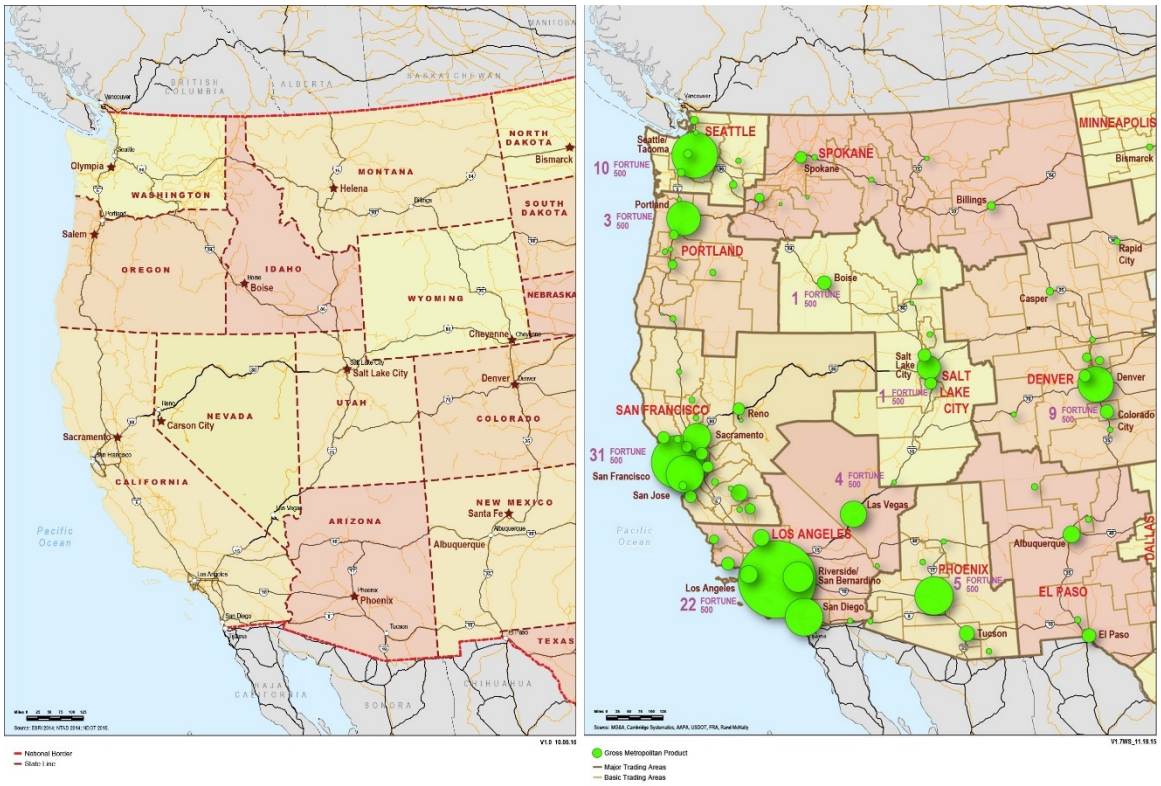


Figure 1-1. Political vs. Economic Geography of the Western United States

The image on the left depicts the political geography of the western United States, while the image on the right depicts the economic geography defined by MTAs within which economic activity occurs. The state of Nevada belongs to three MTAs and is not defined by its political boundaries (Source: Michael Gallis & Associates (MG&A), 2016 based on ESRI, 2014, NTAD 2014, NDOT 2015, BEA, and Rand McNally data).

While incremental improvements to the state's existing freight system will improve various aspects and conditions of the system, they will not create the significant competitive advantage that will change Nevada's desirability nor its position or role and function within the Western grid. To grow the economy will require structural changes within the freight system that can have a transformational effect on the role and function of Nevada. To make this transition, Nevada will have to change from a corridor state to a crossroads state. This involves creating a parallel North American Free Trade Agreement (NAFTA) corridor that connects from Mexico City through Phoenix onto Las Vegas and Reno and into western Canada. This corridor would parallel the Interstate 5 (I-5)/State Route (SR) 99 coastal corridor in California that is becoming highly congested and overbuilt. This would transform the northern and southern Nevada hubs into crossroads with a larger distribution area, direct access to the very large California markets, and provide a more resilient western U.S. freight distribution network.

1.1.1 The Framework for a New Freight Logistics Model

The essential requirements of a growth-facilitating hub system are evident from a review of other metro areas (e.g., Columbus, Ohio; Charlotte, North Carolina; and eastern Pennsylvania), where transportation assets create advantages for firms who do business at these locations. The review points to a freight planning and development strategy that is focused on elevating the market access, modal integration, capacity, and performance of Nevada facilities and transportation services, to create intermodal hubs that are primary, not secondary, in their regional impact and global outreach.

Based on this analysis, Nevada must improve in three ways in order to develop a competitive advantage:

One is to strengthen its position within the distribution network; that is, adding strong crossroads connections to gain broader access to more markets from all major points on the compass.

Another is to increase Nevada's capacity and efficiency for intermodal rail–truck and air–truck transfers through a more integrated multimodal configuration.

The third is to be conscious of capacity and performance issues that must increase in size and efficiency in order for Nevada to realize its full potential.

Building the capacity for crossroads freight movements is not enough without more efficient modal integration in the hubs, just as modal integration is not enough without strengthened network access. Thus, a strategy addressing these three areas of crossroads support, intermodal development, and improved capacity and performance is required for Nevada to develop a multidimensional competitive advantage. A detailed description of the framework is described below.

The Nevada's Existing Freight Logistics Model

Nevada's existing logistics model has evolved incrementally over the past century as a system of stops along national corridors between the coastal gateway ports and inland hubs. It is based on responses to local conditions within a series of east-west corridors that are largely determined by forces outside and beyond the state: the ports in California and the Midwest hubs. The primary urban areas, Las Vegas and Reno-Sparks-Carson City, became the processing or distribution zones for external freight flows of manufactured and retail products as well as a service conduit to rural areas that were primarily involved in resource extraction and agriculture.

Thus, Nevada's major metros function primarily as origin and destination (O&D) points located between the superior crossroads of Northern and Southern California to the west and Salt Lake City to the east. The freight infrastructure in these areas has developed through a series of incremental steps in response to changing and evolving local market conditions. In other words, Nevada's metro areas deliver consumer goods from other hubs. Goods received from external sources exceed the output of goods created or distributed from within Nevada at a ratio of 2:1. The freight corridors on which Nevada relies are serving the inland port and global hubs where intermodal and multi directional transfers can take place. As such, Nevada's metros function only as "stop-drop-and-pick-up" locations that do not have any function other than to serve the local market space. They are not primary multichannel assembly or retail points serving a larger western U.S. distribution network. Continuing incremental improvements to these hubs can have benefits for the local economy, but will not have the transformative effect of adding the inland hub functions needed to create and sustain the competitive advantages necessary to grow and diversify Nevada's economy.

Instead, Nevada's best long-term economic results would come from a major change in the current logistics role within the Western trade pattern and a major improvement in its intermodal infrastructure to increase its distribution functions. Such a transformational investment requires adding assets and market size needed to create sub hubs that offer auxiliary space and services to the larger global hubs, eventually generating the growth in distribution and manufacturing needed to become bona fide inland ports (Figure 1-2).

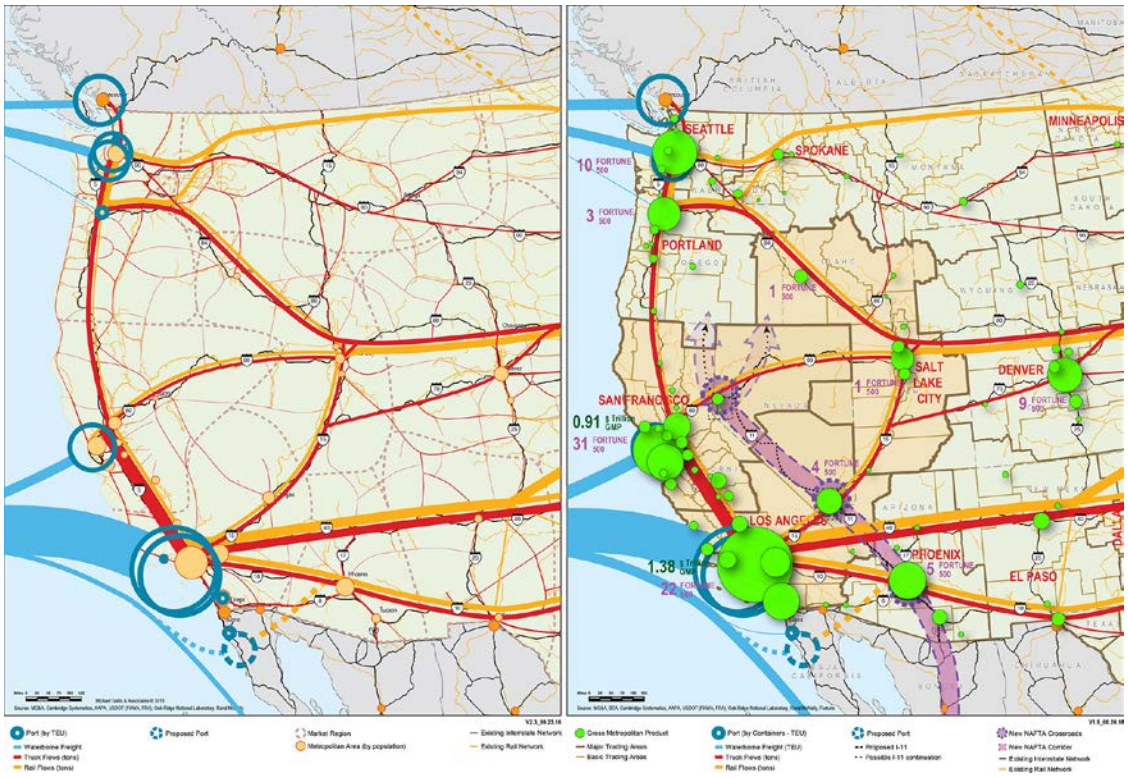


Figure 1-2. Creating the Future Corridor System of Nevada in the Western United States

The image on the left depicts current freight flows in the western United States, showing that Nevada's major metros of Las Vegas and Reno are simply stops along corridors, while the image on the right depicts a potential new future with Nevada's major metro hubs as crossroads having NAFTA connectivity and increased market access (Source: MG&A, 2015 based on USDOT (FHWA, FRA), AAPA, Oak Ridge National Laboratory, U.S. Census Bureau, BEA, Fortune data).

Nevada's New Freight Logistics Model

Urban growth and economic activity in California, the western United States, and within Nevada are transforming the state and its relationship to the domestic and global trading network. With the goal of creating a competitive advantage for the state, the new freight logistics model or framework is initiating a long-term shift away from being secondary service O&D points to regional hubs that are well positioned to serve regional, national, and international markets.

The key element of the strategy is to unite the focus of Nevada stakeholders around creating a strong crossroad intermodal network (north-south as well as east-west) to feed a strong logistics and manufacturing base supported by high-quality and integrated multimodal transfer facilities. To do so requires an awareness of competitive services close to Nevada's metro hubs and their ability to capture distribution and manufacturing growth emanating from Southern and Northern California, as well as take into account the logistics hub services of other major metro areas, including Salt Lake City and Phoenix. This long-term model or framework will guide shorter-term decision making about the policies, regulations, and investments needed to initiate an evolutionary process towards transforming the state's freight infrastructure and competitive position within the western United States, contributing to statewide efforts to create a New Nevada.

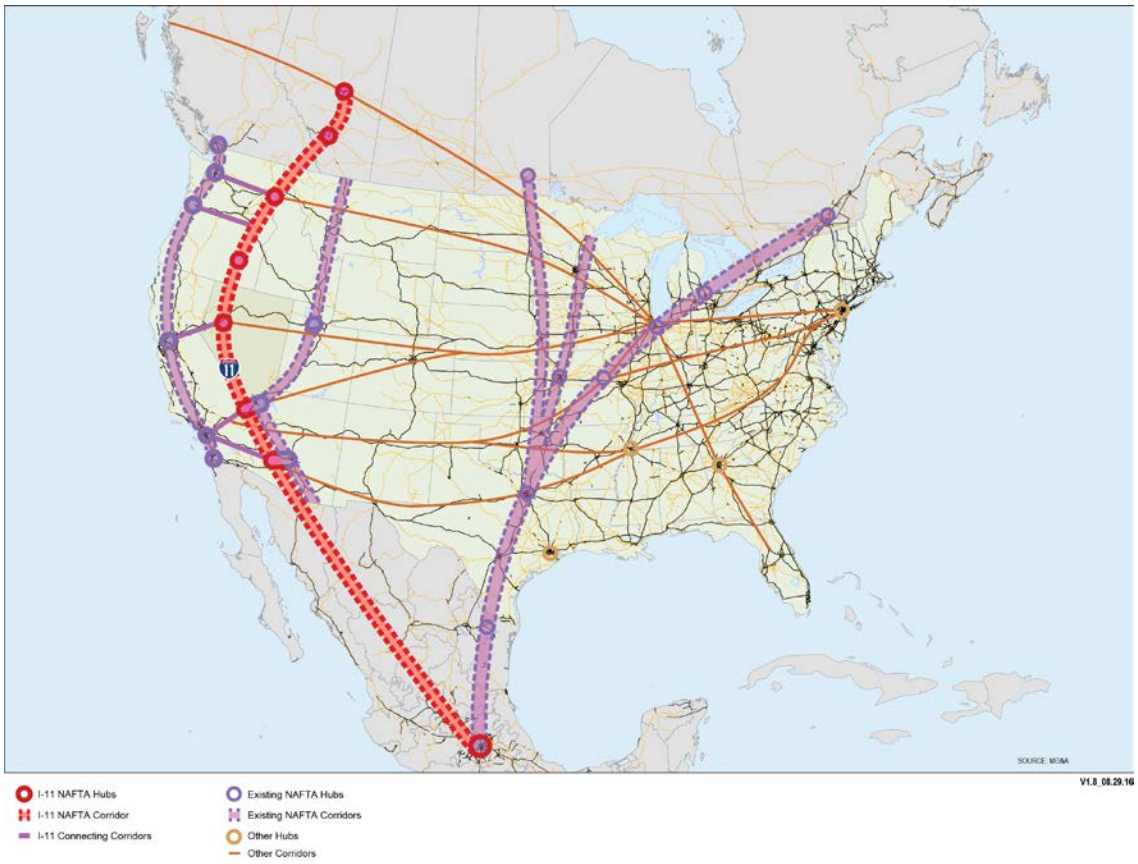


Figure 1-3. Conceptual Diagram of the Western NAFTA Corridor in the National Context

This conceptual diagram depicts the eastern U.S. NAFTA corridor and the potential for I-11 to be part of a western U.S. continental corridor. Within this conceptual configuration, the West Coast corridor, I-5, would function as an arterial distributor, while I-11 would become the continental superhighway connecting the three nations of North America. It is important to note that this is a conceptual diagram that does not show exact alignments, but is rather intended to depict the possibility of having a NAFTA corridor in the western United States as strong as that in the eastern United States (Source: MG&A, 2015).

Market Access: From Corridors to Crossroads

A competitive metro hub provides a multimodal crossroads system that allows freight to flow north and south as well as east and west; Nevada does not have this. There are no interstate or rail connections between Las Vegas and Phoenix, the only two top 100 U.S. metropolitan areas that lack such connections. Moreover, there are no interstate or rail connections between Las Vegas and Reno-Sparks-Carson City. The lack of these connections adds time and cost to trucking services, inhibits intermodal growth at prospective rail hubs at Las Vegas and Reno, and limits greater Nevada participation in NAFTA trade.

Multi-dimensional access improvements include additions to the direction from which freight can be competitively collected and distributed as well as improvements in the facilities that transfer goods from one mode to another. At present, both Las Vegas and Reno have limited market access due to the road and rail pattern in Nevada. The two primary corridors traversing the state, I-15 and I-80, provide only east-west and southeast-northwest access. Thus, Las Vegas and Reno are classified as having one-dimensional distribution because they are simply stops along corridors. Adding direct connections between and beyond Reno and Las Vegas will greatly improve the range in which freight could be collected and distributed from these points and improve connectivity to the growing NAFTA trade (Figure 1-3). An intermodal I-11 corridor represents a significant opportunity to increase both metros'

ability to perform distribution functions, becoming crossroads with multi-directional access. This added connectivity would increase synergy between Nevada's major hubs and improve their access to western U.S. markets, eventually to Canada and Mexico.

Improvements in west-east intermodal rail would add additional freight capabilities for Nevada shippers and receivers. Large volumes of freight transferred from super post-Panamax vessels can nearly triple the amount of 20-foot equivalent units (TEUs) released to a port from a single vessel. The efficient inland distribution of such volumes on the land side will increasingly require railroad economies of scale connections to overcome the inherent inefficiencies clearing these containers: one container, per one chassis, per one truck. The ability of Nevada rail yards to efficiently handle marine cargo and domestic intermodal containers would remove large volumes of containerized cargo from congested urban highways, thereby adding highway capacity and improving air quality along the service corridor. With large enough manufacturing logistics distribution bases at Reno and Las Vegas, intermodal rail would provide efficient lower cost services by splicing into larger intermodal trains moving between California and major inland ports to the east.

Metro Modal Configuration: From Fragmentation to Integration

Along with providing multidimensional access, competitive hubs provide efficient intermodal interchanges, which facilitate the transfers between an efficient and high-volume mode such as rail, the long-distance reach provided by air, and flexible pick-up and delivery by truck (Figure 1-4). Each mode has been developed independent of others, at different times in history, different periods in growth, and under different economic conditions. Thus, freight infrastructure is fractured and movements require a dray function to provide connectivity between the yards, terminals, ports, airports, and other ancillary services. This induces unnecessary conflict between freight and passenger volumes, thereby reducing safety and reliability. These trips also add cost and increase negative environmental effects.

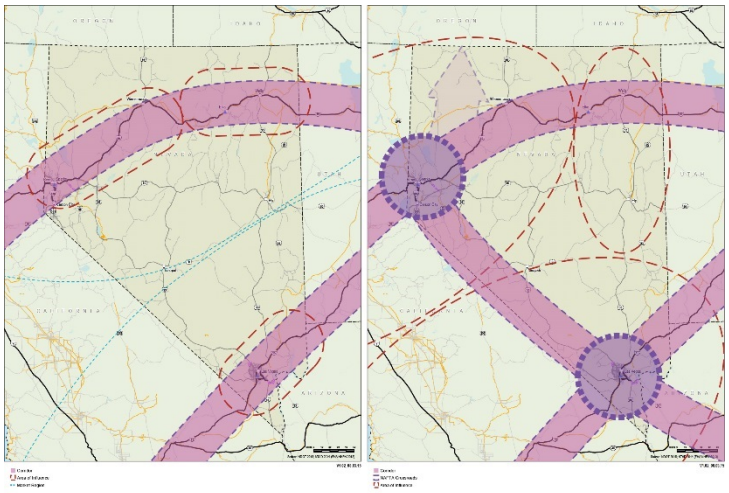


Figure 1-4. Changing Geometry to Increase Access

Two primary corridors provide single-dimensional distribution and access to nearby metros: I-15 from Los Angeles to Salt Lake and onto the East Coast markets and I-80 from San Francisco to Chicago. Nevada has two hubs along these corridors: Reno-Sparks-Carson City in northern Nevada and Las Vegas in southern Nevada; Adding a connection between the hubs (right) strengthens Nevada's geometry within the distribution network, creating crossroads with broader access to more markets and allowing them to take on more inland port distribution functions (Source: MG&A, 2015).

Modal fragmentation causes two problems within metropolitan areas. One is that it induces unnecessary conflict between freight and passenger volumes that are involved in transfer between the dispersed facilities in metropolitan areas, which reduces reliability and safety. The second is that these trips add cost and increase negative environmental effects. Mode integration seeks to use future capital

investments as the financial vehicle for either creating better connectivity or relocating facilities closer together to coterminous locations where transfers can take place without the need of a dray.

As in most urban centers in the United States, Las Vegas and Reno have a scattered and fragmented pattern of air, rail, trucking, customs, and other freight service functions, and have never emerged as major freight centers. There are extremely modest intermodal yards in Reno and Las Vegas, as well as a few bulk transloading facilities throughout the state. Although there is major through-railroad activity in Nevada, the trains do not stop in the state and they do not create cost and congestion relief advantages for Nevada shippers going east and west. This fragmented pattern of logistics forces trucks involved in freight movements and transfers through heavily urbanized areas results in conflicts and inefficiencies. This is a major inhibitor to a development-positive rail system that will be needed to further unite the state into the global economy and to increase its logistic function within its western U.S. context. Additionally, Nevada airports have both the capacity and the desire to increase their air cargo role; however, more locally generated freight volume is needed to create greater interest among the airlines.

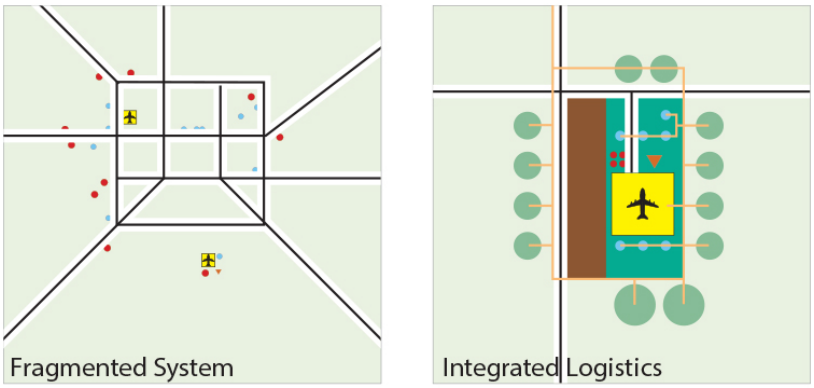


Figure 1-5. Modal Configuration: Fragmented System vs. Integrated Logistics
Both Las Vegas and Reno currently have fragmented systems, as pictured left; however, increasing integration will create the seamless system, as pictured right (Source: MG&A, 2015).

A more integrated multimodal configuration would increase Nevada's capacity and efficiency for intermodal rail-truck and air-truck transfers (Figure 1-5). Consolidating intermodal rail yards, truck terminals, and freight service at the major airports would increase efficiency while reducing urban truck transfer traffic. Linking together the modes would form highly efficient and integrated logistics centers in both Las Vegas and Reno, providing them with a competitive advantage over other metropolitan areas.

An integrative model known as a freight village is a similar but broader facilities concept than an inland port, an area within which various operators carry out activities relating to transport, logistics, and the distribution of goods. The primary features of a freight village are multimodal service, warehousing, distribution, intermodal terminal, customs service, and freight forwarding.

Capacity and Performance

The third important criterion is increased capacity and performance to strengthen the last-mile services. Capacity constraints and performance inhibitors are typically barriers to improving the freight system and can affect the reliability and efficiency of the freight network. Capacity constraints typically arise due to the urban growth that takes place around transportation facilities limiting their ability to increase in size and add capacity. For example, facilities are typically "locked" and unable to grow in their current locations, which requires the creation of a new facility at another location or the entire relocation of a facility to a location where it can assemble the required amount of land to add capacity.

Performance inhibitors are also typically the result of urban growth that does not allow a system to modify or adapt itself to the changing needs of the system. This can take place in terms of everything from storage areas to number of lanes, turning radiuses, heights of bridges, and other inhibitors to the movement through the system that would affect its operational performance.

To be conscious of capacity constraints and performance inhibitors that must increase in size and efficiency is critical for Nevada to realize its full potential, reducing traffic bottlenecks and other congestion issues along the major urban and rural highways to allow for freight to move more efficiently. Building a resilient system is also important in achieving more reliable performance of the system.

Conclusions

Creating a new aspirational plan provides a framework for prioritizing decision making by establishing a new vision and set of goals for the future of the freight logistics system. A New Nevada will be well served by a concerted public and private sector effort to improve market access, modal configuration, and capacity and performance simultaneously in order to build a more competitive freight network that is reliable, cost effective, and safe.

This framework and new model will help focus public and private sector resources on Reno and Las Vegas' proximity to major California gateways and to their Phoenix and Salt Lake connections to explore how Nevada's production, transportation, and communication assets can be applied to foster competitiveness and growth. It will also support global logistics-based growth through the creation of a vital trade crossroads with the addition of a NAFTA freight corridor through Nevada, such as I-11, to link Reno, Las Vegas, and Phoenix together and to Canada and Mexico.

Without the visionary concept, Nevada will simply continue to grow incrementally and maintain the same economic and freight logistics relationships: functioning as local hubs or stops along the corridor that serve O&D functions. By identifying the long-term concept of Nevada's hubs functioning as crossroads with integrated modal configuration and increased capacity and performance, the state can determine the best path of incremental improvements that are also steps towards the visionary goal of a New Nevada.

1.2 Strategic Goals, Objectives, Performance Measures, and Targets

The FAC agreed on eight strategic goals to be included in the Freight Plan to Nevada's freight transportation system. These strategic goals are intended to guide current and ongoing freight-related transportation planning efforts and serve as a touchstone by which to gauge the success of these efforts. The goals identified for Nevada's freight transportation system were informed by federal, state, and local planning efforts, and are consistent with the federal goals established under Title 23, United States Code (U.S.C.), Section 167, *National Freight Policy*. Together, these goals address the areas of economic competitiveness, mobility and reliability, safety, infrastructure preservation, technology, environmental sustainability and livability, funding, and collaboration.

In addition to articulating goals for the state's freight transportation system, objectives, performance measures, and performance targets are identified for each goal, with emphasis on highways that are under NDOT's control. Accomplishment of these objectives will make concrete, measureable progress toward the attainment of the goals and ultimate realization of the Nevada freight transportation system vision.

1.2.1 Performance Management

Figure 1-6. Transportation Performance Management

State and federal transportation agencies have long used asset and performance management techniques to assess, measure, and gauge infrastructural and operational capabilities of their systems. Nevada has been involved in performance management since 2007 when Legislative Assembly Bill 595 was passed. The bill requires NDOT "to develop a performance management plan for measuring its performance, which must include performance measures approved by the Board of Directors."

In an effort to incorporate uniformity in these measures and emphasize a performance-based approach in applying the Federal Highway Program, the U.S. Department of Transportation (USDOT), by way of MAP-21 legislation, has proposed several draft performance measures across key management areas, including safety, pavements, bridges, freight, emissions, performance, and congestion. This approach will incorporate performance management into federal and state transportation programs, unify high-level national transportation goals, and link key measures to state and local funding opportunities

The performance management process, illustrated in Figure 1-6, begins with shared goals and objectives, performance measures and targets for gauging progress, and a plan for achieving the goals. Achievements are measured and reported periodically, and goals revised as needed. To avoid confusion and facilitate achieving consensus, the definitions below will help to maintain clarity and consistency in communications and across all documents produced for the planning effort:

- ***Vision:*** An inspirational statement defining the optimal desired future state
- ***Goal:*** What the organization wants to achieve over the long term
- ***Objective:*** A specific accomplishment that helps to achieve a goal
- ***Performance measure:*** The measure used to systematically track and periodically assess progress toward accomplishing an objective or goal using quantitative and/or qualitative data
- ***Performance target:*** A specific, measurable target that helps to achieve an objective—how much of a desired result and by when
- ***Performance plan:*** A set of strategies (projects, programs, or policies) for achieving the targets, and ultimately the goals, including implementation actions
- ***Target achievement:*** A measure of the performance to assess if and how well a target is achieved
- ***Performance reporting:*** A report documenting performance and target achievement, helpful for re-evaluating goals and plans

1.2.2 Establishing the Goals

Federal Requirements

It is essential that Nevada's goals be consistent with federal goals established under Title 23, U.S.C., Section 167, *National Freight Policy*, which are:

(1) To invest in infrastructure improvements and to implement operational improvements that

  (A) Strengthen the contribution of the national freight network to the economic competitiveness of the United States,

  (B) Reduce congestion, and

  (C) Increase productivity, particularly for domestic industries and businesses that create high value jobs;

(2) To improve the safety, security, and resilience of freight transportation;

(3) To improve the state of good repair of the national freight network;

(4) To use advanced technology to improve the state of good repair of the national freight network;

(5) To incorporate concepts of performance, innovation, competition, and accountability into the operation and maintenance of the national freight network;

(6) To improve the economic efficiency of the national freight network; and

(7) To reduce the environmental impacts of the national freight network.

Nevada Context

In addition to the federal freight goals, the Consultant Team reviewed policy and planning documents prepared, as parts of separate efforts, by various economic development, land use, and transportation planning agencies within the state. The intent of this review was to identify goals and strategies related to goods movement and the economy developed as part of these previous efforts as well as common themes that cross jurisdictions. Prior reports and planning documents used during this review include the following:

- *Moving Nevada Forward: A Plan for Excellence in Economic Development* (Nevada Board of Economic Development)
- *Unify Regionalize Diversify* (The Brookings Institution)
- *Greater Reno-Sparks-Tahoe Economic Development Three-Year Strategic Plan* (Economic Development Authority of Western Nevada)
- *Envisioning Nevada's Future* (Nevada Vision Stakeholder Group)
- *Comprehensive Economic Development Strategy 2014* (Western Nevada Development District)
- *Comprehensive Economic Development Strategy* (Las Vegas Global Economic Alliance)

Examples of Existing Reports Reviewed

- *2035 Regional Transportation Plan* (Carson Area Metropolitan Planning Organization)
- I-*11 and Intermountain West Corridor Study* (ADOT and NDOT)
- *Connecting Nevada* (NDOT)
- *I-15 Corridor System Master Plan* (ADOT, Caltrans, NDOT, and UDOT)
- *I-80 Corridor System Master Plan* (Caltrans, NDOT, UDOT, WYDOT)
- *Nevada State Rail Plan* (NDOT)
- *Southern Nevada Strong* (Regional Transportation Commission of Southern Nevada)
- *Regional Transportation Plan, 2013-2035* (Regional Transportation Commission of Southern Nevada)
- *Mobility 2035* (Tahoe Metropolitan Planning Organization)
- *2035 Regional Transportation Plan* (Regional Transportation Commission of Washoe County)
- Northeastern Nevada Regional Development Authority's website
- Northern Nevada Development Authority's website

There is significant commonality in these documents relating to the need for a robust transportation system that serves the needs of Nevada's communities and businesses. The following are relevant themes frequently mentioned in these documents:

- Increasing economic competiveness
- Improving efficiency and productivity
- Safety and security
- Proper maintenance of the infrastructure
- Environmental protection and sustainability
- Adequate funding
- Compatibility of infrastructure with local land use decisions and community values
- Economic diversification
- Intermodal connectivity

1.2.3 Performance Measures and Targets

In addition to identifying goals and objectives for the Freight Plan, performance measures and targets are defined for each objective as a method of tracking the state's performance against the objectives, and revealing trends over time. The performance measures and targets were developed based on state and federal performance management techniques as well as federal guidance.

Table 1-1 lists the goals, objectives, performance measures and targets, and then provides a summary assessment of baseline conditions and analysis. A full description of the goals, objectives, performance measures, and targets is included in Appendix 1A: Analysis of Strategic Goals, Objectives Performance Measures, and Targets.

Table 1-1. Baseline Performance of Nevada's Freight System

WHAT IS THE PLAN TRYING TO ACHIEVE?

The Freight Plan identifies eight strategic goals and related objectives to guide current and ongoing freight-related planning efforts to meet the state's freight transportation needs. The goals identified for Nevada's freight transportation system were informed by federal, state, and local planning efforts, and are consistent with the federal goals established under Section 167, National Freight Policy, of Title 23, Highways, of the United States Code. Together, these goals address the areas of economic competitiveness, mobility and reliability, safety, infrastructure preservation, technology, environmental sustainability and livability, funding, and collaboration.

Strategic Goals of the Freight Plan

Economic Competitiveness
Improve the contribution of the freight transportation system to economic efficiency, productivity, and competitiveness.

Mobility & Reliability
Provide an efficient and reliable multimodal freight transportation system for shippers and receivers across the State.

Safety
Improve the safety of the freight transportation system.

Infrastructure Preservation
Maintain and improve essential multimodal infrastructure within the State.

Advanced Innovative Technology
Use advanced technology, innovation, competition, and accountability in operating and maintaining the freight transportation system.

Environmental Sustainability & Livability
Reduce adverse environmental and community impacts of the freight transportation system.

Sustainable Funding
Fully fund the operations, maintenance, renewal, and expansion of the freight transportation system.

Collaboration, Land Use, and Community Values
Establish an ongoing freight planning process to coordinate the freight transportation system and ensure consistency with local land use decisions and community values.

Table 1-1
Baseline Performance of Nevada's Freight System

BASELINE PERFORMANCE

Summary of Goals, Objectives, Performance Measures and Targets, and Baseline Conditions

Objectives with performance measures and targets are identified for each goal, with emphasis on highways that are under NDOT's control. Accomplishment of these objectives will make concrete, measureable progress toward the attainment of the freight transportation system goals and ultimate realization of our shared vision for Nevada's freight transportation system.

Mobility & Reliability Provide an efficient and reliable multimodal freight transportation system for shippers and receivers across the state.	Safety Improve the safety of the freight transportation system.	Advanced Innovative Technology Use advanced technology, innovation, competition, and accountability in operating and maintaining the freight transportation system.
Objective: **Choke Points on Major Truck Routes:** Reduce the number of locations where the average truck speed is below 40 mph.	**Objective:** **Highway Safety:** Improve daily highway system operations management to eliminate freight-associated motor vehicle fatalities.	**Objective:** **Freight-related R&D:** Support research and development of innovative freight-related technologies that can advance improvements and measure system performance.
Measure: Truck speeds on I-15, I-80, I-580, US 395, US 93, US 95, I-215/CC-215	**Measure:** Number of fatal motor-vehicle crashes involving trucks	**Measure:** Number of freight related research tasks completed annually by the NDOT Research Section
Baseline: **2015 Conditions:** 42 locations with speeds below 40 mph	**Baseline:** **2009-2013 Statewide Average:** 13.8 fatalities	**Baseline:** **2014 Freight-Specific Research:** None **2015 Freight-Specific Research:** TBD
Target: ≥ 10% reduction by 2021	**Target:** < 10 fatalities by 2021	**Target:** ≥ 2 per year
Score: ◆	**Score:** ◆	**Score:** ■
Analysis: Travel speeds during afternoon peak periods (4 to 6 pm) on the major truck routes were evaluated to identify some of the chokepoints on major truck corridors. During the month of July 2015, there were 42 locations where the average truck speed during the afternoon peak period dropped below 40 miles per hour.	**Analysis:** While total highway fatalities in Nevada have been trending downward, truck-involved motor vehicle crash fatalities remained relatively flat from 2009 through 2013.	**Analysis:** While there were no recent research programs directly related to freight-specific technologies initiated in 2013-2014, the NDOT Research Section's primary mission is the advancement of innovations in transportation; therefore, many research programs initiated benefit the freight transportation system either directly or indirectly.

▼ Maintain or Needs Some Improvement ◆ Needs More Improvement ⬢ Needs Significant Improvement ■ Not Yet Scored

Table 1-1 (Continued)
Baseline Performance of Nevada's Freight System

BASELINE PERFORMANCE

Summary of Goals, Objectives, Performance Measures and Targets, and Baseline Conditions (Continued)

Infrastructure Preservation

Maintain and improve essential multimodal infrastructure within the state.

Objective: **Pavement Condition:** Maintain a minimum 95% of state-maintained pavements in fair or better condition.	**Objective:** **Bridge Conditions:** Target of less than 5% of NDOT state-maintained bridges are in poor condition and a minimum 50% in good condition.	
Measure: Percentage of state-maintained pavements in fair or better condition	**Measure:** Percentage of NDOT state-maintained bridges that are in good and poor condition	
Baseline: **Roadways in fair or better condition:** 71%	**Baseline:** **Bridges in poor condition:** NHS - 2% Non-NHS - 1%	**Baseline:** **Bridges in good condition:** NHS - 48% Non-NHS - 51%
Target: ≥80% by 2021	**Target:** Maintain 5%	**Target:** Maintain 50%
Score: ▼	**Score:** ▼	**Score:** ▼
Analysis: At the current annual average expenditure for pavement rehabilitation, it is projected that the state-maintained roadway network will deteriorate from 75% to less than 50% of roads in fair or better condition by 2027. ** NDOT is actively working on adjusting their pavement management system reporting capabilities to enable the reporting of pavement conditions in accordance with FHWA's recently proposed metrics.*	**Analysis:** Bridge preservation funding for the 2015-2017 biennium is expected to be decreased by over 30% as compared to 2013-2014 expenditures. Under the current funding plan, bridge preservation backlog is expected to increase by nearly 300% by 2027.	

▼ Maintain or Needs Some Improvement ◆ Needs More Improvement ⬢ Needs Significant Improvement ■ Not Yet Scored

Table 1-1 (Continued)
Baseline Performance of Nevada's Freight System

BASELINE PERFORMANCE

Summary of Goals, Objectives, Performance Measures and Targets, and Baseline Conditions (Continued)

Environmental Sustainability & Livability

Reduce adverse environmental and community impacts of the freight transportation system.

Objective:

Vehicular Emissions: Reduce vehicular emissions by reducing congestion, deploying technologies that improve the fuel-efficiency of commercial vehicles, and providing better mode-choice and integration to encourage utilization of the most sustainable options.

Measure: Percentage of trucks registered within the state having an engine model-year of 2010 or newer	**Measure:** Truck speeds on I-15, I-80, I-580, US 395, US 93, US 95, I-215/CC-215
Baseline: **2015 Trucks registered in Nevada with MY2010 or newer engines:** 22%	**Baseline:** **2015 Conditions:** 42 locations with speeds below 40 mph
Target: ≥ 4% new trucks registered per year	**Target:** 10% reduction by 2021.
Score: ▼	**Score:** ◆
Analysis: A majority of Nevada-based trucking fleets operate within California, and are required to meet the CARB GHG emissions standards, providing a direct benefit to Nevada. As a result, there has been a steady increase of approximately 4% per year of newer vehicles (14% in 2013 to 18% in 2014), which is expected to continue to rise through 2023 as fleets continue to be upgraded.	**Analysis:** Travel speeds during afternoon peak periods (4 to 6 pm) on the major truck routes were evaluated to identify some of the chokepoints on major truck corridors. During the month of July 2015, there were 42 locations where the average truck speed during the afternoon peak period dropped below 40 miles per hour.

▼ Maintain or Needs Some Improvement ◆ Needs More Improvement ⬢ Needs Significant Improvement ■ Not Yet Scored

Table 1-1 (Continued)
Baseline Performance of Nevada's Freight System

BASELINE PERFORMANCE

Summary of Goals, Objectives, Performance Measures and Targets, and Baseline Conditions (Continued)

Collaboration, Land Use, and Community Values

Establish an ongoing freight planning process to coordinate the freight transportation system and ensure consistency with local land use decisions and community values.

Objective:

Collaboration: Establish and foster an inclusive, long-term relationships and processes between and within the public sector, private sector, communities, agencies, and other transportation stakeholders regarding freight transportation.

Measure: Establish and meet regularly with the FAC

Baseline: FAC has been established as an early action item during the NSFP development

Target: Meet quarterly

Score: ▼

Analysis: State, local, and regional agencies and key private industry stakeholders have been invited to provide representatives to serve on the FAC. The FAC will help to guide the development of the Freight Plan and provide recommendations regarding projects, policies, programs, advanced technologies, and services to be presented to the Nevada State Transportation Board for further consideration. Upon completion of the Freight Plan, NDOT will continue to engage the FAC in ongoing freight planning efforts.

Sustainable Funding

Fully fund the operations, maintenance, renewal, and expansion of the freight transportation system.

Objective	Objective
Pavement Funding: Provide consistent and adequate sources of funding to support the state's pavement preservation goal	**Bridge Funding:** Provide consistent and adequate sources of funding to support the state's bridge preservation goal.
Measure: Percentage of available funding to full funding required to meet state's pavement preservation needs	**Measure:** Percentage of available funding to full funding required to meet state's bridge preservation needs
Target: Fund 60% of capital needs by 2021	**Target:** Fund 75% of capital needs
Score: ⬢	**Score:** ⬢

Analysis: The only dedicated revenue source for transportation infrastructure in Nevada is the fuel tax, which was last increased in 1992. This funding stream has been stretched as a result of increased demands being placed on the freight transportation system, decreased purchasing power due to inflation, and declining revenues as new technologies and tougher federal standards have led to the development of more fuel efficient vehicles. Additional funding sources will need to be identified to adequately meet the preservation and capital improvement needs of the freight transportation system.

▼ Maintain or Needs Some Improvement ◆ Needs More Improvement ⬢ Needs Significant Improvement ■ Not Yet Scored

Table 1-1 (Continued)
Baseline Performance of Nevada's Freight System

BASELINE PERFORMANCE

Summary of Goals, Objectives, Performance Measures and Targets, and Baseline Conditions (Continued)

Economic Competitiveness

Improve the contribution of the freight transportation system to economic efficiency, productivity, and competitiveness.

Objective:

Freight transportation that provides a competitive advantage: Support and enhance the state's economic competitiveness through transportation investments that improve and sustain the following critical factors of the state's freight transportation system: mobility and reliability; safety; infrastructure preservation; advanced innovative technology; environmental sustainability and livability; collaboration land use and community values; and sustainable funding.

Measure: Composite indicator reflective attainment in critical factor objectives

Baseline:

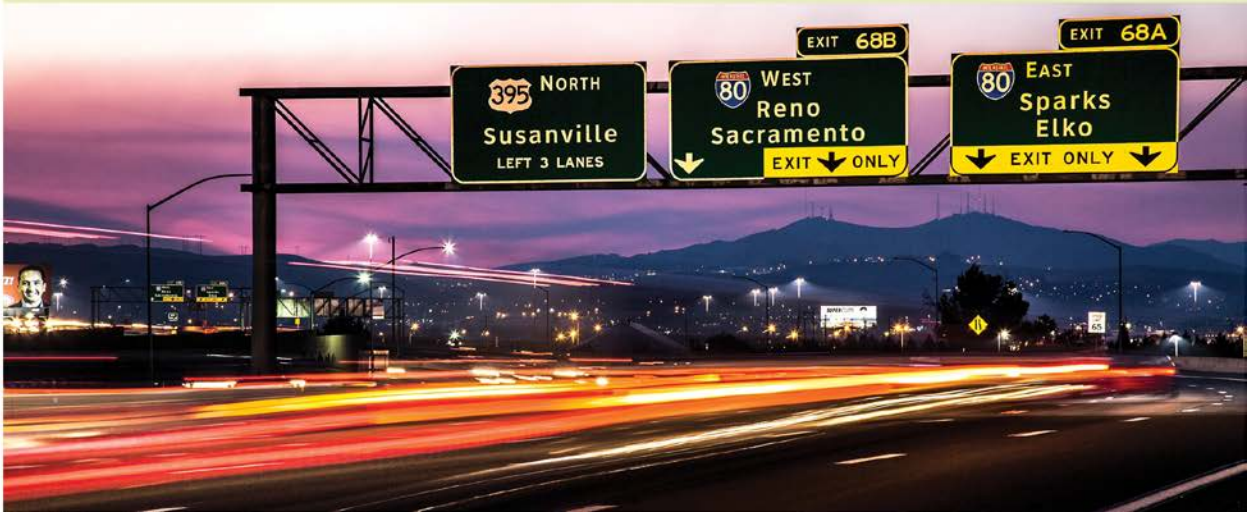
Chokepoints on major truck routes	Highway safety	Pavement conditions
Bridge conditions	Freight-related R&D	Collaboration
Vehicular emissions	Funding	

Target: ≥75% of critical factor objectives have positive trends towards meeting their performance targets by 2021

Score: Progress on about 45% of critical factor objectives are trending positive

Analysis: The vision for the Nevada State Freight System is that it will provide the state with a competitive advantage. The combined impacts of improvements in the critical factors of freight transportation are envisioned to create this advantage. Tracking our overall progress towards achieving the established performance targets for the objectives established for the critical factors provides a measure to ascertain progress toward achieving this competitive advantage.

Maintain or Needs Some Improvement | Needs More Improvement | Needs Significant Improvement | Not Yet Scored



1.3 Performance and Implementation Plan

The next step in the performance planning process, as illustrated on Figure 1-6, is to develop performance plans for achieving the near-term targets and ultimately the state goals. This Performance and Implementation Plan presents a suite of strategies and actions to achieve the vision and goals of the Freight Plan. The strategies meet at least one identified goal, although many of the strategies contribute to meeting multiple goals. The strategies include major investments in freight transportation infrastructure, as well as low-cost programs and policies designed to enhance freight operations and freight-supported economic development.

Incremental improvements to the existing freight system within the state will improve various aspects and conditions, but will not create the significant competitive advantage that will change Nevada's desirability or its position or role and function within the Western grid. Large-scale transformational solutions have the ability to instigate major change, but typically come with more involved planning, approval, and construction processes, and, therefore, require longer timeframes for implementation. The following suite of strategies identified as part of the Freight Plan includes a combination of both scales of projects in order to meet the vision. Table 1-2 summarizes the 18 strategies presented and identifies the goal(s) that each strategy either directly or indirectly addresses.

Table 1-2. Freight Plan Goals and Strategies

Each strategy directly (☀) or indirectly (☾) addresses specific goals

	Strategies	Economic Competitiveness	Safety	Mobility and Reliability	Infrastructure Preservation	Collaboration, Land Use, and Community Values	Innovative Technology	Environmental Sustainability and Livability	Sustainable Funding
1	I-11 Corridor	☀	☾	☀		☾	☾		
2	Freight Villages	☀	☾		☾		☾		
3	Freight Vehicular Emission Reduction			☾	☾		☾	☀	
4	Roadway Preservation Program		☾	☾	☀		☾		☾
5	Short-line Freight Rail Preservation Program	☾			☀			☾	☾
6	At-Grade Crossing Safety Improvement and Grade Separation Program		☀	☾	☾				☾
7	Freight Transportation, Land Use and Economic Development Integration	☾				☀		☾	☾
8	Freight Advisory Committee					☀			
9	Western State Freight Coalition	☾	☾	☾		☀	☾		
10	Logistics and Manufacturing Local Workforce Education and Training Policy Initiative	☀		☾		☾			
11	Freight Technologies and Trends Research	☾					☀	☾	

Strategies		Economic Competitiveness	Safety	Mobility and Reliability	Infrastructure Preservation	Collaboration, Land Use, and Community Values	Innovative Technology	Environmental Sustainability and Livability	Sustainable Funding
12	Autonomous/Connected Vehicle Systems	☾	☾	☾			☀	☾	
13	Freight Truck Parking Expansion and ITS Program		☀	☾			☀		☾
14	Truck Inspection and Over-Dimensional Vehicle Program		☀						☾
15	Freight System Resiliency		☾	☀	☾			☾	
16	Nevada State Freight Plan Update	☀	☾	☀	☾	☾	☾	☾	☾
17	Implementation of Freight Project Priorities	☀	☀	☀	☀	☀	☀	☀	
18	Sustainable Transportation Funding	☾	☾	☾	☾	☾	☾	☾	☀

1.3.1 Nevada's Highway Freight Network

An important component of the Freight Plan and precursor to aligning prioritized projects with available funding sources is defining Nevada's Highway Freight Network, which is a combination of the National Highway Freight Network and additional corridors that are also important for Nevada. Together, there are six components Nevada's Highway Freight Network, defined by USDOT or states agencies, as indicated in Table 1-3.

Table 1-3. Components of Nevada's Highway Freight Network

National/State Network	Component	Defined by	Mileage Cap
National Highway Freight Network (NHFN)	Primary Highway Freight System (PHFS)	USDOT	None
	Critical Rural Freight Corridors (CRFCs)	NDOT	150
	Critical Urban Freight Corridors (CUFCs)	NDOT and MPOs	75
	Other Interstates Not on NHFN	USDOT	None
Additional corridors important to Nevada	Critical Multistate Freight Corridors	NDOT	None
	Other Nevada Freight Corridors	NDOT and MPOs	None

State transportation agencies are responsible for defining the Critical Rural Freight Corridors (CRFCs), Critical Urban Freight Corridors (CUFCs), and Other Nevada Freight Corridors. Having a defined network is required to apply for certain federal funding opportunities. For instance, only projects on the National Highway Freight Network (NHFN) are eligible for funding from the National Highway Freight Program (NHFP) and the new freight-related discretionary grant program: Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies (FASTLANE).

Because the mileage cap for the nationally defined system is disproportionately low within large states like Nevada, two additional corridor categories important to Nevada were added to help prioritize state funding for projects not on the NHFN. Critical Multistate Freight Corridors are major US highways that traverse the state of Nevada and our neighboring states—helping to fill the large expanses where no interstate freeways exist, and provide critical long-distance connectivity. Other Nevada Freight Corridors are additional highways that serve regional and local freight mobility. Figures 1-7 through 1-9 illustrate Nevada's Highway Freight Network. The selection process, along with a complete list of corridors and criteria for selecting them, is included in Appendix 1B.

1.3.2 Project Prioritization

A key element of the Freight Plan is a list of prioritized improvement projects that will form a direct input into the State Transportation Improvement Program (STIP) and Regional Transportation Plans (RTP) developed by the metropolitan planning organizations (MPOs). To continue to advance transportation and freight mobility in the state, follow-through of these concepts to implementation is required.

A Multiple-Objective Decision Analysis (MODA) tool also used to identify Nevada's Highway Freight Network, was used to efficiently input and sort projects. With a methodology in place, updating this project list on an established interval can be completed in a consistent manner, allowing defensible comparisons of new projects. The project list was separated into four broad regions across the state—Las Vegas, Reno-Sparks, Carson City, and rural areas—and the projects sorted by MODA value within each region. The prioritized list was further refined based on input received from the FAC, NDOT, public agency partners, and key industry stakeholders and separated into three categories: critical, very important, and important. The current list of prioritized projects is found in Appendix 1B. Figures 1-7 through 1-9 show all projects on the list, including a sampling of several critical projects, overlaid onto Nevada's Highway Freight Network.

Figure 1-7. Nevada's Highway Freight Network and Projects: Statewide

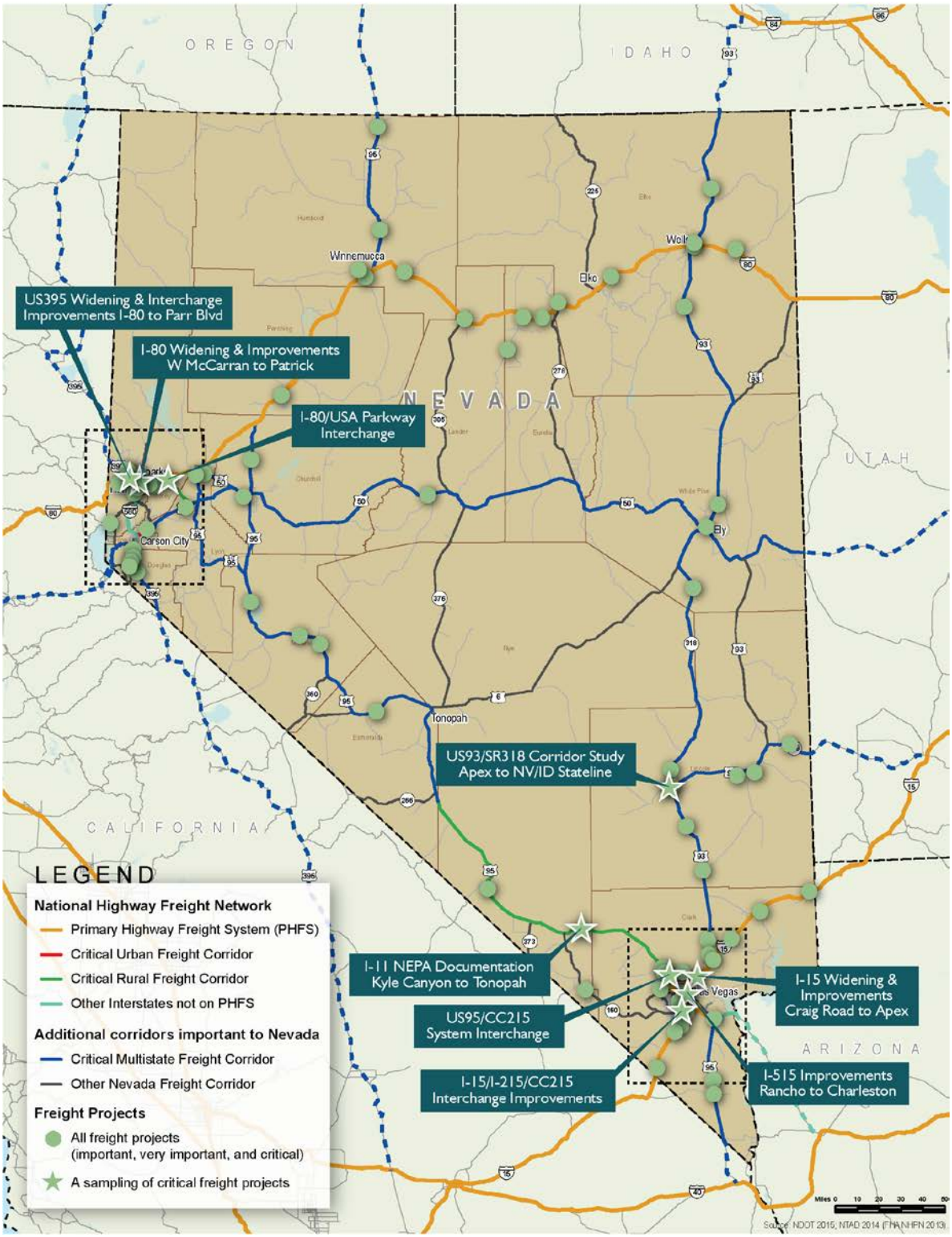


Figure 1-8. Nevada's Highway Freight Network and Projects: Las Vegas Area

Figure 1-9. Nevada's Highway Freight Network and Projects: Reno-Sparks Area

1.3.3 Implementation Actions

A full description of each strategy is provided in Appendix 1B. Table 1-4 below summarizes these strategies and actions that NDOT and its partners will need to carry out to realize advancement of the Nevada freight system. The list of actions is not meant to be final or fully inclusive. As actions are completed and regular performance monitoring identifies new issues, this list is meant to evolve to the changing needs of the state's freight system. The table provides the following information to facilitate implementation:

Timeframe to Initiate Action: Immediate (0-2 years), short term (3-5 years), and mid term (6+ years). Because the Freight Plan is expected to be updated every 5 years, most actions list the specific task required to be accomplished within the next 5 years. For longer-term or phased strategies, immediate or near-term actions are likely to have follow-on implementation actions to be initiated with the subsequent Freight Plan update.

Lead Agency/Department: Agency/organization responsible for initiating action. It is the responsibility of this agency to ensure that these actions are identified in any relevant plans and/or programs required to instigate initiation. Additionally, the lead agencies listed have various boards, commissions, or councils who may have a role in approving these actions.

Required Partnerships: Key partners or stakeholders to accomplish the implementation action. Many actions will require a wider stakeholder interest group, but those listed are the primary agencies or organizations whose input will be critical to decision making. The broader list of partners should be determined on a project-by-project basis at project initiation.

Funding Category: Primary funding program or agency responsible for implementation. Where a specific funding source is known, it is identified.

Funding Need Approximation: Monetary estimate to complete implementation action. In some cases, this estimate is for the initial phase of implementation (oftentimes a study), with a full funding need to be estimated as each project progresses.

Table 1-4. Freight Strategies and Implementation Actions

Strategy	Actions		Timeframe to Initiate Action	Lead Agency/ Department	Required Partnerships	Potential Funding Source	Funding Need Approximation
1. Advance multi-use corridor planning for I-11.	1.1	Conduct an analysis of the regional freeway system in Southern Nevada, and determine how and where the I-11 corridor would most appropriately fit in the network.	Immediate/ongoing	NDOT	• FHWA • RTCSNV • City of Boulder City • City of Henderson • City of Las Vegas • City of North Las Vegas • Clark County	NDOT – Other	$2.5 million
	1.2	Perform a series of studies to assess the strategic extension of I-11 from Las Vegas to the Canadian border, comprising two levels of investigation: (1) detailed corridor planning to determine a single preferred I-11 corridor between the Las Vegas metropolitan area and Northern Nevada border, and (2) high-level visioning to assess the most logical connection to Canada, based on the greatest economic and trade-related opportunities.	Immediate	NDOT	• FHWA • Washoe RTC • CAMPO • RTCSNV • Western States Freight Coalition • Cities/Counties	NDOT – Other	$2.5 million
	1.3	Update the Nevada Rail Plan with an analysis of the feasibility of completing a freight rail connection between Las Vegas and Reno-Sparks-Carson City.	Near-Term	NDOT	• FRA • Washoe RTC • CAMPO • RTCSNV • Western States Freight Coalition • Cities/Counties • UPRR	NDOT – Other	$500,000
2. Facilitate private development of freight village(s) in Northern and/or Southern Nevada.	2.1	Identify and facilitate private development opportunities for intermodal facilities.	Immediate/ongoing	GOED	Economic development agencies	GOED	NA
3. Deploy technologies that improve the fuel-efficiency of commercial vehicles, and provide better mode-choice and integration to encourage the most sustainable freight transportation options.	3.1	Encourage use of cleaner vehicle technologies to reduce freight vehicular emissions.	Near-Term	Nevada Trucking Association	• NDOT • DMV	NA	NA
	3.2	Work with the FAC to develop a mode policy that encourages moving freight in the most sustainable manner.	Immediate	NDOT	• FAC • State Transportation Board	NA	NA
	3.3	Build a compelling public benefits analysis and demonstration of potential market feasibility for new intermodal and/or bulk transload rail services from/to the State.	Near-Term	GOED	• NDOT • UPRR • LVCVA • RTCSNV • Washoe RTC	GOED	$100,000
	3.4	Pursue electrification at truck stops to reduce vehicle emissions from idling	Near-Term	Private Truck Stops	• NDOT • Nevada Trucking Association • Department of Conservation and Natural Resources • Nevada Governor's Office of Energy	Private	TBD
	3.5	Establish incentives to encourage the trucking industry to invest in next generation truck technologies.	Near-Term	Nevada Trucking Association	• NDOT • DMV	NDOT – Other	TBD
4. Preserve and renew Nevada's freight highway network.	4.1	Update the State Highway Preservation Report every two years to keep an accurate assessment of current maintenance needs to renew funding allotments by the Nevada State Legislature.	Immediate/ongoing	NDOT	NA	NDOT – Other	TBD

Table 1-4. Freight Strategies and Implementation Actions

Strategy	Actions		Timeframe to Initiate Action	Lead Agency/ Department	Required Partnerships	Potential Funding Source	Funding Need Approximation
	4.2	Determine a reliable source of funding for implementation of needed preservation/maintenance requirements.	Immediate	NDOT	• State Transportation Board • State legislature • Nevada Trucking Association • FHWA	NDOT – Other	TBD
5. Develop a preservation and expansion program for short-line freight rail infrastructure.	5.1	Establish a policy to strengthen NDOT's role in rail planning and implementation, including funding. Establish a policy and criteria for state involvement in rail preservation. Based on criteria, identify investments on short-line rail infrastructure and service preservation.	Immediate	FAC	• FRA	FRA	NA
	5.2	Develop a new rail spur to the Apex Industrial site in Southern Nevada to serve existing and near-term anticipated manufacturers.	Immediate	RTCSNV	• NDOT • City of North Las Vegas • Apex Holding Company	City of North Las Vegas	$35 million
6. Strengthen NDOT's Rail Safety and Security Program	6.1	Secure additional funding for NDOT's Rail Safety and Security Program. Additional funding from private stakeholders, discretionary grants, or other Federal, state, or local sources could help to fund more significant changes, such as closures or physical grade separations.	Near-Term	NDOT	• UPRR • MPOs • Cities • Counties	TBD	TBD
7. Develop a method to track and integrate freight transportation, land use, and economic development planning along major freight corridors in Nevada.	7.1	Form land use advisory committees throughout the state to coordinate with NDOT on changes in land use strategies that may impact access along state-owned freight corridors, as well as new land developments that may impact the movement of freight vehicles.	Immediate/ongoing	• Cities • Counties	• MPOs • NDOT • GOED • Economic development agencies	NA	NA
8. Maintain organization of the FAC to advise on implementation of freight strategies statewide.	8.1	Establish a schedule and process for convening or engaging the FAC in freight-related planning issues and progress upon completion of the NSFP.	Immediate/ongoing	NDOT	• FAC	NA	NA
9. Maintain organization and coordination of the WSFC to advise and support on regional freight issues, projects, and policies.	9.1	Establish the mission, organizational structure, process, and schedule for engaging the WSFC in freight-related planning issues upon completion of the NSFP.	Immediate/ongoing	NDOT	• WSFC	NA	NA
10. Encourage logistics and manufacturing-based companies and organizations to pursue workforce development training opportunities.	10.1	Advise on known educational/training opportunities at FAC meetings and encourage members to pursue educational opportunities	Immediate/ongoing	FAC	• GOED • Nevada System of Higher Education • DETR	Knowledge Fund	TBD
11. Pursue freight-related research through NDOT's Research Section to improve the State's readiness and adaptability to new freight movement and technology trends.	11.1	Develop freight related problem statements to submit to NDOT's Research Section.	Immediate/ongoing	FAC	• Nevada Trucking Association • UNR, UNLV, and other research entities	State Planning and Research Program	TBD
12. Incorporate autonomous system technologies into Nevada's freight system.	12.1	Understand and develop strategies to respond to advances in autonomous/connected vehicle technology and their impact on the freight transportation system, including related "smart infrastructure" to support implementation.	Immediate	Nevada Center for Advanced Mobility	• NDOT • GOED • DMV	GOED	NA
	12.2	Understand and develop strategies to respond to drone or unmanned aerial vehicle technology as a potential supportive freight-delivery technique.	Immediate	Nevada Institute for Autonomous Systems	• NDOT • GOED • FAA • DMV	GOED	NA
13. Increase the number of truck parking spaces and facilities, along with supportive ITS improvements.	13.1	Create a Nevada Truck Rest Stop Implementation Plan. Phase I is largely completed as part of the NSFP, and Phase II would consist of continued data collection and analysis, including surveys and interviews that will result in identification of issues as well as recommendations for additional truck parking areas.	Near-Term	NDOT	• Nevada Trucking Association • WSFC	National Highway Freight Program	$500,000

Table 1-4. Freight Strategies and Implementation Actions

Strategy	Actions		Timeframe to Initiate Action	Lead Agency/ Department	Required Partnerships	Potential Funding Source	Funding Need Approximation
	13.2	Implement investments in partnership with private and public stakeholders on truck parking ITS and expanding rest areas along interstate and interregional highways. Explore multistate partnerships.	Near-Term	NDOT	• FAC • WSFC	National Highway Freight Program	$2.5 million
14. Enforce regulatory compliance through aggressive inspections, use advanced inspection technologies to reduce costs and improve efficiencies for law enforcement and operators alike, and develop reasonable standards for over-dimensional vehicles to operate with fewer impediments on the freight network.	14.1	Identify locations for permanent truck inspection equipment, stations, and data system. Develop a scalable implementation plan with potential phased improvements (e.g., truck weigh stations, pre-screening lanes). Determine a method to sustainably fund improvements and operations, including full-time staffing and determine a fee schedule and appropriate use of fines (e.g., use truck fines to fund the inspection program). Change the Nevada Revised Statutes to allow permit fees to be charged in excess of administrative needs. The additional fees could be used for inspections or pavement preservation. Explore use of a consolidated online website or application to issue and store state-required permitting and credentials, allowing streamlined access for freight carriers and law enforcement compliance officers alike.	Immediate	• NDOT • Nevada Highway Patrol	Nevada Trucking Association	NDOT – Other	$500,000
	14.2	Construct the inspection stations at key locations, including integration of advanced technologies to gather information – reducing layover time for truckers and limiting the number of on-hand staff required (e.g. Drivewyze or PrePass, which use electronic transponders to quickly access vehicle information and ensure compliance with state requirements).	Mid-Term	• NDOT • Nevada Highway Patrol	TBD	National Highway Freight Program	$2 million
	14.3	Develop design standards to require an 18-foot-0-inch bridge clearance for all new construction be considered, and implemented when feasible.	Near-Term	NDOT	Nevada Trucking Association	TBD	TBD
15. Develop response plans and mitigation strategies for potential threats to Nevada's freight transportation system.	15.1	Research and document risks, mitigation measures, and emergency plans in a Comprehensive Disaster Risk Assessment.	Near-Term	NDOT	Nevada Highway Patrol	NDOT – Other	$200,000
	15.2	Conduct a Hazardous Commodity Flow Study to document by what route and mode all hazardous materials are transported throughout Nevada.	Near-Term	NDOT	• State Emergency Response Commission • Nevada Dept. of Public Safety, HAZMAT Permitting Office	National Highway Freight Program	$300,000
16. Update the NSFP at regular intervals to insure relevance of goals, objectives, and performance measures, and maintain a prioritized list of projects and programs.	16.1	Integrate recommendations from the NSFP into NDOT's performance-based Long Range Transportation Plan (LRTP).	Immediate	NDOT	• MPOs • Cities • Counties	NA	NA
	16.2	Integrate freight performance measures into NDOT's annual Performance Management process, allowing the monitoring of performance and progress of freight improvements. Based on the resultant analysis, maintain a list of high priority freight performance needs.	Near-Term	NDOT	• FAC • MPOs	NDOT – Other	TBD
	16.3	Conduct periodic updates to Nevada's defined National Highway Freight Network.	Near-Term	NDOT	FAC	NA	TBD
	16.4	Conduct a wholesale update to the NSFP every five years.	Mid-Term	NDOT	FAC	NDOT – Other	$1.5 million
	16.5	Hire or allocate support staff to the NDOT Freight Program to implement these strategies.	Immediate/ongoing	NDOT	FAC	NDOT – Other	TBD
17. Implement projects defined in the NSFP prioritized list of improvements.	17.1	Incorporate the fiscally constrained freight investment plan into the long-range transportation plan, and update as needed.	Near-Term	NDOT	FAC	In conjunction with NDOT's LRTP	NA

Table 1-4. Freight Strategies and Implementation Actions

Strategy	Actions		Timeframe to Initiate Action	Lead Agency/ Department	Required Partnerships	Potential Funding Source	Funding Need Approximation
	17.2	Periodically identify and prioritize additional freight-related capital improvement projects, and update the prioritized list of projects and fiscally constrained freight investment plan	Near-Term	NDOT	FAC	NA	NA
18. Pursue an "all of the above" strategy to achieve sustainable transportation funding to operate, maintain, and expand Nevada's freight transportation system.	18.1	Stay abreast of legislative changes that may result in grant opportunities.	Immediate/ongoing	NDOT	• FAC • WSFC • AASHTO	NA	NA
	18.2	Strategize project opportunities for this five-year round of NSFHP grants; prepare necessary planning and environmental studies to meet grant requirements.	Immediate	NDOT	FAC	National Highway Freight Program	Varies depending on project
	18.3	Maintain coordination with FAC and WSFC to collaborate on potential funding opportunities that are conducive to multi-state projects or partnerships.	Immediate/ongoing	NDOT	NA	NA	NA
	18.4	Communicate to the public and stakeholders the status quo outlook for the condition and performance of the State Highway System and how this could change with fuel tax indexing if approved by the voters in November 2016.	Immediate	FAC	• NDOT • DMV • Nevada Trucking Association • MPOs • National Association of Counties	NA	NA
	18.5	Prepare a "business case" document that assesses quantitatively and/or qualitatively the economic and non-economic benefits of full implementation of the state's long-range transportation plan to the significant beneficiary groups.	Near-Term	NDOT	TBD	NDOT – Other	$1 million

Table Organization Notes:

- Timeframes to initiate action:
  - Immediate = 0-2 years
  - Near-Term = 3-5 years
  - Mid-Term = 6-10 years
- Required partnerships, funding category or funding needs noted as "To Be Determined (TBD)" require additional study or project identification to further define.

1.3.4 Fiscally Constrained Freight Investment Plan

Developing and updating a fiscally constrained freight investment plan from the list of prioritized freight infrastructure projects is one of the Freight Plan's major strategy solutions (see #17). As an outcome of the FAST Act, each state has been awarded an allotment of formula funds over a 5-year period, from fiscal years 2016 to 2020. These funds may be obligated for various project types, with some restrictions on the percentage of uses (e.g., no more than 10 percent for intermodal or freight rail projects). In addition to the NHFP funds, Nevada has other federal, state, regional, and local funding sources available to implement this freight program.

The current list of prioritized projects found in Appendix 1B, Attachment E formed the foundation for the investment plan, and was screened to identify possible candidate projects for funding through the NHFP. The objective of this screening was to make a recommendation for the priority use of these formula funds that Nevada will receive over the 5 years of the FAST Act. To be eligible for use of these formula funds, projects must be located on the NHFN.

The amount of money available to Nevada under the NHFP over the 5 years of the FAST Act will be about $57.9 million, plus NDOT's 5 percent match of $2.9 million, for a total of $60.8 million available for projects. In considering possible candidate projects for funding from the NHFP, only projects on the NHFN, under $12 million, and not currently funded were considered. Projects were further screened based on their importance to freight mobility and limited funding priority from other funding sources.

Table 1-5 outlines the funding allocation scheme for Freight Plan implementation actions and proposed list of projects eligible for use of the NHFP funds. Projects are divided into the five fiscal years and meet each year's specified apportionment. Table 1-6 outlines the early project development activities for a few priority projects that are not good candidates for the NHFP, but are important for freight mobility and could be good candidates for future FASTLANE grants.

Table 1-5. Projects to be Funded by the National Highway Freight Program

Strategy	Actions		Funding Year and Costs*					
			2016	2017	2018	2019	2020	Total
13. Increase the number of truck parking spaces and facilities, along with supportive ITS improvements.	13.1	Create a Nevada Truck Rest Stop Implementation Plan. Phase I is largely completed as part of the NSFP, and Phase II would consist of continued data collection and analysis, including surveys and interviews that will result in identification of issues as well as recommendations for additional truck parking areas.		$500,000				$500,000
	13.2	Implement investments in partnership with private and public stakeholders on truck parking ITS and expanding rest areas along interstate and interregional highways. Explore multistate partnerships.			$1,000,000	$1,000,000	$500,000	$2,500,000
14. Enforce regulatory compliance through aggressive inspections, use advanced inspection technologies to reduce costs and improve efficiencies for law enforcement and operators alike, and develop reasonable standards for over-dimensional vehicles to operate with fewer impediments on the freight network.	14.2	Construct the inspection stations at key locations, including integration of advanced technologies to gather information.		$500,000	$500,000	$500,000	$500,000	$2,000,000
15. Develop response plans and mitigation strategies for potential threats to Nevada's freight transportation system.	15.2	Conduct a Hazardous Commodity Flow Study to document by what route and mode all hazardous materials are transported throughout Nevada.		$300,000				$300,000
17. Implement projects defined in the NSFP prioritized list improvements.	17.2	Deliver low-cost, high-impact projects:						
		#21C, I-80/I-580/US395 Interchange Improvements NEPA Study	$12,870,000					$10,354,961
		#22, I-80 Safety Improvements (eastern Truckee Canyon)		$7,000,000				$7,000,000
		#45E, I-15 Widening, Apex Interchange to Garnett Interchange (US93) NEPA Study		$1,000,000				$1,000,000
		#100, Upgrade US95 to 4-lane divided highway from Kyle Canyon to Tonopah, NEPA Study		$200,000				$200,000
		#74, I-80 Truck Climbing Lanes at Emigrant Pass			$6,000,000			$6,000,000
		#76, I-80 Truck Climbing Lanes at Pequop Summit			$3,500,000			$3,500,000
		#54B, New Via Nobila interchange on I-15 to provide access the South Limited Transition Area (industrial area)				$11,000,000		$11,000,000
		#85A, I-80/SR306 Interchange Improvements					$1,200,000	$1,200,000
		#32, I-80 Exit 176 Improvements: realign intersection at Pilot Travel Center					$1,500,000	$1,500,000
		#18C, North Virginia Street Improvements from Parr Blvd to BUS395					$9,700,000	$9,700,000
		Total estimated project cost(s)	***$12,870,000***	***$9,500,000***	***$11,000,000***	***$12,500,000***	***$13,400,000***	***$59,270,000***
		National Highway Freight Program (NHFP) funds	***$10,354,961***	***$9,025,000***	***$10,450,000***	***$11,875,000***	***$12,730,000***	***$54,434,961***
		5% Local match (for NHFP funds)	$544,998	$475,000	$550,000	$625,000	$670,000	$2,864,998
		Other Federal funds	$934,958	$0	$0	$0	$0	$934,958
		Local match (for other Federal funds)	$49,209	$0	$0	$0	$0	$49,209
		Additional Local funds	$985,874	$0	$0	$0	$0	$985,874
		National Highway Freight Program Running Balance						
		Unused portion of the NHFP carried forward **from** prior fiscal years	$0	$211,326	$1,293,209	$1,868,900	$2,397,802	$3,449,916
		Annual Allotment available from the NHFP	$10,566,287	$10,106,883	$11,025,691	$12,403,902	$13,782,114	$57,884,877
		Total available from the NHFP	$10,566,287	$10,318,209	$12,318,900	$14,272,802	$16,179,916	$61,334,793
		NHFP funds used on project(s) this year	$10,354,961	$9,025,000	$10,450,000	$11,875,000	$12,730,000	$54,434,961
		Unused portion of the NHFP carried forward **to** the next fiscal year	$211,326	$1,293,209	$1,868,900	$2,397,802	$3,449,916	$6,899,832

* Estimated project costs will be refined as the projects are developed further.

Table 1-6. Studies Needed to Advance Freight Priorities, to be Funded from Sources Other than NHFP

Strategy	Actions		Funding Need Approximation
1. Advance multi-use corridor planning for I-11.	1.2	Perform a series of studies to assess the strategic extension of I-11 from Las Vegas to the Canadian border, comprising two levels of investigation: (1) detailed corridor planning to determine a single preferred I-11 corridor between the Las Vegas metropolitan area and Northern Nevada border, and (2) high-level visioning to assess the most logical connection to Canada, based on the greatest economic and trade-related opportunities.	$2,500,000
	1.3	Update the Nevada Rail Plan with an analysis of the feasibility of completing a freight rail connection between Las Vegas and Reno-Sparks-Carson City.	$500,000
15. Develop response plans and mitigation strategies for potential threats to Nevada's freight transportation system.	15.1	Research and document risks, mitigation measures, and emergency plans in a Comprehensive Disaster Risk Assessment.	$200,000
18. Pursue an "all of the above" strategy to achieve sustainable transportation funding to operate, maintain, and expand Nevada's freight transportation system.	18.2	Strategize project opportunities for this five-year round of NSFHP grants; prepare necessary planning and environmental studies to meet grant requirements.	
		– US 93/SR 318 Corridor Study, Apex to Idaho Border	$2,000,000
		– US 50 Corridor Study, US 395 to USA Parkway	$1,000,000

1.4 Funding and Financing

The development of sustainable, adequate transportation funding is the single most significant issue that must be addressed if we are to transform the vision for Nevada's freight transportation system to reality. While this topic often presents political challenges, simply maintaining the freight system that we have today, much less making the significant, transformational improvements necessary to successfully meet the challenges and opportunities of tomorrow, will not be possible unless sustainable, adequate funding is secured. To be successful, the state's funding strategy must address the following six major issues:

1. Development of a sustainable revenue stream to provide the funding needed to operate, maintain, renew, and expand all transportation modes
2. Identification and effective communication of the benefits that transportation investments provide to society to build public support

3. Development of funding mechanisms to effectively mitigate the loss of purchasing power of transportation revenues as a result of inflation
4. Development of funding mechanisms to mitigate the impacts of increasing vehicle fuel economy on fuel tax revenue streams
5. Equitable cost sharing across all beneficiaries of the transportation system
6. Improved mechanisms for increasing private sector participation in delivering transportation infrastructure and services

1.4.1 Strategic Freight Transportation Funding Issues

There is Only One Transportation System

While federal mandates require that states develop a freight plan, it is important to remember that there is not a separate, stand-alone freight transportation system, but rather a multimodal transportation system that serves the nation's mobility needs, including the movement of freight. This has important implications for how the funding of "freight improvements" should be approached and communicated to the public. Due to the multimodal nature of the transportation system, virtually every freight-related improvement will provide either direct or indirect benefits to other users of the transportation system. Conversely, the vast majority of our surface transportation investments that are not regarded solely as freight improvements, regardless of mode, will provide either direct or indirect benefits to freight users.

Who Should Pay for Freight Improvements and How Much?

The state's multimodal transportation system serves a wide range of users and improvements made to the system provide direct and indirect benefits to virtually everyone living, working, or visiting the state. However, funding dedicated to improving the freight system can only cover a very small fraction of all the improvements that could benefit freight movement. The key to successfully and sustainably funding the needed investments in the state's transportation system, including freight improvements, is to understand and effectively quantify the value that these investments create and who receives this value. With this information, we can devise financial strategies to fund the needed investments by capturing a reasonable portion of this value from the various beneficiaries through appropriate revenue mechanisms. Because each revenue collection mechanism impacts the various groups benefitting from transportation investments differentially, having a variety of diverse revenue sources enhances our ability to create an overall funding structure that achieves reasonable equity among all beneficiaries based upon the relative value received.

Current Funding Shortfalls

The Freight Plan indicates that an estimated $13.5 billion is needed to fund the currently identified high-priority freight projects and services. This number understates the total freight needs because it does not include system operations and maintenance (O&M) costs and does not capture substantial portions of major new initiatives such as I-11 and the creation of intermodal freight villages. The Freight Plan does not attempt to identify a specific "freight" funding shortfall for two reasons. First, while the list of high-priority projects and services identified within the Freight Plan is extensive, it is not an exhaustive list of all of the projects and services that would provide additional benefit to freight users. As stated previously, virtually every transportation investment in every mode could arguably yield benefits for freight users. Secondly, the vast majority of funding that can be used to implement freight-related improvements and services is fungible across a wide array of other transportation improvements. For these reasons, it makes sense to consider the needs of the entire multimodal transportation system and all transportation funding sources when discussing funding shortfalls.

Currently, the best available data on total system needs and revenues are likely those that are contained in the "2035 Nevada Unified Transportation Investment Plan Preview." This document presents needs and revenues compiled from various state and local long-range transportation plans. In constant dollars, the aggregate statewide needs through 2035 are estimated at $47.25 billion and revenues during this same period are estimated at $20.80 billion, indicating a projected funding shortfall of $26.45 billion. While these numbers are the best currently available, they understate the severity of the shortfall as local road and transit needs of communities outside MPO boundaries, and aviation and heavy rail needs and revenues are not included.

Causes of Existing Transportation Funding Shortfalls

The most significant reason for the transportation funding shortfall in the state of Nevada is the heavy reliance on flat fuel taxes. While fuel taxes have served the state well for many decades, they have become increasingly less effective in raising the revenue needed to adequately meet the demands placed on the state's multimodal transportation system. The two most significant factors contributing to the declining effectiveness of the current fuel tax mechanism's ability to meet the growing needs of Nevada's transportation system are inflation and increasing vehicle fuel economy. These factors impact both the revenue collected from state and local fuel taxes as well as federal transportation funding coming to Nevada, the primary source of which is federal fuel taxes.

From 1993 to 2013, each dollar collected in federal and state gas taxes lost approximately 50 percent of its purchasing power and this trend will continue. The indexing of fuel tax rates to inflation instituted by Washoe County in 2003 and by Clark County in 2013 has allowed these jurisdictions to begin recovering the lost purchasing power from the time of implementation forward by annually adjusting fuel tax rates. Indexing, however, does not recover the cumulative inflationary losses experienced prior to its implementation.

While adjusting fuel tax rates can be effective in recovering some of the purchasing power lost as a result of inflation, in general, fuel taxes as a revenue collection mechanism are becoming increasingly less effective and less equitable as:

- Improved vehicle efficiency diminishes the fuel tax revenue collected per mile driven
- Increasing numbers of all-electric vehicles (EVs) are introduced which contribute nothing in fuel taxes

From 2008 to 2013, state gas tax collections per mile driven by light-duty vehicles (LDVs) declined approximately 23 percent. LDV's are significant because they make up about 96% of Nevada's vehicle fleet and account for about 89% of all VMT. This decline is projected to continue with mandated improvements in vehicle fuel efficiency through 2025. If there is no increase in state gas tax rates, the nominal dollar amount collected in 2025 for each mile driven by LDVs is expected to decline to approximately 50 percent of the amount collected in 2008 (Figure 1-10). For the LDV fleet, this trend resulted in an estimated loss of approximately $44 million in revenue for the state's Highway Fund in 2013. Assuming there is no increase in the state's gas tax rate, the annual loss in revenue to the state's Highway Fund in 2025 is estimated at approximately $122 million. The cumulative loss between 2015 and 2025 is estimated to exceed $1.0 billion (Figure 1-11). These estimates do not include the loss in purchasing power of these dollars due to inflation. These large revenue losses, coupled with the impacts of inflation and increasing use of the highway system, will accelerate the growing backlog of road repairs and cripple Nevada's ability to expand the road system at the pace necessary to meet the future needs of its citizens and businesses.

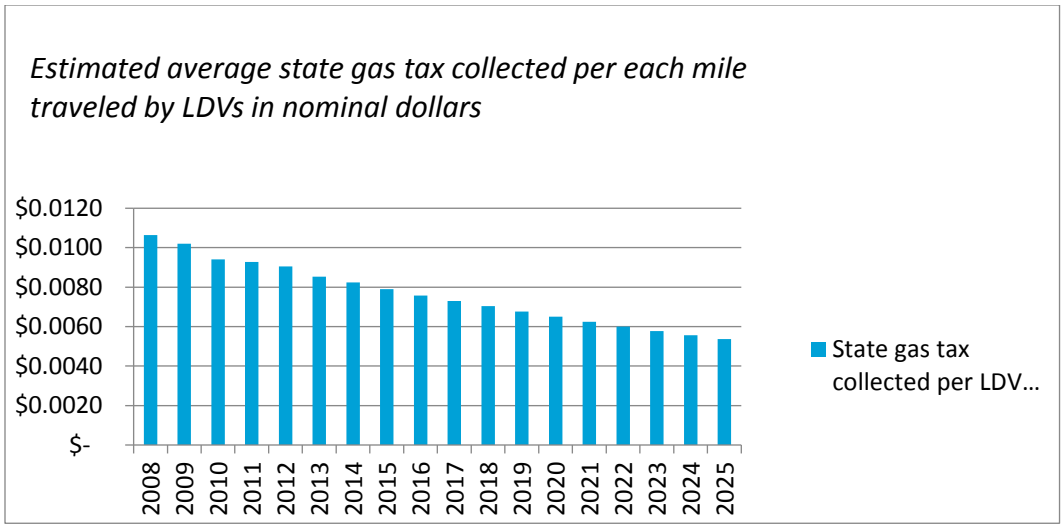


Figure 1-10. Estimated Average State Gas Tax Collected per Each Mile Traveled by LDVs in Nominal Dollars

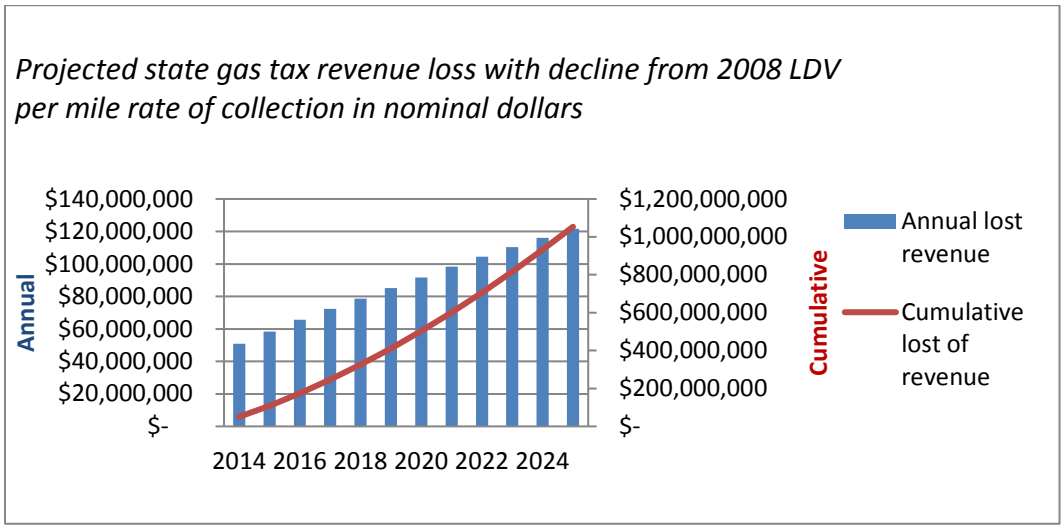


Figure 1-11. Projected State Gas Tax Revenue Loss with Decline from 2008 LDV per Rate of Collection in Nominal Dollars

From Where Will Additional Transportation Funding Come?

While total transportation funding has increased nationwide over the past two decades, funding at the federal level has been fairly stagnant. The significant majority of this increase has been at the local level. Between 1999 and 2014, there were approximately 475 local and 48 statewide transportation-funding questions on ballots across the nation, 72 percent of which were approved. Nevada has been a leader in this regard where local money accounts for more than 50 percent of all transportation funding. Much of the local activity has been motivated by the growing realization that neither the federal nor the state government has the capacity to fully fund transportation needs, and that any increases in federal and state levies to fund these shortfalls would largely be paid by the residents of these local communities. By going to residents directly, local communities increase the level of control, accountability, and efficiency in the use of these funds, and can take on a decisive role in determining their own economic destinies.

Understanding the Difference Between Funding and Financing

The terms funding and financing are often used interchangeably, which is unfortunate and confusing. Transportation funding is typically money that comes from taxes, user fees, or grants that can be spent on infrastructure improvements, services, and/or program initiatives, and does not need to be paid back

or reimbursed. Financing is essentially borrowing money against projected future revenues typically by issuing bonds. These bonds may be repaid from funding sources such as fuel taxes, property taxes, and sales taxes. It is important that the public understand this distinction because this typically means that future revenues have been committed to paying off the bonds and will thus reduce the amount of funding available for making needed transportation improvements in the future. Additionally, the interest paid to bond holders over the life of the bond increases the real cost of the current project. This same confusion often clouds the discussion of public-private partnerships (PPP). PPPs are a financing tool as the persons investing private capital in these endeavors expect to recover their investment with interest commensurate to the risk they are taking. The funding for making this repayment is typically from user fees (e.g., tolls), availability payments funded by tax revenues, development rights, etc. While financing is important, funding remains the single most critical impediment to meeting the state's mobility needs.

1.4.2 Current and Potential Sources of Transportation Funding

Nevada currently has a wide variety of transportation funding sources at the state and local level including:

- State gas taxes
- State special fuel taxes
- Motor vehicle registration taxes
- Driver's license fees
- Motor carrier fees
- Formula and discretionary federal transportation funds (primarily derived from federal fuel taxes)
- Local gas taxes
- Local special fuel taxes
- Sales and use taxes
- Property taxes
- Impact fees
- Assessments through improvement districts
- Development tax
- Government services tax-supplemental

While the majority of current federal, state, and local transportation funding in Nevada is generated by fuel taxes, Nevada should pursue an "all-of-the-above" strategy. Having a variety of funding sources can improve revenue stability and increase overall funding while providing the means to distribute the burden of paying for transportation investments among the beneficiaries in a reasonably equitable manner. Because eligible uses and administrative processes vary from funding source to funding source, having multiple funding sources can provide flexibility and enhance the efficiency of project delivery.

The state's existing funding sources could be expanded along two dimensions: first by annually or biannually adjusting rates of the sources to address inflationary pressures and stabilize the purchasing power of these revenues, where this is not already in place; and second by increasing the rates to generate the new revenue needed to meet the growing needs of our residents, businesses, and visitors.

Improvement districts and impact fees have potential for generating considerable revenue for improvements in defined geographies within the state. One existing source that currently plays a relatively minor role in transportation funding but has potential to generate significant revenue throughout the state is the property tax.

Funding sources that are currently unused in Nevada but that could have major impact include vehicle-miles traveled (VMT) fees and tolling. VMT fees are of particular importance because they can address the dire impacts of increasing fuel economy on motor vehicle fuel tax revenues. Beyond this, VMT fees

and tolling could play significant roles in generating substantial additional revenue needed to meet the mobility needs of the state.

1.4.3 Financing tools

In addition to municipal bonds, Nevada has a wide variety of other financing tools at its disposal that can be used for improving the timeliness and efficiency of delivering transportation infrastructure, including:

- Grant Anticipation Revenue Vehicles (GARVEEs)
- Tax Credit Bonds
- Section 129 loans
- TIFIA loans
- Private Activity Bonds
- Bank debt
- Tax increment financing
- Public-private partnerships
- Railroad Rehabilitations and Improvement (RRIF) loans

Among potential new financing tools, both a State Infrastructure Bank with adequate capitalization and a National Infrastructure Bank have great potential. If adequately capitalized, these institutions could provide low-cost, flexible, patient financing for infrastructure projects of all modes. This type of financial tool could be particularly useful as the state moves to implement new technologies and significant projects whose economic impacts may take decades to be fully realized.

Section 2: Nevada's Freight Transportation System

Nevada has a robust freight transportation system that supports multiple supply chains for a unique set of industries—from natural resource extraction to tourism. An inventory of these assets, supply chains, and commodity flows that make up and influence our freight network is presented here.

2.1 Statewide Inventory: Freight Assets and Conditions

The transportation system plays an important role in the economy, allowing freight movements to aid import and export activities. An efficient transportation network and quality infrastructure components can have positive impacts on both regional and national economies.

Having an understanding of the state's existing freight transportation network provides a baseline to compare future progress. Beyond simply the conditions and operations of the infrastructure itself, this includes serving freight-related industries, ensuring intermodal connectivity, understanding the impact of this infrastructure on the surrounding natural and human-made environment, and the institutional framework for which freight infrastructure plays a role within Nevada.

2.1.1 Major Freight-Dependent Employment Centers

The Nevada Department of Employment, Training, and Rehabilitation maintains detailed records of industry types and number of employees throughout the state. This information establishes the foundation for understanding commodity flow data, described in Section 2.2. It reasons that the number of employees in a freight-related industry is a good indication of the amount of freight coming or going from a particular employment center. Locations with a large number of employees generate a large number of freight shipments, whereas a lesser number of employees are likely not handling as many freight shipments.

Appendix 2A includes detailed maps of the total number of freight-dependent employment centers statewide, with more detailed maps of the Las Vegas and Reno-Sparks metropolitan areas by industry and by geography. Summary-level observations of industry-specific data include:

- **Trucking and warehousing employment centers** generate the highest proportion of truck trips per employee and are a major indicator of where shipments are generated and received. This category includes couriers, the postal service, general warehousing and storage, and freight or specialized trucking companies. The largest concentrations of these facilities are located in the Reno/Sparks and Las Vegas metropolitan areas, specifically along freeway/highway corridors.
- **Manufacturing industries** vary in type, but like trucking and warehousing, are primarily focused in the metropolitan areas, with a heavy concentration at the Sparks Intermodal Facility, with increased activity in the future at the Tahoe-Reno Industrial Center with the opening of the Tesla Giga Battery Plant.
- **Agricultural industries** produce a much smaller proportion of truck trips per employee and unlike the abovementioned, are more widespread and primarily located outside urbanized metropolitan areas. Churchill and Lyon counties have the highest concentration of agriculture facilities in the state.
- **Mining industries** generate a large proportion of truck trips per employee because of the mass of material, including gold, silver, copper ore, nickel ore, sand, and gravel. Like agriculture, these industries are more widespread in less urbanized areas. The highest concentration of mines is near the I-80 corridor in Eureka, Elko, Humboldt, and Lander counties.
- **Construction** includes residential, non-residential, commercial, industrial, highway/bridge, oil and gas pipeline, power/communication system, and heavy construction companies. These industries are typically based in areas of highest population (metropolitan centers).
- **Retail, wholesale, and fulfillment centers** typically generate fewer trucks trips per employee, but still generate a significant number of truck trips due to the large numbers of employees. This category includes internet fulfillment centers—some of the larger are Amazon.com Inc. and Zappos.com. These are primarily located within urbanized areas.

- **Entertainment and accommodations** include the hospitality and tourism industry and is a major driving economic force in Nevada. The largest employers are the mega-resort hotel-casinos, primarily located along the Las Vegas Strip, with 2,000 to 8,500 employees each. Other large hotel-casinos are located throughout the Las Vegas and Reno-Sparks-Carson City areas, along with industries at the borders of Nevada.

2.1.2 Existing Infrastructure

Highways

Figure 2-1 shows the primary interstates and U.S. highways in Nevada, including two interstates, I-80 and I-15. I-80 is an east-west transcontinental route stretching from California to the Atlantic coast, including approximately 400 miles across northern Nevada, connecting to the Reno-Sparks metropolitan area. I-15 is the primary north-south, high-capacity corridor that serves travel across more than 120 miles of southern Nevada and through the Las Vegas metropolitan area. The I-15 corridor was designated by USDOT in 2007 as one of six "Corridors of the Future" because of its regional significance for transportation of goods and people. Additionally, some routes in Nevada are considered National Highway System (NHS) routes designated by the Federal Highway Administration (FHWA) as roadways important to the nation's economy, defense, and mobility. For the non-interstate highways, these corridors tend to be highways that provide access to a major port, airport, public transportation facility, or other intermodal transportation facility (FHWA, 2012). As identified NAFTA, FHWA High-Priority Corridors—including the CANAMEX Corridor—also are illustrated on Figure 2-1.

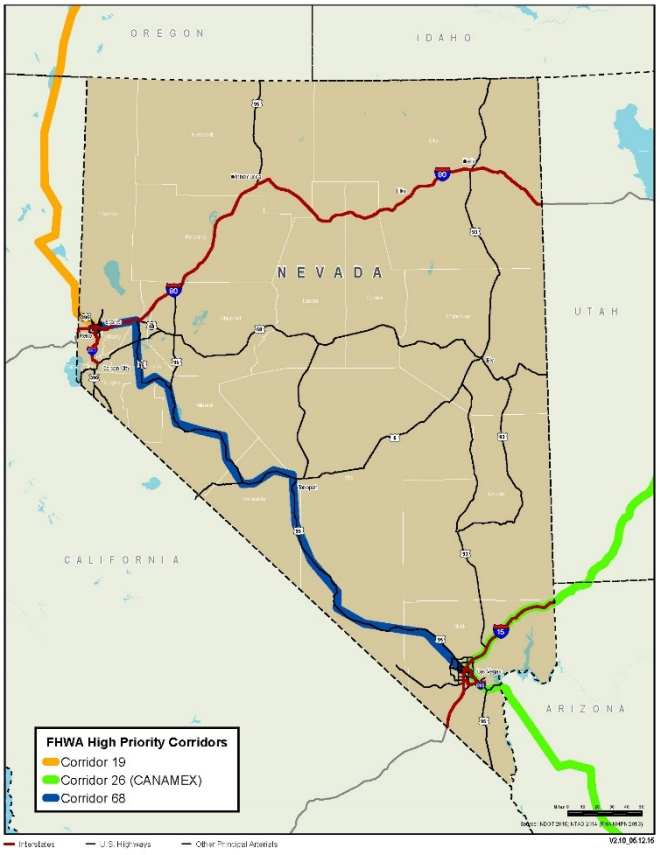


Figure 2-1. Nevada Interstates and Major Highways

From the perspective of physical condition, NDOT updates the *State Highway Preservation Report* every 2 years, which summarizes the work performed and projected amount of work required to preserve the state-maintained roadway network and bridge infrastructure assets. NDOT is responsible for maintaining more than 1,150 bridges and 20 percent of the roads in Nevada, which carry 52 percent of all automobile traffic and 82 percent of all heavy truck traffic. The last update was conducted in 2015, and projected an anticipated decrease in bridge preservation funding below the current need, which can increase the backlog of bridge work and exacerbate the funding deficiency. When bridges deteriorate and require closure, traffic delays can cost hundreds of thousands of dollars per day, and can have significant impacts to freight.

NDOT maintains a database of statewide roadways, measuring the annual average daily traffic (AADT) for all vehicles and for trucks only. Statewide, the interstates carry the highest truck volumes, ranging from 5,000 total trucks per day on I-80 through the Reno-Sparks area to more than 6,300 trucks per day on I-15 through Las Vegas. The overwhelming majority of truck traffic (more than 75 percent) on both

corridors is combination-unit trucks, which are defined as trucks consisting of at least two units, one of which is a tractor or straight truck power unit.

Nevada has 56 truck parking facilities across the state along the major interstate and highways, including I-15, I-80, and U.S. Routes 93, 95, and 50 (US 93, US 95, and US 50). NDOT maintains a website that graphically shows the locations of all commercial truck parking across the state, the number of spaces provided, and the amenities available.

Nevada has 157 commercial vehicle truck parking spaces per daily 100,000 miles of combination truck vehicle miles of travel (Jason's Law Truck Parking Survey Results and Comparative Analysis. Photo credit: CH2M/Cameron Arizmendez).

Truck parking shortages are a national safety concern, according to FHWA. An inadequate supply of truck parking spaces can result in two negative consequences. First, tired truck drivers may continue to drive because they have difficulty finding a place to park to rest. Second, truck drivers may choose to park at unsafe locations, such as on the shoulder of the road, exit ramps, or vacant lots, if they are unable to locate official, available parking (FHWA, 2016b).

Truck parking facilities with amenities should be spaced closely enough to provide drivers more options for layovers to meet their hours-of-service regulations. Spacing greater than a 2-hour drive could force a driver to stop far short of the required hours-of-service, at a significant operational and financial loss, but spacing closer than that, especially in rural areas, may not be financially feasible for private developers of the facilities. Rest areas are useful for short stops; however, for longer durations, such as fulfilling a 10-hour forced rest, truck drivers prefer to rest where there are amenities. Currently, there are no truck parking facilities with amenities along US 93 between Las Vegas and Ely (more than 3.5 hours apart), so an additional facility along this route is desirable.

Rail

Nevada has two primary rail corridors, both of which run generally east-to-west across the state, with a few supplemental branch lines (Figure 2-2). There are no north-south rail lines in the state connecting the northern and southern regions. UPRR owns and operates all 1,085 mainline route miles in the state. BNSF Railway does not own any tracks in Nevada, but has trackage rights on 804 route miles, or 74 percent, of the freight rail lines in the state. These rail corridors are classified as Class 5 tracks under the Federal Railroad Administration (FRA) Track Safety Standards, with a maximum operating speed of 79 miles per hour (Jacobs, 2012).

According to FRA there are 542 at-grade highway-rail crossings in Nevada, including 290 public, 247 private, and five pedestrian. The majority of the at-grade crossings are located in Elko (104), Clark (96), and Washoe (82) counties (FRA, 2015).

Nevada has 309 railroad route miles of track on seven branch and short lines, serving six Nevada counties (see Figure 2-2). Of the 309 route miles, 107 miles are in service, accommodating commercial freight railroad operations. The Nevada Northern Railway (currently out-of-service track) and the U.S. Army (Thorne Branch) own the remaining 202 miles. The entire network of branch and short lines is single-tracked, consisting of Class 1 and 2 tracks with maximum operating speeds of 10 and 25 miles per hour.

Figure 2-2. Nevada Rail Network

Nevada has two freight intermodal facilities where trailer-on-flat-car or container-on-flat-car can be transferred between railcars and/or trucks. The facilities include the Union Pacific Railroad (UPRR) Sparks Intermodal Facility in northern Nevada and the UPRR Las Vegas Intermodal Facility in southern Nevada.

Additionally, UPRR operates three classification yards, which organize railcar shipments bound for the same destination. The Elko Yard on the Central Corridor line and the Carlin Yard on the Overland Route serve industries in the northern part of the state. Furthermore, the Arden Yard on the South Central Route serves the southern part of the state.

Industrial lead facilities are primarily used for shipping, transloading, and warehousing. In Nevada, the larger industrial facilities include the Northeastern Nevada Regional Railport intermodal transload facility at Elko; spurs at Fernley that serve industrial parks and companies, as well as the future Clean Energy Rail Center; and track access east of Reno for the Tahoe Reno Industrial Center. Industrial lead tracks connect these industrial parks, business parks, and individual companies directly to the branch and main lines. BNSF owns a transload facility in Sparks and can use the UPRR Sparks Intermodal Facility.

Air Cargo

Three airports in Nevada provide commercial freight service, including McCarran International Airport (LAS) in southern Nevada, Reno-Tahoe International Airport (RNO) in northwestern Nevada, and Elko Regional Airport in northeastern Nevada (see Figure 2-3).

LAS is the ninth busiest airport in North America, servicing 42 million annual passengers (Federal Aviation Administration [FAA], 2014). While competitive on the passenger side, the airport also continues to expand air cargo, with 210,000 square feet of cargo and shipping facilities, serving more than 100,000 tons of cargo a year (McCarran International Airport, 2014). The high level of passenger service at the airport – specifically international flights – enables LAS to offer a significant amount of available belly space for air cargo. Furthermore, the abundance of belly cargo capacity available due to these air services gives LAS the potential to effectively compete for air cargo in the greater Southwest region, with the greater advantage that Las Vegas is very cost competitive, specifically related to warehouse and distribution space, and is accessible to various Southwest destinations, including Phoenix and Southern California.

The Marnell Air Cargo Center at LAS opened in 2010 and provides direct access to loading facilities for both trucks and airplanes. Several hundred trucks pick up or deliver goods to the Air Cargo Center each day. This facility is a designated Foreign Trade Zone. In 2013, commercial passenger carriers transported 37 percent of the air cargo that passed through LAS. LAS is located within 1 mile of I-15 and rail service.

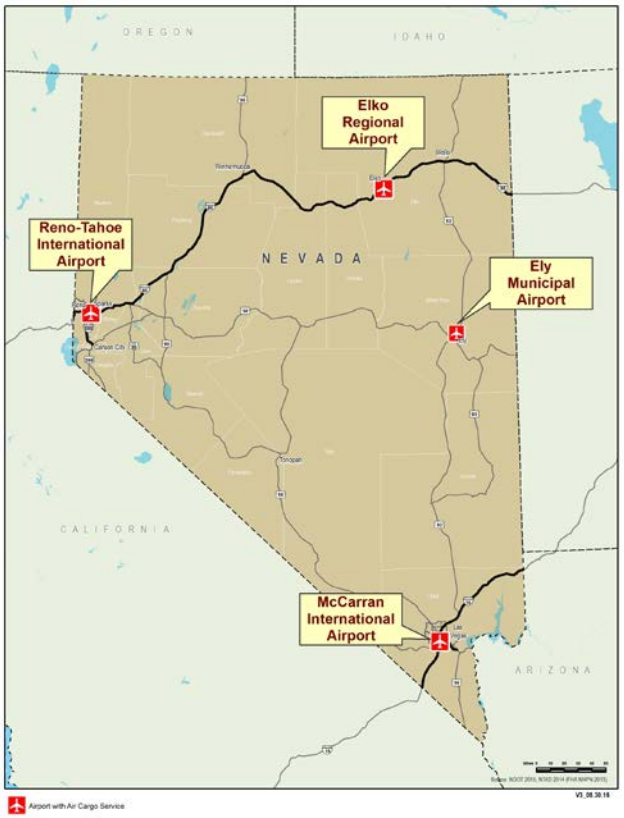


Figure 2-3. Nevada Airports with Air Cargo Services

Current tenants include: UPS, US Airways, Airport Terminal Services, Allegiant, Worldwide Flight Services, Inc., Southwest Airlines, and FedEx. In 2014, Reno-Tahoe International Airport (RNO) handled more than 64,500 tons or 129 million pounds of cargo shipments. This was the highest annual cargo tonnage reported at this airport during the last 8 years (Reno-Tahoe Airport Authority, 2014). Approximately 310,000 pounds of cargo arrives or departs the airport each day. Companies handling air cargo at RNO include Amerijet, DHL, FedEx, and UPS (Reno-Tahoe Airport Authority, 2015). RNO is within a designated foreign trade zone, and is located within 2 miles of two major highway corridors, I-80 and U.S. Route 395 (US 395), and less than 1 mile from the UPRR Sparks Intermodal Facility.

The air traffic control tower at Elko Regional Airport closed in 2009, which has reduced both commercial and cargo flights at the airport. Elko Regional Airport has steadily handled an average of 33,000 pounds of air cargo freight annually since 2009 (Gibbs, 2015). It receives two flights per day of Ameriflight cargo and freight in the belly of cargo space of passenger aircraft. Currently, two daily commercial flights are scheduled from Elko Regional Airport to Salt Lake City International Airport, operated by SkyWest Airlines (a Delta affiliate) (Elko Regional Airport, 2015). The number of daily commercial flights has dropped from a peak of six flights per day, which has decreased the capacity to enplane cargo. The Ely Municipal Airport also handles a small amount of small package air cargo.

Pipelines

Pipelines constitute another form of transportation of goods and can carry commodities such as natural gas, petroleum, or bio-fuels. Pipelines are a low-cost modal option if the material can be shipped in this manner. Figure 2-4 shows the pipelines and related infrastructure in Nevada.

Multiple firms pipe natural gas though 1,983 miles of pipeline across Nevada, including Colorado Interstate Gas Company, LLC. (360 miles), Kern River Gas Transmission Company (275 miles), NV Energy (8 miles), Paiute Pipeline Company (860 miles), Southwest Gas Corporation (335 miles); Tuscarora Gas Transmission Company (107 miles); and United States Gypsum Corporation (38 miles) (Jacobs, 2013).

Kinder Morgan Energy Partners and/or its subsidiaries (Buckeye Partners, LP; Calnev Pipeline Company; and SFPP, LP) operate 86 miles of refined petroleum products pipeline in Washoe County that serve the Reno Terminal in Sparks and the Reno-Tahoe International Airport (RNO). They also operate 3 miles of line between the terminal and the airport, as well as 116 miles of refined petroleum products pipeline serving Nellis Air Force Base (AFB) and LAS in southern Nevada (Jacobs, 2013).

There are two tank farms in the Reno/Sparks area. The larger of these two is the Sparks Solvent/Fuel Site, which is a rail yard and fuel terminal tank farm located in Sparks between I-80 and the UPRR Overland Rail Line just east of Interstate 580 (I-580) and northeast of RNO. Operations at the terminal include storage, distribution, and loading of gasoline heating oil, diesel fuels, military fuels, and fuel additives. Fuel is transported to the facility via a pipeline over the Sierra Nevada Mountains from San Francisco Bay area refineries. The site is the central storage and distribution point for most vehicle and heating fuels supplied to the northern Nevada and eastern California region. The terminal also supplies military fuels, with the exception of the Fallon Naval Air Station, which receives fuel via a dedicated pipeline; the military fuels are trucked from the terminal to their intended destination (Nevada Division of Environmental Protection, 2015).

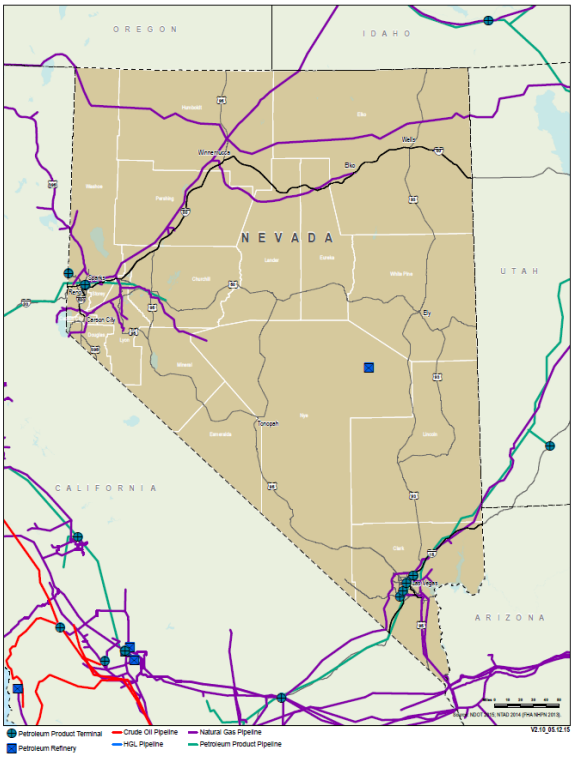


Figure 2-4. Nevada Pipelines and Related Infrastructure

The major natural gas pipeline through the Las Vegas metropolitan area is located along I-15 and is known as the Kern River Transmission Company system, beginning in southwest Wyoming and running southwest through Utah, southern Nevada, and Southern California. This system has a capacity of 1.8 billion cubic feet per day and delivers more than 90 percent of its product to southern Nevada and Southern California (CH2M, 2015).

Petroleum is the main commodity shipped via pipeline to southern Nevada, and delivered to the holding tanks in the northwest corner of the Las Vegas metropolitan area and at Apex Industrial Park. Nevada does not export or ship anything within the state using pipelines. Tanker trucks are distributed from these locations to fueling stations throughout the Las Vegas metropolitan area and to several mines in northern Nevada, via US 95 and US 93.

2.1.3 Intermodal Relationships

The metropolitan areas of Las Vegas and Reno-Sparks-Carson City are the primary freight hubs within the state, and I-80 and I-15 are the primary freight corridors connecting these hubs with hubs outside of Nevada. Currently, the Nevada hubs are connected to each other by US 95, but not by interstate highway or rail. While they do not carry the volume in Nevada that trucks do, rail, pipeline, and air transport play very important roles in carrying unique items to, from, and within Nevada. The relationship between these modes, hubs, and corridors is an important aspect of a freight network and distribution.

Nevada has very few intermodal facilities with only six rail-truck facilities and three air-truck facilities. Details on these facilities are provided in Table 2-1. Understanding the location and function of the intermodal facilities is important to both identifying the amount and types of freight processed in the region, and maintaining efficiency on connecting freight corridors.

The Las Vegas region includes four intermodal facilities: UPRR Las Vegas Intermodal Facility, UPRR Moapa Transload Facility, Pan Western Transload Facility, and McCarran Air Cargo Center. In total, the

Las Vegas region includes approximately 140 acres of intermodal facilities. The Reno-Sparks metropolitan area includes three intermodal facilities: the Sparks and Parr intermodal yards, and the Reno-Tahoe International Airport (RNO) Air Cargo Center. The Sparks Intermodal Yard is home to a host of manufacturing, trucking, warehousing, and construction companies, as well as the petroleum products tank farm. With its close proximity to RNO, it is a great example of a truly intermodal facility that combines rail, truck, air, and pipeline in a single location.

One of the proposed strategies from the *Southern Nevada Regional Goods Movement Master Plan* (CH2M, 2015) is to improve intermodal connectivity through development of an integrated logistics center, or Freight Village, in the Las Vegas region. This industrial park or mixed-use development would be constructed specifically around high-performance freight servicing facilities, with access to major highways and railroads, and (where possible) pipelines and airports. It should range in size from 300 to 500 acres (CH2M, 2015).

Table 2-1. Nevada Intermodal Facilities

Facility	Type	Function	Location
UPRR Las Vegas Intermodal Facility	Rail-Truck	Intermodal container-on-flatcar and auto carload facility Typically handles paper products, autos, and building materials Storage capacity of 80 trailers and containers Includes two tracks for auto loading/unloading and two for intermodal 97.5-acre facility	Las Vegas Metro Area
Moapa Transload Facility[a]	Rail-Truck	Includes two rail sidings and two conveyor belts to transfer freight	Las Vegas Metro Area
Pan Western Transload Facility	Rail-Truck	Transloading services are provided for box, flat, center beam, gondola, hopper, and liquid railcars Onsite services include: forklifts, straddle cranes, conveyors, pumps and compressors Typically handles aggregates, fuels, liquids, dimensional and over-dimensional freight, as well as hazardous materials 24,000 feet of rail capacity that can accommodate up to 250 railcars 24.8-acre facility	Las Vegas Metro Area
McCarran Air Cargo Center	Air-Truck	Freight and distribution facility; designated foreign trade zone Includes two buildings, totally 200,000 square feet Typically accommodates airline and mail cargo 19.2-acre facility	Las Vegas Metro Area
Northeastern Nevada Regional Railport	Rail-Truck	Rail-to-truck and truck-to-rail capabilities, as well as railcar switching, storage, and warehousing Dry and liquid bulk, hazardous material, and food-grade transloading Companies at facility include Rudy Pipeline, Pacific Steel, and Liebherr Mining Equipment Served by UPRR and BNSF 60-acre facility	Elko County
UPRR Sparks Intermodal Facility	Rail-Truck	Only intermodal terminal in the state with both container-on-flatcar and trailer-on-flat-car facility Specializes in longer trains carrying commodities, such as chemicals, coal, minerals, autos and auto parts, agricultural goods, and petroleum Includes facility that adds and removes helper locomotives to assist train movements over Donnor Pass 1,442-acre facility	Reno-Sparks Metro Area

Table 2-1. Nevada Intermodal Facilities

Facility	Type	Function	Location
Parr Intermodal Yard[b]	Rail-Truck	Four-track facility, with paved rail serving industrial development and office facilities Supports general carload business and intermodal and automotive traffic; automotive business consists of outbound shipments of used vehicles 9.1-acre facility	Reno-Sparks Metro Area
Elko Regional Airport	Air-Truck	Typically accommodates airline and mail cargo	Elko
Reno-Tahoe International Airport	Air-Truck	Freight and distribution facility; designated foreign trade zone Typically accommodates airline and mail cargo	Reno-Sparks Metro Area

Sources: CH2M, 2015; Jacobs, 2012; and Elko Regional Airport, 2015

[a] *Moapa Transload Facility is located west of Hidden Valley Road, east of the UPRR rail corridor, between two spur lines. The facility is a small component of the larger parcel.*

[b] *Parr Intermodal Yard is served by the UPRR Reno Branch, but the railroad owns a small section of the overall 205-acre facility, which is comprised of numerous privately owned parcels.*

2.1.4 Environmental Resource Framework

Environmental Features

The analysis of natural environment features included a review of areas of critical environmental concern (ACECs), wilderness areas, National Conservation Areas (NCAs), national monuments, critical habitats, and other land management categories. Nevada has the following environmental features:

- **ACECs**: There are 54 ACECs in Nevada, as identified by Bureau of Land Management (BLM). The ACECs are primarily located in Clark, Lincoln, Nye, and Washoe counties. In Clark County, the Coyote Springs Valley and Hidden Valley ACECs are located northeast of the metropolitan area. The Rainbow Gardens and River Mountains ACECs are located east of Las Vegas, and the Bird Springs and Arden ACECs are located south and southwest of the Las Vegas metropolitan area. In Lincoln and Nye counties, there are ACECs along US 93 and State Route 318 (SR 318) south of US 50, and the Timber Mountain Caldera ACEC is located along the US 95 corridor in Nye County.
- **Wilderness Areas:** Nevada contains 122 federally designated wilderness areas, located in almost every county. Several wilderness areas are located along the US 93 corridor through Lincoln, White Pine, and Elko counties, including Delamar Mountains, Meadow Valley Range, Arrow Canyon, Parsnip Peak, Fortification Range, Mount Grafton, Becky Peak, and Goshute Canyon. In Clark County, there are more than eight federally designated wilderness areas that surround the Las Vegas metropolitan area.
- **NCAs**: The BLM has identified three NCAs on its lands in Nevada, and no national monuments. The Black Rock Desert-High Rock Canyon Emigrant Trails NCA is the only one in northern Nevada and is located in the northwest part of the state far west of US 95 in Washoe, Humboldt, and Pershing counties. In southern Nevada, the Red Rock Canyon NCA is located west of Las Vegas with a portion along the US 95 corridor, and the Sloan Canyon NCA is south of Las Vegas between I-15 and US 95. The Great Basin National Park and Death Valley National Park are located in northern Nevada. Great Basin National Park is located in White Pine County near the Nevada/Utah border, and Death Valley National Park extends between California and Nevada in the southwestern part of Nevada. National Park Service properties in southern Nevada include the Lake Mead National Recreational Area (NRA) in Clark County.

- **Critical habitats**: Critical habitats for 23 wildlife species are located in Nevada.

Topographic Features

Northern Nevada has various dispersed mountain ranges across that entire portion of the state. With more than 150 mountain ranges statewide, the major ranges in northern Nevada include the Battle, Monitor, Ruby, Santa Rosa, Schell Creek, Sierra Nevada, Snake, and Toiyabe ranges. The Ruby range runs along US 93, near I-80, and the Schell Creek and Snake ranges are along the east side of US 93 near US 50. The Sierra Nevada range runs along the Nevada/California border, south of Carson City and west of the US 95 corridor. The Santa Rosa range runs along the east side of US 95, north of I-80, to the Nevada and Oregon border. The Las Vegas Valley is surrounded by the Spring Mountains to the west, Sheep Mountains to the north, Muddy and River Mountains to the east, and the McCullough and Eldorado Mountains to the south.

Major Drainage Features

Drainage features reviewed include major areas of surface water, rivers, reservoirs, wetlands, riparian areas, and Federal Emergency Management Agency (FEMA) flood hazard zones. Some of the most prominent surface water features in Nevada are Lake Tahoe on the Nevada/California border, Pyramid Lake northeast of Reno, Walker Lake southeast of Reno, Humboldt Lake northeast of Reno (near US 95 and I-80), and the Humboldt River, which is the longest river in the state. The Humboldt River runs along the northern half of the state into the Humboldt Sink near US 95 and I-80. The Walker, Truckee, and Carson rivers drain the western part of Nevada. The Truckee River feeds into Pyramid Lake, one of the largest natural lakes in Nevada. The mountainous areas surrounding the Las Vegas Valley feature rough terrain with steep slopes, high ridgelines, and deep natural washes. The Las Vegas Wash drains all stormwater in the Las Vegas Valley into Lake Mead and the Colorado River system. Tributaries to the Las Vegas Wash include Las Vegas Creek, Red Rock Wash, Flamingo Wash, Pittman Wash (which drains into Duck Creek), Sloan Channel, and Monson Channel. FEMA has identified 100-year flood hazard zones throughout the area along smaller rivers and washes.

Major Land Ownership

Figure 2-5 summarizes the percentage of land that belongs to each major landowner/ management category. Developed land in the urban areas is largely privately held, but private land is greatly outnumbered by the percentage of federal land holdings. The BLM, followed by the U.S. Forest Service (USFS) and Nellis AFB, owns the majority of land. Major national forests and parks outside of the Las Vegas metropolitan area are Humboldt-Toiyabe and Inyo National Forests, and Death Valley and Great Basin National Parks. Several Indian reservations are located throughout Nevada. Larger reservations are Moapa River northeast of Las Vegas; Pyramid Lake, Washoe Ranches, and Walker River near Reno-Carson City; and Goshute and Duck Valley (United States Environmental Protection Agency [EPA], 2012).

Topography and land ownership patterns form the major environmental constraints in Nevada. Nevada contains many isolated mountain ranges separated by flatter basins. These ranges generally trend north to south and most are short and narrow, with steep slopes (greater than 12 percent). The western side of the state includes portions of the Sierra Nevada (located primarily in California), as well as many lakes

and reservoirs. From a land management standpoint, the Humboldt-Toiyabe National Forest comprises 6.3 million acres in Nevada (the largest national forest in the lower 48 states), split into more than 10 clusters of forest lands throughout the state. Military land holdings are large, specifically Nellis AFB, located north of the Las Vegas metropolitan area. The area also has several state wildlife areas, wilderness areas, and tribal communities. Most ACECs and critical habitat areas are located in the southeastern and northwestern parts of Nevada. Population clusters are dispersed, with Las Vegas and Reno-Sparks/Carson City being the primary population/employment center in Nevada.

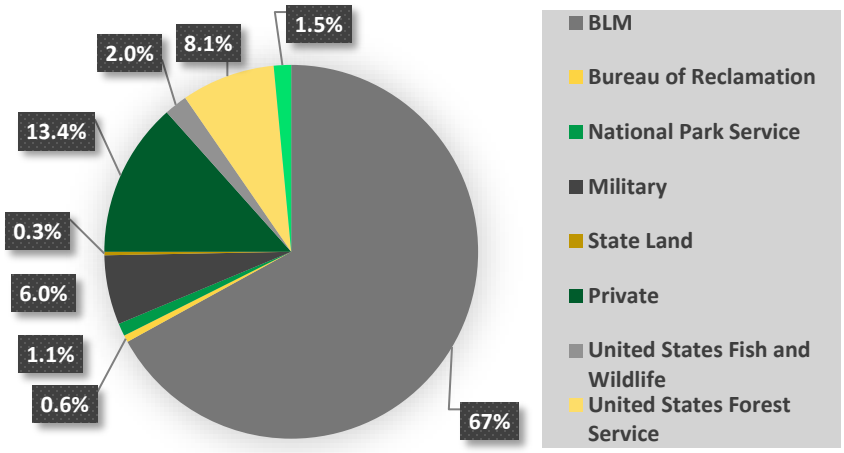


Figure 2-5. Major Land Ownership and Management in Nevada

2.1.5 State Freight Statutes, Regulations, and Institutions

Statutes and Regulations

There are numerous federal, state, and local laws regulating the transport of goods and materials over public highways. This includes, among other things, requirements for overweight and oversized vehicles, route restrictions, day and time restrictions, and limitations related to truck idling on public roadways. Detailed information regarding these laws can be found in Appendix 2A: Statewide Inventory.

Larger vehicles are typically subject to route restrictions. The federal government establishes size and weight standards for the Interstate Highway System, but does not issue permits for oversize or overweight vehicles. This is handled at the state level, and states may allow heavier vehicles to operate on their roadways under special permits or exemptions. The maximum gross vehicle weight (equal to the weight of the vehicle or vehicle combination plus the load) of the most commonly used long-haul vehicles is 80,000 pounds on the Interstate Highway System.

NDOT regulates and permits longer combination vehicles and over-dimensional and overweight vehicles. Loads that are oversized or overweight and not divisible must apply for over-dimensional permits. This includes loads that are 70 feet or less in length and exceed 80,000 pounds. Nevada also enforces time and day restrictions for over-dimensional vehicle (ODVs) and longer combination vehicles (LCVs) to mitigate travel during heavy motorist travel days. Non-reducible, ODVs that exceed the legal width or length are restricted on certain routes for safety and asset management purposes.

Like most states, Nevada also has anti-idling laws to reduce emissions when trucks are not actively transporting goods. Regulations regarding idling are written and managed by the Nevada Bureau of Air Pollution Control, which has jurisdiction over air quality programs throughout the state with the exception of Washoe and Clark counties. These two counties have their own distinct air quality jurisdictions and control over fines and exemptions.

Institutions

The following three organizations are actively involved in freight related issues in Nevada:

- **The Interstate 80 Freight and Logistics Working Group** was formed to investigate topics related to freight mobility. The mission statement of the group was "…to thoroughly investigate all issues relevant and actionable regarding the topic of freight mobility and the I-80 corridor from San Francisco to Cheyenne" (I-80 Vision.org, 2015). The goal of the group was to "determine the existing condition(s) of each topic, identify gaps and/or unmet needs, and develop actions to address deficiencies" (I-80 Vision.org, 2015). While the focus group primarily worked on highway-related issues first, it plans to cover topics vital to all freight modes.
- **The Interstate 15 Mobility Alliance** is an ongoing working group that is led by the DOTs in California, Nevada, Arizona, and Utah, and includes 72 public and private agencies. In 2012, the alliance developed the I-15 Corridor System Master Plan to provide policy and decision makers with a strategic action plan that defines future transportation infrastructure, and supports national, regional, and local approaches to improve freight delivery and relieve congestion. The alliance was selected as one of six Corridor Coalitions nationwide to receive $1,250,000 in funding under the Multistate Corridor Operations and Management Program. This funding will help to execute and accelerate the delivery of the I-15 Dynamic Mobility Project, which will improve real-time information exchange between the states and population centers in the corridor, as well as traveler information with an emphasis on service to the freight industry.
- **The Nevada Trucking Association** is a nonprofit association devoted to promoting the interests of the trucking and bus industries, and opposing regulations and tax burdens they feel inhibit their member's ability to compete and be profitable. It was initially formed in 1932 as the Commercial Motor Operators of Nevada to be a defensive measure as truck and bus operators in Nevada joined together in the face of threatening and oppressive legislation and regulations. The Nevada Trucking Association continues to remind legislators, regulators, media, and the public that the trucking and bus industries are essential to Nevada and America's economy.

2.2 Existing and Forecasted Freight Flows

The existing and forecasted freight flows developed for the years 2012 and 2040 in this Plan were based on the FHWA Freight Analysis Framework (FAF) database[1] (FHWA, 2015), a national commodity flow forecast. The 2012 freight flows in FAF are estimates based on U.S. Census Bureau and U.S. Bureau of Transportation Statistics' nationwide commodity flow survey that gathers information from manufacturing, mining, wholesale, and selected retail and services establishments on commodities shipped, their value, weight, and mode of transportation, and the origin and destination of shipments. The 2040 forecasted freight flows are estimated based on FHWA's baseline[2] economic forecasts of national consumption patterns and foreign trade that are converted into volumes of commodities while applying historical mode shares by commodity and origin-destination pairs. As a result, these forecasts do not reflect what could be achieved through a strategic program of transportation and economic investments and policy strategies. However, state and regional economic forecasts were used to supplement the FAF forecasted freight flows. Together, these forecasts provide insight into where there

[1] FAF version 3.5 containing the most recent published forecast was used in the Freight Plan. This is mainly based on the U.S. Census Bureau and U.S. Bureau of Transportation Statistics 2007 Commodity Flow Survey and other supporting trade and economic data. The 2012 and 2040 freight flow estimates contained in FAF3.5 take into account the effect of the 2008-2009 global recession. Although, in the duration of this Freight Plan, the Census Bureau started to release a newer version of FAF, FAF 4, based on the 2012 Commodity Flow Survey, it was too late for use in this Plan.

[2] Based on a reasonable extrapolation of current economic trends, but do not reflect major shifts in national economy, modal capacity limitations, or changes in transportation costs and technology.

may be opportunities for Nevada to create greater economic advantages through transportation investments.

2.2.1 Existing Freight Flows

In 2012, a total of $150 billion and 146.9 million tons of freight either originated or terminated in Nevada. The freight flows through Nevada were not estimated. The consumption of goods in Nevada is mainly driven by the major population and business centers of the Las Vegas metropolitan statistical area (MSA) and Reno-Sparks-Carson City combined statistical area (CSA); together they contain more than 90 percent of the total population and 94 percent of the total private sector jobs in the state. Approximately one-third of the total private sector jobs in these economies are in the leisure and hospitality industry sector, and approximately a fifth (about 21 percent) are in the trade, transportation, and logistics industry sector. Manufacturing plays a smaller role in the Nevada economy than the national average. The key differences between the regional economies are that the Las Vegas MSA has a higher share of regional jobs in the leisure and hospitality industry sector, but lower shares of regional jobs in the trade, transportation, and logistics, and manufacturing industry sectors than the Reno-Sparks-Carson City CSA. The proximity of Nevada to the international gateway ports in California provides the state's trade, transportation, and logistics industry sector an advantage to store goods imported through the ports, before supplying them to retail trade and wholesale trade stores in both Nevada and California. They also support local manufacturing.

On the other hand, from a gross domestic product (GDP) contribution perspective, the natural resources and mining industry sector is also important to the overall economic vitality of Nevada. The northern central parts of Nevada that are mostly rural are home to the nation's largest gold mine reserve and a variety of non-metallic mineral mines. These ores and minerals have global and national markets; non-metallic minerals are also used in the production of construction-related products in the states metropolitan areas.

Directional Shares

Based on the existing flows shown below, Nevada is primarily a consuming economy (comparing inbound and outbound flow shares in Figure 2-6).

Modal Shares

In 2012, trucks carried the highest percentages of about 78 percent in value and 83 percent in tonnage of the total freight flows for Nevada; this is due to their flexibility and a door-to-door service capability, and is the preferred mode for nearly all movements within the metropolitan areas in the State. In a consumer-driven economy such as Nevada's, the heaviest goods carried by trucks in metropolitan areas are non-metallic minerals and non-metallic mineral products, sand, gravel, building stone, cement, etc. used in construction. In

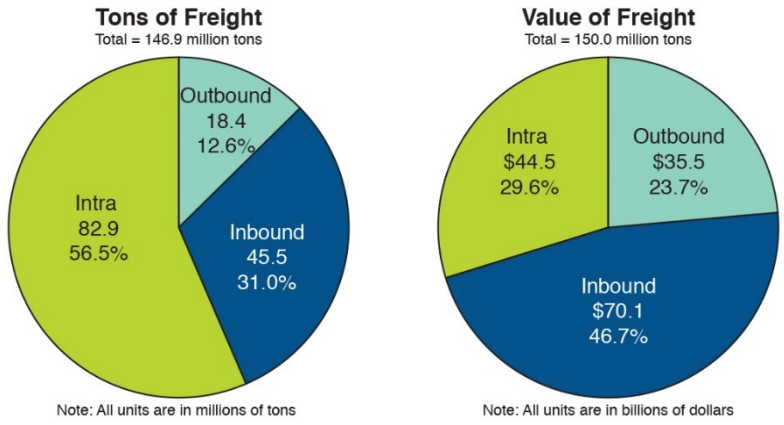


Figure 2-6. Nevada Statewide Freight Flows by Direction of Movement, 2012

These two charts depict the total outbound, inbound, and intra flows by tonnage (left) and value (right). A comparison between inbound and outbound flows reveals the imbalance between the two, with inbound being the dominant by both weight and value. Intra flows are dominated by weight and not value (Source: Disaggregated FHWA FAF3 Database for Nevada). Note: The charts include outbound, inbound, and intra Nevada freight flows but do not include freight flows through Nevada.

addition, trucks also carry waste generated in metropolitan areas to landfills. Among the high-valued goods, trucks carry a majority of the manufactured goods (e.g., machinery, electrical and electronic equipment, apparel and accessories, and miscellaneous), pharmaceutical and other chemical products, and mixed freight.

However, rail is the lifeline of the natural resources and mining industry and scrap metal industry. Rail based goods, except a few ores and minerals (e.g., gold), are generally low-valued goods. Rail also brings in out-of-state bulk or low-valued commodities such as coal, wood products, paper, grain, and other agricultural products, which have limited or no local supply. Some of imported manufactured goods, mixed freight (a variety of household and office supplies), and automobiles also are moved by intermodal rail service. Although they form small shares of total tonnage, goods using air, multiple modes (including intermodal rail service) or postal or courier goods are found to have a very high value per ton. Pipelines in the state bring in gasoline and natural gas to locations in or near the metropolitan areas.

Top Commodities

Total tons and value of the top five commodities overall, as well as the total of all other commodities, and their directional shares in the state are summarized in Table 2-2.

Table 2-2. Nevada's Top Five Commodities by Tons and Value, 2012

These two tables depict the top five commodities by total tonnage (top) and total value (bottom), as well as their shares of outbound, inbound, and intra flows.The majority of top commodities by tonnage belong to resource-based industries and are moved within the state, while the majority of top commodities by value belong to consumer goods industries (retail, food, beverage) and are inbound to the state (Source: Disaggregated FHWA FAF3 Database for Nevada).

SCTG Commodity	Tons (in thousands) by Commodity and Percentage Distribution by Direction				
	All Directions	Outbound	Inbound	Intra	Total
Nonmetal min. prods.	**32,296**	8%	15%	77%	**100%**
Gravel	**14,182**	1%	5%	94%	**100%**
Nonmetallic minerals	**14,178**	16%	11%	73%	**100%**
Waste/scrap	**13,061**	2%	6%	92%	**100%**
Coal and petroleum prods.	**8,533**	2%	84%	14%	**100%**
All Other	**64,602**	21%	47%	32%	**100%**
TOTAL	**146,852**	**13%**	**31%**	**56%**	**100%**
SCTG Commodity	**Value (in millions of dollars) by Commodity and Percentage Distribution by Direction**				
	All Directions	**Outbound**	**Inbound**	**Intra**	**Total**
Machinery	**19,047**	7%	18%	74%	**100%**
Electronics	**15,760**	24%	61%	15%	**100%**
Mixed freight	**15,153**	30%	51%	19%	**100%**
Textiles/leather	**9,338**	38%	49%	13%	**100%**
Motorized vehicles	**8,687**	12%	61%	27%	**100%**
All Other	**82,046**	27%	49%	27%	**100%**
TOTAL	**150,031**	**24%**	**47%**	**30%**	**100%**

Note: Standard Classification of Transported Goods (SCTG) is a classification system used by the U.S. Census Bureau to uniformly aggregate and present the data produced from Commodity Flow Survey (CFS). The classification level shown above for SCTG is Level I; it has a 2-digit structure and consists of product categories that have been designed to emphasize the link between industries and their outputs.

Top Trading Partners

The trading partner distribution maps are shown in Figures 2-7 and 2-8. The tonnage-based trade partner distribution shows that there is a strong economic linkage between rest of Nevada and the metropolitan areas. In addition, there is a large amount of tonnage flows within the metropolitan areas

in the state. This is mainly a result of demand for a small amount of consumer goods in rural areas that are stored at distribution facilities in the metropolitan areas, as well as demand for bulky and low-valued non-metallic minerals mined in the rural areas that are essential ingredients for a constantly demanding construction industry in the metros. Outside of the state, Nevada has inbound flows of coal from the Powder River Basin in Wyoming and agricultural and petroleum refinery products from California, and outbound flows of metallic ores and non-metallic minerals and their products to California.

The value-based trade partner distribution pattern shows that Southern California has strong trade linkages to the Las Vegas CSA, while the San Joaquin Valley has strong trade linkages to the Reno-Sparks-Carson City CSA. The former is mainly a result of Southern California being a strong freight hub with an extensive transportation and logistics network that supports the nation's busiest ports for imported goods; the consumer base and manufacturing centers in southern Nevada receive a majority of their imported goods from Southern California. The latter is mainly a result of the San Joaquin Valley region being a major agricultural production center in southwestern United States; the processed food manufacturing centers in northern Nevada make use of the agricultural commodities. In addition, the San Joaquin Valley region supplies goods imported through Port of Oakland. Moreover, Nevada also has strong trade linkages to the Mountain and "East North Central State" regions of the United States. These may be related to freight flows processed at freight hub cities such as Salt Lake City, Denver, Chicago, and Columbus, Ohio.

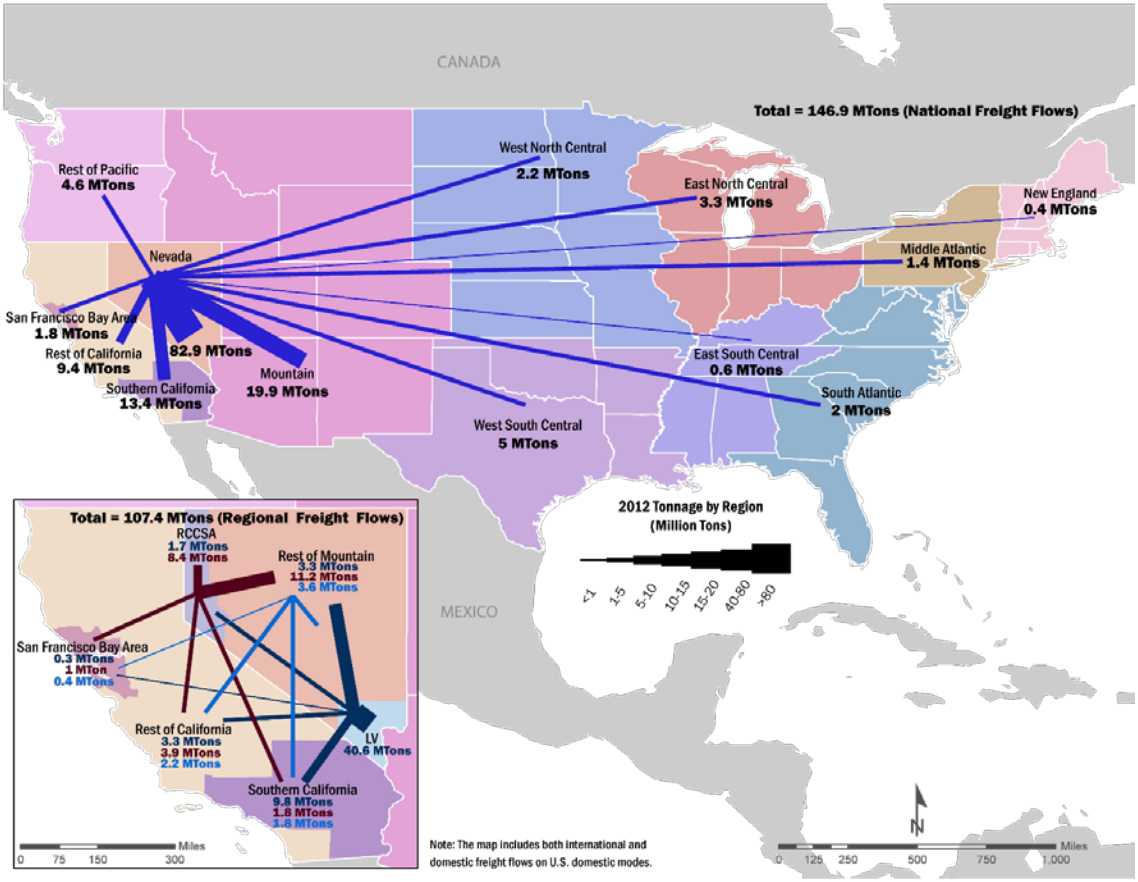


Figure 2-7. Nevada's Statewide and Regional Freight Tonnage by Trading Partner for Domestic and International Combined Markets, 2012

The map depicts the top trading partners for Nevada by total tonnage and the inset depicts intra Nevada flows. The majority of trading by tonnage occurs within the state; however, trading partners outside Nevada also act as key suppliers and consumers, including the rest of Mountain region, Southern California, and the San Joaquin Valley region in California (Source: Disaggregated FHWA FAF3 Database for Nevada).

Note: The charts include outbound, inbound, and intra Nevada freight flows but do not include freight flows through Nevada.

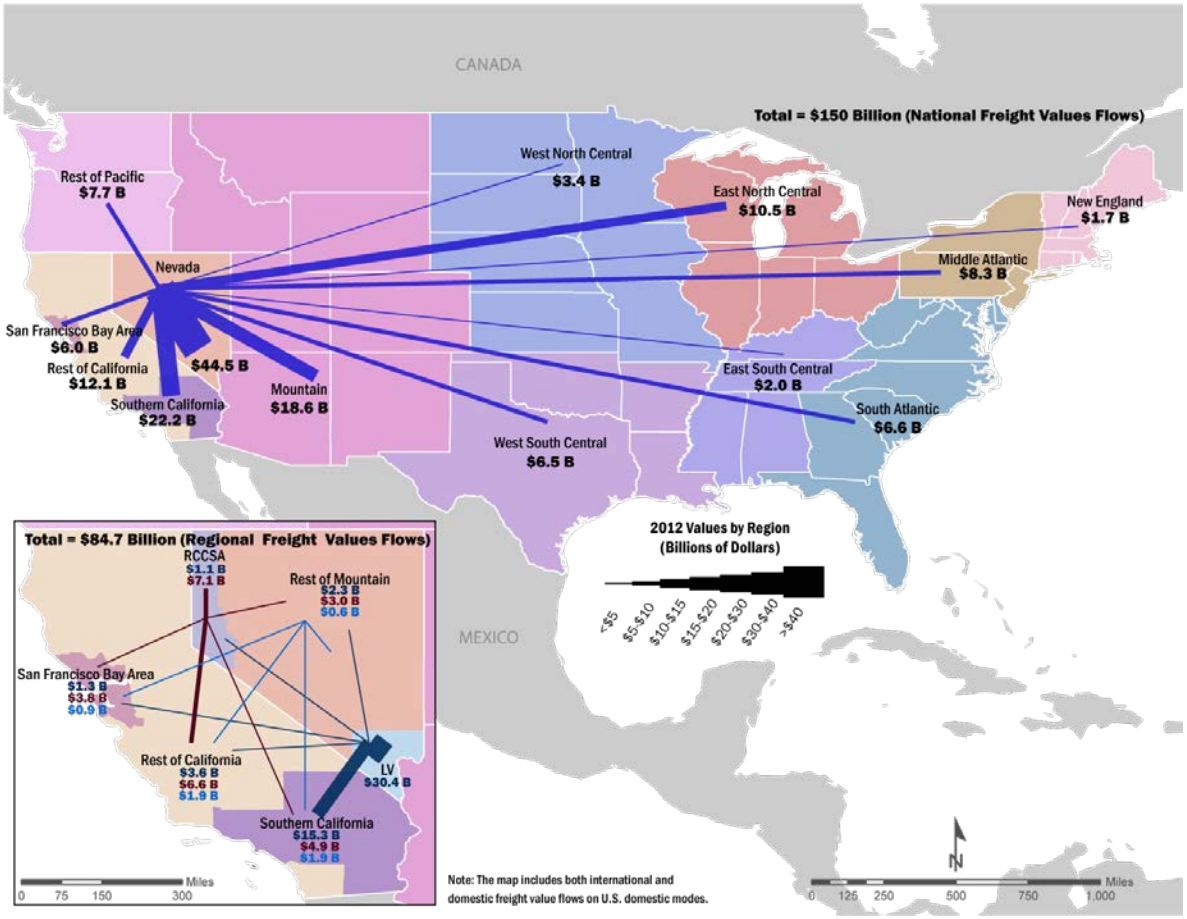


Figure 2-8. Nevada's Statewide and Regional Freight Value by Trading Partner for Domestic and International Combined Markets, 2012

The map depicts the top trading partners for Nevada by total value, and the inset depicts intra Nevada flows. The majority of trading by value occurs within the state; however, trading partners outside Nevada also act as key suppliers and consumers, including Southern California, the rest of the Mountain region, the San Joaquin Valley region in California, and East North Central States region (Source: Disaggregated FHWA FAF3 Database for Nevada).

Note: The charts include outbound, inbound, and intra Nevada freight flows but do not include freight flows through Nevada.

2.2.2 Forecasted Freight Flows

Baseline forecasts using FAF data indicate that freight flows that either originate or terminate in Nevada will increase from 146.9 million tons and $150.0 billion in 2012 to 183.1 million tons and $333.4 billion by 2040, which is a growth of about 24.7 percent, or 0.8 percent annually, by tons and about 122.3 percent, or 2.9 percent annually, by value. Growth in freight flows through Nevada were not estimated. Growth will be driven mainly by population-related factors. State and regional economic forecasts indicate that freight demand in the trade, transportation, and logistics industry will have rapid growth in Nevada's metros, while the freight demand in traditional resource-based industries (mining, construction, etc.) across all of Nevada will have slow growth. As new high-tech manufacturing industries are established and jobs are added, freight demand may increase beyond the baseline forecasts.

State and Regional Drivers of Freight Demand Growth

Several population-related factors will drive growth in freight demand for consumer goods and create opportunities for investments in the trade, transportation and logistics industry in Nevada, and eventually for Nevada to become a major Western freight hub for the distribution of consumer goods:

- Nevada State Demographer projects that the Nevada's population is projected to grow by about 17.9 percent, or 0.8 percent annually, between 2013 and 2033 (Nevada State Demographer, 2015). The growth rate in population of Nevada's counties that contain the major urban areas is expected to be higher than other counties. Population growth between 2013 and 2033 in the Reno-Sparks-Carson City CSA is about 25.6 percent, or 1.15 percent annually, without the Tesla plant, and about 31.3 percent, or 1.37 percent annually, with the Tesla plant.
- The neighboring states are also projecting growth in population (California Department of Finance, 2015; Arizona State Demographer's Office, 2015; and Utah Governor's Office of Management and Budget, 2015) particularly in Arizona and Utah, the growth rate is projected to be nearly twice that of Nevada. California is expected to add nearly 10 million people between 2010 and 2040. These are potential markets for goods manufactured in Nevada or goods delivered from Nevada as the state develops into a Western freight hub with greater distribution functions.
- Per capita disposable income in the United States is expected to grow. In particular, the University of Las Vegas' (UNLV) Center for Business and Economic Research (CBER) forecasts that personal income per capita in fixed dollars in southern Nevada will rise at a rate of 1.8 percent annually between 2014 and 2040 (UNLV CBER, 2015). This would result in the workforce in Nevada having a higher disposable income to purchase or sell goods.
- People and businesses in Nevada will continue to depend on imported consumer goods coming through the global gateway ports in California and air cargo facilities in Nevada, though the sourcing of trade in Asia may undergo a shift – labor-intensive sectors would move from China to lower-cost Asian countries such as Vietnam and Bangladesh, while China moves up the supply chain (HSBC Global Connections, 2015).

The state has a business-friendly climate with lower property taxes, ease of permitting process, etc. Realizing the growth in global population and their growing demand for high-tech products, the Governor's Office of Economic Development is focusing on increasing specialization in manufacturing either using very high technology or advanced knowledge of sciences, as they will not only create high-paying manufacturing jobs in Nevada but also increase exports from the state (Nevada GOED, 2015). The delivery of high-tech products can leverage growth in the trade, transportation, and logistics industry that will result from population-related factors. The state considers that developing programs for training the workforce for advanced manufacturing jobs is essential to keep a steady growth.

On the other hand, the state projects (Nevada DETR, 2015) that mining industries employment will decline by a small amount, but this may not result in a significant reduction in contribution to Nevada's economy and freight demand; marginal productivity gains may be sufficient to keep the freight demand a constant. However, mining-related freight demand for high-value metals such as gold and silver will remain sensitive to short-term fluctuations in market prices.

Nevada lost many construction jobs during the Great Recession (Tuman et al., 2013). The state projects that construction employment will grow at a rate of 5.3 percent annually between 2012 and 2022. This high growth rate over the short term is likely reflective of not just the growth in economy but also continued recovery of jobs lost during the recession. The industry sector and resulting freight demand will remain volatile and sensitive to the health of the U.S. economy.

Total Tonnage Growth versus Total Value Growth

The faster growth in total value of freight flows (2.9 percent annually) compared to total tons of freight flows (0.8 percent annually) between 2012 and 2040 is indicative of a shift in the state's economy from resource-based industries (generally low-valued commodities) to trade, transportation, and logistics industries (generally high-valued commodities). Thus, population-related factors are expected to be the main drivers of the growth in freight demand.

Directional Shares

Figure 2-9 shows the FAF-based relative growth rates of outbound, inbound and intra freight flows. A majority of the intra freight flows are related to resource-based industries; they exhibit a small decline in tons but a moderate growth in value. The intra freight flows will remain the largest portion of future tons and a substantial part of future value of goods. The intra freight flows will require maintenance of Nevada's existing transportation system and limited investment in transportation services and logistics facilities.

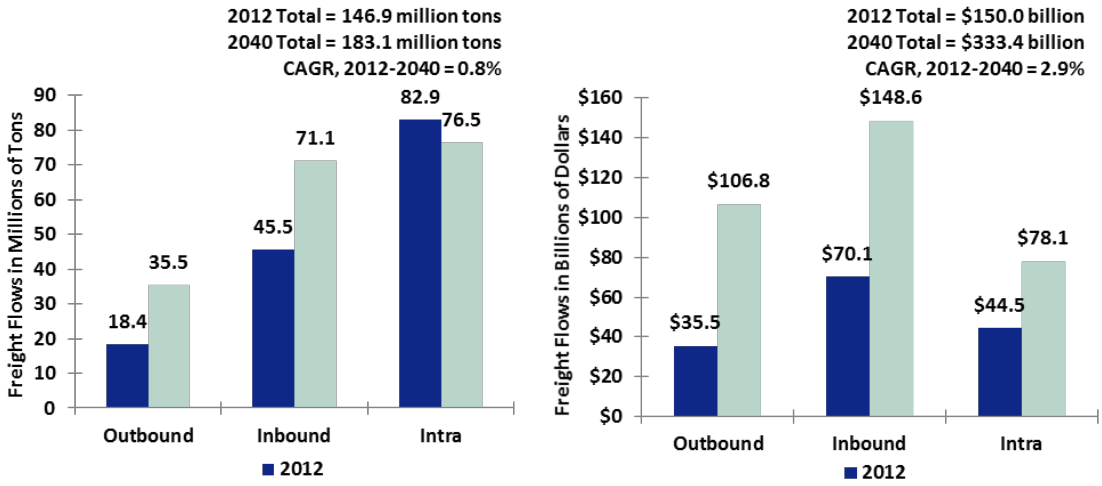


Figure 2-9. Nevada's Growth in Freight Flows in Tons and Value by Direction of Flow, 2012-2040

These two charts depict the relative growth in total outbound, inbound, and intra flows by tonnage (left) and value (right) over the forecast period. A comparison between inbound and outbound flows in 2012 and 2040 reveals the imbalance between the two will increase in tonnage and value (Source: Disaggregated FHWA FAF3 Database for Nevada).

Note: The charts include freight flows from Nevada (outbound), to Nevada (inbound), and within Nevada (intra), but do not include freight flows through Nevada.

On the other hand, a large growth will be witnessed in inbound freight flows both in tons and value as Nevada continues to take advantage of trade (both domestic and international) to meet its demand for consumer goods. Simultaneously, the baseline forecasts using FAF data show that outbound freight will double in tons and triple in value between 2012 and 2040 due to growth in manufacturing. Growth in exports from mines in Nevada contributes only a small amount to the growth in the outbound freight. These statistics indicate a need for significant investment on transportation corridors and/or services and logistics facilities in the vicinity of the Las Vegas and Reno metropolitan areas where manufacturing is concentrated.

The issue of trade imbalance, with a two-to-one inbound-to-outbound ratio, and the resulting empty equipment movements will worsen in the future unless: a) dependence on inbound freight is replaced with locally manufactured goods; c) even more aggressive growth in outbound freight is made possible by investment into goods producing jobs (e.g., Tesla plant for electric cars manufacturing) in the state; and c) Nevada's shippers and trucking firms participate in empty equipment (truck, railcar, etc.) reduction strategies.

Modal Shares

Baseline forecasts using FAF data show that between 2012 and 2040, 29.1 million tons, or 80.2 percent of the total change in tonnage, and $111.3 billion, or 60.7 percent of the total change in value of freight demand for Nevada, are associated with truck-only movements, revealing a high level of dependence on this mode (Figure 2-10). The rail-only mode ranks second in terms of the change in tonnage of freight demand (6.2 million tons or 17.1 percent of the total change in tonnage), while multiple modes and mail mode (includes rail/truck intermodal, ship/truck intermodal, postal or courier goods) ranks second in terms of the change in value of freight demand ($63.4 billion, or 34.6 percent, of the total change in value).

A low percentage of rail-dependent industries (both railcar load and rail/truck intermodal service) and inadequate rail service are considered reasons for Nevada to continue its trajectory of a high truck-only mode share. However, there is an opportunity for increased rail usage. This would require targeting rail-dependent industrial developments, and strategically adding rail services for them, such as service to the gateway ports in California, or service to national distribution centers east of the state. Both of these would require increased coordination with the railroads. These would alter the projected baseline mode shares in favor of rail, which is a more environmentally friendly and fuel efficient mode of transportation on a ton-mile basis.

The baseline forecasts also show that freight tons moved by truck-only and rail-only (not including rail/truck intermodal) will grow at rates of 0.8 and 1.5 percent annually, respectively. As a result, there will be increased O&M costs, capital infrastructure investment needs, and external costs. These needs would be the highest on I-15 and I-80 multimodal trade corridors. On the other hand, freight value moved by truck-only, multiple modes, mail, and air (includes air/truck intermodal)

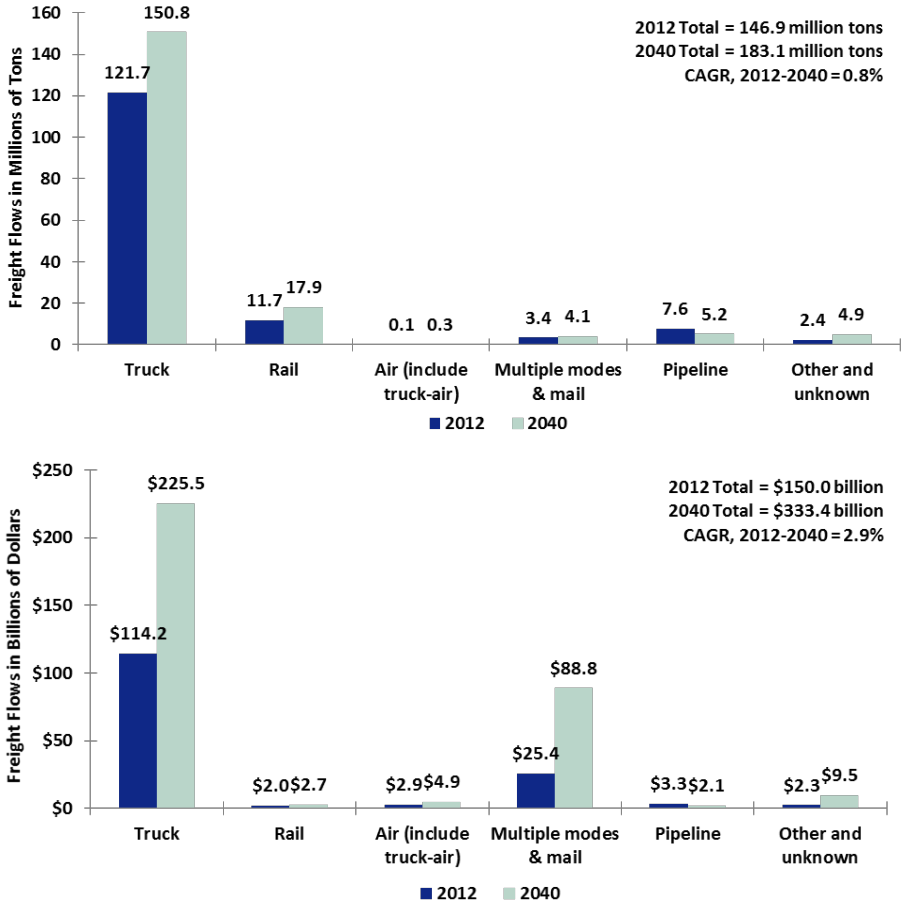


Figure 2-10. Nevada's Growth in Freight Flows, Tons and Value by Mode, 2012-2040

These two charts depict the relative growth in tonnage (top) and value (bottom) by mode of transportation over the forecast period. A comparison between modal flows reveals that trucks will continue to be the dominant mode for freight delivery, though tonnage by rail mode and value by multiple modes and mail mode also rise simultaneously (Source: Disaggregated FHWA FAF3 Database for Nevada).

Note: The charts include freight flows from Nevada (outbound), to Nevada (inbound), and within Nevada (intra), but do not include freight flows through Nevada.

will grow under the baseline scenario at rates of 2.5, 4.6, and 1.9 percent, respectively. The large growth in value of commodities will add pressure on the transportation system operators for improving service quality (availability, reliability, flexibility, etc.) in Nevada. The service quality needs would be the highest in "last mile" connections and mode transfer locations (rail yards, airports, truck terminals, etc.) in the Las Vegas and Reno metro areas. Even with growth in auto and truck traffic, I-15 and I-80 highways within the state would remain generally reliable; however, I-80 would continue to be affected by weather in the Sierras.

Even under the scenario of increased rail usage, the above needs would remain; however, state policy makers would give investment priority to rail service availability and reliability over I-15 and I-80 highway capacity.

Top Commodities

Table 2-3 summarizes the top commodities for Nevada by tons and value under baseline forecasts using FAF data. The growth rates are high in tons for miscellaneous manufacturing products and high in value for precision instruments, motorized vehicles, and miscellaneous manufacturing products, while the growth rates are low to moderate for other top commodities. The high-growth commodities are mostly related to trade and logistics industries, while the low-growth commodities are mostly related to resource-based industries. In other words, the baseline forecasts using FAF data are consistent with the state economic forecasts.

Based on the projected commodity mix under the baseline scenario, there is an opportunity to improve trade balance and generate economic benefits for Nevada. This would mainly come from replacing inbound movements for non-metallic mineral products and electronic products with local manufacturing of such products. In addition, this would come from expanding or developing new high-productivity, technologically advanced, and export-quality manufacturing clusters. Especially in the Las Vegas and Reno metro areas, this would leverage the expansion in the trade, transportation, and logistics industry that will take place to handle increased demand for inbound consumer goods. Increasing nonmetallic mineral exports from the state is also an option to improve economic value of goods movement.

Table 2-3. Nevada's Top Five Commodities in 2040 by Tons and Value and their 2012-2040 Growth Rates

These two tables depict the top five commodities by total tonnage (top) and total value (bottom), as well as their relative growth and shares of outbound, inbound, and intra flows. The majority of top commodities by tonnage will have low to moderate growth rates, while the majority of top commodities by value will have high growth rates. As a result, the growth in consumer goods is expected to outpace growth of products from resource-based industries (Source: Disaggregated FHWA FAF3 Database for Nevada).

SCTG Commodity	2040 Tons (in thousands) by Commodity and Percentage Distribution by Direction					
	All Directions.	Outbound	Inbound	Intra	Total	CAGR Tons, 2012-2040
Nonmetal min. prods.	**31,235**	11%	21%	68%	**100%**	-0.1%
Gravel	**15,381**	2%	3%	95%	**100%**	0.3%
Nonmetallic minerals	**15,262**	27%	5%	68%	**100%**	0.3%
Waste/scrap	**12,577**	1%	71%	28%	**100%**	-0.1%
Misc. mfg. prods.	**9,213**	59%	23%	18%	**100%**	4.8%
TOTAL (All Commodities)	**183,124**	**19%**	**39%**	**42%**	**100%**	**0.8%**
SCTG Commodity	**2040 Value (in millions of dollars) by Commodity and Percentage Distribution by Direction**					
	All Directions.	**Outbound**	**Inbound**	**Intra**	**Total**	**CAGR Value, 2012-2040**
Precision instruments	**55,578**	40%	48%	12%	**100%**	10.5%
Machinery	**38,453**	8%	23%	68%	**100%**	2.5%
Electronics	**29,769**	25%	64%	11%	**100%**	2.3%
Motorized vehicles	**27,780**	52%	14%	35%	**100%**	4.2%
Misc. mfg. prods.	**27,667**	42%	39%	19%	**100%**	4.4%
TOTAL (All Commodities)	**333,445**	**32%**	**45%**	**23%**	**100%**	**2.9%**

Note: The tables include freight flows from Nevada (outbound), to Nevada (inbound), and within Nevada (intra), but do not include freight flows through Nevada. Standard Classification of Transported Goods (SCTG) is a classification system used by the U.S. Census Bureau to uniformly aggregate and present the data produced from Commodity Flow Survey (CFS). The classification level shown above for SCTG is Level I; it has a 2-digit structure and consists of product categories, which have been designed to emphasize the link between industries and their outputs.

Top Trading Partners

Baseline forecasts using FAF data show that in 2040, the shares of global, national, and local trade are expected to be about 6.2, 52.0, and 41.8 percent, respectively, of the total trade tons, and about 6.7, 69.9, and 23.4 percent, respectively, of the total value. The top trading partners for Nevada by tons and value with all trade types combined, are summarized in Table 2-4.

Table 2-4. Nevada's Top Five Trading Partners in 2040 by Tons and Value and their 2012-2040 Growth Rates

The table depicts the top trading partners for Nevada by tonnage (top) and value (bottom), their relative growth, and shares of total tonnage and total value, respectively. Data reveals that flows within Nevada will remain the dominant freight flows. Trading with Arizona and the San Joaquin Valley region will have a high tonnage growth rate, while trading with Arizona, the San Francisco Bay Area, and Utah will have a high-value growth rate *(Source: Disaggregated FHWA FAF3 Database for Nevada).*

Trading Partner	2040 Tons *(in thousands)*	% of Total Tons	CAGR Tons, 2012-2040
Intra Nevada	76,542	41.8%	-0.3%
Arizona	15,266	8.3%	5.2%
Southern California	14,937	8.2%	0.5%
Utah	13,387	7.3%	1.6%
San Joaquin Valley	7,819	4.3%	2.3%
TOTAL (All Trading Partners)	**183,124**	**100.0%**	**0.8%**
Trading Partner	**2040 Value *(in millions of dollars)***	**% of Total Value**	**CAGR Value, 2012-2040**
Intra Nevada	78,067	23.4%	2.0%
Southern California	41,183	12.4%	2.4%
Arizona	19,250	5.8%	4.2%
Utah	16,843	5.1%	3.1%
San Francisco Bay Area	15,893	4.8%	3.8%
TOTAL (All Trading Partners)	**333,445**	**100.0%**	**2.9%**

Note: The tables include freight flows from Nevada (outbound), to Nevada (inbound), and within Nevada (intra), but do not include freight flows through Nevada.

The growth rates are high in tons for trade with Arizona and in value for trade with Arizona and the San Francisco Bay Area, while they are low to moderate for other top trading partners. The relative changes in population of neighboring states, Nevada's outbound and inbound commodity mix, and the relative cost of transportation and logistics in neighboring states are mainly driving this growth.

There is an opportunity to increase economic activity in Nevada. This would mainly come from expanding or developing new high productivity and competitive transportation and logistics services for distribution of goods to the western United States, especially Arizona and the San Francisco Bay Area. These regions currently receive their consumer goods from logistics facilities in Southern California, the San Joaquin Valley region of California, and Mexico.

2.3 Supply Chain Analysis of Key Sectors in Nevada

Supply chains of key sectors (see Figure 2-11) within the state of Nevada, including food and allied manufacturing, advanced manufacturing, and mining and allied activities, were analyzed in this Freight to better understand how these key sectors use the transportation system and what types of transportation system improvements in the state may have positive effects on their businesses opportunities and future growth.

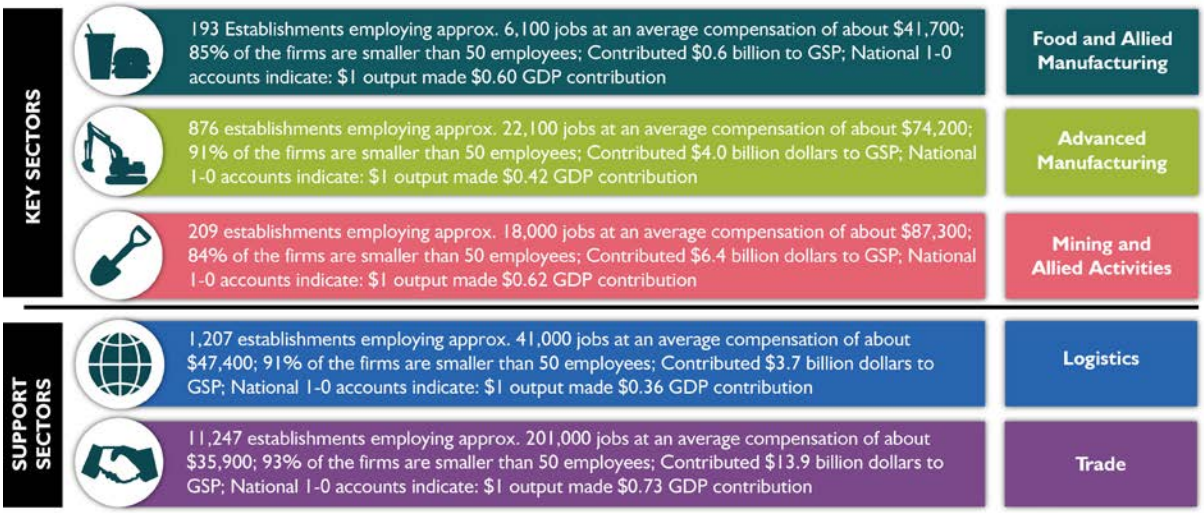


Figure 2-11. Economic Characteristics of Key and Support Sectors in Nevada

The image above summarizes key economic information about the selected key and support sectors in Nevada. The 3-digit NAICS codes used for each sector are noted below (Source: U.S. Census Bureau, 2013 County Business Patterns Data; U.S. Department of Commerce, Bureau of Economic Analysis).

Key Sectors include:

1. **Food and Allied Manufacturing:** 311 - food manufacturing, 312 - beverage and tobacco product manufacturing
2. **Advanced Manufacturing:** 325 - chemical manufacturing, 332 - fabricated metal product manufacturing, 333 - machinery manufacturing, 334 - computer and electronic product manufacturing, 335 - electrical equipment, appliance, and component manufacturing, 336 - transportation equipment manufacturing, 339 - miscellaneous manufacturing
3. **Mining and Allied Activities:** 212 - Mining (except oil and gas), 213 - Support activities for mining

Support Sectors include:

1. **Logistics:** 481 – air transportation, 482 – rail transportation, 483 – water transportation, 484- truck transportation, 488 – support activities for transportation, 491 – postal service, 492 – couriers and messengers, 493 – warehousing and storage
2. **Trade:** 423 – merchant wholesalers, durable goods, 424 – merchant wholesalers, nondurable goods, 425 – wholesale electronic markets and agents and brokers, 441 - motor vehicle and parts dealers, 442 - furniture and home furnishings stores, 443 - electronics and appliance stores, 444 - building material and garden equipment and supplies dealers, 445 - food and beverage stores, 446- health and personal care stores, 447 – gasoline stations, 448 - clothing and clothing accessories stores, 451 - sporting goods, hobby, musical instrument, and book stores, 452 - general merchandise stores, 453 - miscellaneous store retailers, 454 – non-store retailers

Food and allied manufacturing and advanced manufacturing supply chains were studied due to their high growth potential in Nevada (Nevada GOED, 2016). Mining sector supply chains in Nevada were studied because the industry has national significance and is a major employer in the state. Logistics and trade sectors are studied only in the context of the support activity they provide to the key sectors, including delivery, storage, distribution, and sale of raw, semi-finished, and finished products.

The supply chain analysis was completed based on publicly available state- and national-level economic data and information gathered through interviews, which are generalized to maintain confidentiality of the firm names and their data. Figure 2-11 shows a summary of the overall economic characteristics of the key sectors and support sectors in Nevada (U.S. Customs and Border Protection, 2015; BEA, 2015a); the summary assumes a defined set of 3-digit level North American Industry Classification System (NAICS) industries.[3]

[3] NAICS is the standard used by federal statistical agencies to classify businesses for the purpose of collecting, analyzing, and publishing statistical data related to the economy at various jurisdiction levels (nation, state, metropolitan areas, etc.).

2.3.1 Food and Allied Manufacturing

Overview

Food and allied manufacturing is a growing piece of the manufacturing industry in Nevada (GOED, 2015). This is due to its proximity to farming and agricultural resources, as well as to primary gateways for overseas imports and exports. Inputs to production, many of which are perishable foods such as fresh meat, vegetables, and milk, are sourced mainly from the western United States, while processed and preserved food outputs are sold to nationwide and global markets. Nevada has many global brands, such as NOW health foods, Hidden Valley Ranch salad dressings, French Gourmet frozen dough, and Pacific Cheese, that engage in manufacturing processed food and food supplements.

Employment Distribution and Growth Potential

Employment in this sector is concentrated in the metropolitan areas of Las Vegas and Reno, and is relatively even between them (see Figure 2-12). Employment is distributed mainly in bakeries, dairy-related manufacturing, perishable prepared foods and frozen specialty foods, coffee and tea manufacturing, and confectionary manufacturing from chocolate.

Based on the state's 10-year industry employment projections provided by the Nevada Department of Employment, Training and Rehabilitation (Nevada DETR, 2015), these industries are all expected to continue to grow in the Las Vegas region by more than 20 percent, while food and allied manufacturing in Reno is anticipated to increase by only about 10 percent.

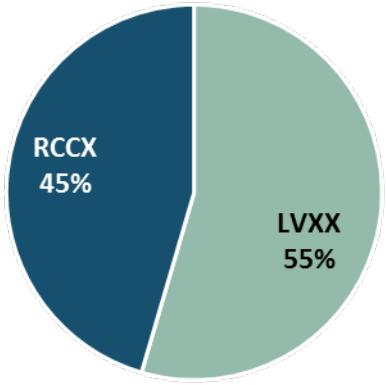


Figure 2-12. Employment Distribution in the Food and Allied Manufacturing Sector, 2013

This figure shows the locational breakout of Nevada's 6,135 employees in the food and allied manufacturing sector, which includes NAICS codes 311 - food manufacturing, 312 - beverage and tobacco product manufacturing. All employees in this sector work in the metropolitan areas, with 55% in the Las Vegas MSA (LVXX) and 45% in the Reno-Sparks-Carson City CSA (RCCX) *(Source: U.S. Census Bureau, 2013 County Business Patterns).*

Disclaimer: Due to disclosure limitation and confidentiality, data from County Business Patterns is missing values for some NAICS industries and counties in Nevada, particularly those counties with a limited number of establishments in the identified NAICS industries. The employment may in fact be higher than reported in the figure.

Production Inputs, Outputs, and Location Decisions

National input-output accounts (BEA, 2015b) show that food and allied manufacturing industries tend to rely on farms and themselves (trading with one another). This was further reflected in the interviews conducted, such as the dependence of this sector on other food processing and preservation industries, logistics for transport, and paper, plastics and fabricated metal for packaging, labeling, and canning. Both the Las Vegas and Reno metros have access to California's Central Valley agricultural region, a major source for farm inputs including dairy, fresh produce, and nuts, in approximately 4 hours, but access from Las Vegas was cited as better due to limited inclement weather events in the northern Nevada/California region.

Some food and allied manufacturing companies consider Nevada as a western U.S. hub for distribution of their manufactured goods, especially those companies that have strong ties to Asian suppliers and markets. They are likely to continue investing in manufacturing plant capacities and goods distribution services in Nevada as trade with Asia grows.

The importance of location to industries dealing with perishable products cannot be understated, as the costs of production and quality of the products can be heavily impacted by delays in transportation.

Perishable products are typically carried in refrigerated containers, often referred to as "reefers." cost and access to reefers are also essential considerations for this sector.

2.3.2 Advanced Manufacturing

Overview

The advanced manufacturing industry is a growing segment of key employment in Nevada with the highest concentrations located in the Las Vegas region (Nevada GOED, 2015). This is due to a "business friendly" climate with low taxes and affordable land and development costs. This sector provides high-paying jobs and is dependent on a skilled workforce. A majority of inputs to production of high-tech products, such as ores and minerals, precision instruments, and machinery, are available within Nevada or within a day's drive from Nevada, which make costs of production competitive. The state's proximity to gateway ports and airports also enables global sourcing and access to the global market. Nevada has an expanding list of advanced manufacturing firms such as Pololu, IGT, and Tesla.

Employment Distribution and Growth Potential

Similar to food and allied manufacturing, employment in the advanced manufacturing sector is concentrated in the metro areas of Las Vegas and Reno, and is relatively even between the two (see Figure 2-13).

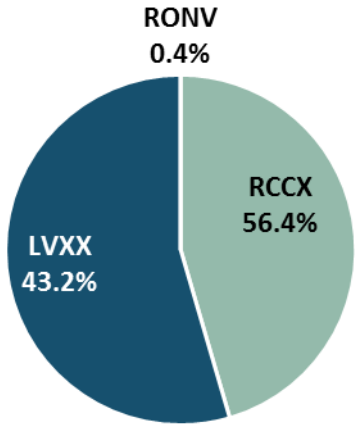


Figure 2-13. Employment Distribution in the Advanced Manufacturing Sector, 2013

This figure shows the locational breakout of Nevada's 22,111 employees in the advanced manufacturing sector which includes the following NAICS codes: 325 - chemical manufacturing, 332 - fabricated metal product manufacturing, 333 - machinery manufacturing, 334 - computer and electronic product manufacturing, 335 - electrical equipment, appliance, and component manufacturing, 336 - transportation equipment manufacturing, 339 - miscellaneous manufacturing. Almost all employees in this sector work in the major metros, with 56.4% working in the Reno-Sparks-Carson City CSA (RCCX), and 43.2% in the Las Vegas MSA (LVXX). A mere 0.4% work in the Rest of Nevada (RONV) *(Source: U.S. Census Bureau, 2013 County Business Patterns).*

Disclaimer: Due to disclosure limitation and confidentiality, data from County Business Patterns is missing values for some NAICS industries and counties in Nevada, particularly those counties with a limited number of establishments in the identified NAICS industries. The employment may in fact be higher than reported in the above figure.

Recent developments in the Reno area include notable investments such as Tesla's Gigafactory and its efforts to relocate some of its suppliers to the Tahoe Reno Industrial Center (Damon, 2016). This trend in particular could shift the current advanced manufacturing industry stronghold from Las Vegas to Reno. There is potential for Nevada to attract employers and a skilled workforce in high-tech computer components manufacturing and assembling from other parts of the country, especially California.

Production Inputs, Outputs, and Location Decisions

Advanced manufacturing constitutes the manufacture of specialized metallic products and non-metallic products such as composite materials and optical fibers, advanced vehicle technologies such as automated guided vehicles, electronic components such as circuit boards, and advanced machinery such as robotics. It is typical to see suppliers cluster around advanced manufacturing centers, which reduces the cost of production.

2.3.3 Mining

Employment Distribution and Growth Potential

Mining industries (excluding oil and gas), unlike the other key industries in Nevada, occur away from the urban centers of Reno and Las Vegas, with the heaviest concentrations in the central and northern parts of the state (see Figure 2-14).

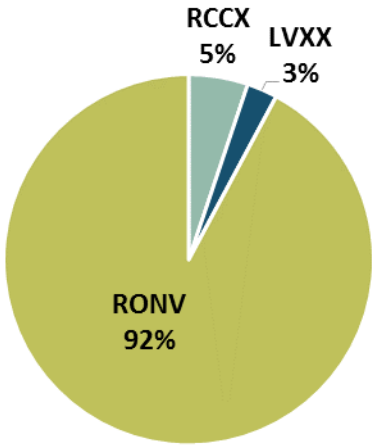


Figure 2-14. Employment Distribution in the Mining Sector, 2013

This figure shows the locational breakout of Nevada's 18,051 employees in the mining sector (NAICS codes 212 - Mining (except oil and gas), 213 - Support activities for mining). The vast majority of employees (92%) work outside of the metropolitan areas (RONV), while 5% work in the Reno-Sparks-Carson City CSA (RCCX) and 3% work in the Las Vegas MSA (LVXX) *(Source: U.S. Census Bureau, 2013 County Business Patterns).*

Disclaimer: Due to disclosure limitation and confidentiality, data from County Business Patterns is missing values for some NAICS industries and counties in Nevada, particularly those counties with a limited number of establishments in the identified NAICS industries. The employment may in fact be higher than reported in the above figure.

Jobs in this sector are typically high paying due to specialized skill requirements and a challenging work environment. The industry continues to grow in locations not only where minerals exist, but also where permitting is feasible.

Production Inputs, Outputs, and Location Decisions

Market fluctuations such as the price of mined product in the world market, extraction costs including the access to inputs to production, such as cement, fuel, heavy machinery, and chemicals (sulfuric acid, ammonium nitrate, cyanide, soda ash, etc.) used in extraction, strongly affect mining production in Nevada. Although cement and fuel are available within the state, most of the chemicals used in mining arrive from outside Nevada. Clusters of secondary industries such as logistics, construction, equipment repair, hospitality, and environmental consulting have developed in the vicinity of the mines.

Mining industry outputs include gold and minerals important to the development of high-tech products. Some of these elements used for high-tech products include lithium, molybdenum, and vanadium. Other uses include non-metallic mineral products manufacturing. The recent decision for Tesla to build its plant in Nevada may have been correlated to its close proximity to lithium mining production.

2.3.4 Analysis of Transportation System Usage for Key Sectors and Suggested Improvements

National-Level Analysis – All Modes and Implications to Nevada

National input-output accounts (BEA, 2015b) were analyzed to understand the 2012 expenditures on transportation modes for the movement of input and output commodities for the key sectors (see Table 2-5). This information is a national average and not based on the particular industry mix for the key sectors in Nevada. However, this helps identify opportunities for increasing non-highway mode use for freight movement in Nevada.

Relative expenditure on transportation modes is similar for input and output commodities for all key sectors, with two exceptions. For the advanced manufacturing and mining sectors, the expenditure on rail is higher for input commodities than for output commodities. In other words, investments in rail in Nevada would likely have greater returns on the movement of input commodities than output commodities for these two sectors.

Among the key sectors, highway expenditure is higher for manufacturing-related key sectors than the mining sector. Rail expenditure is higher for the mining sector than the food and allied manufacturing sector, which, in turn, is higher than the advanced manufacturing sector. Air expenditure is higher for the advanced manufacturing sector than the food and allied manufacturing sector, which, in turn, is higher than the mining sector. Thus, investment in highways would equally benefit all key sectors, while investment in the non-highway modes of rail and air would have varying benefits to the key sectors: investments in rail would benefit the mining sector more, while investments in air would benefit the advanced manufacturing sector more.

Table 2-5. National Input-Output Accounts based Relative Levels of Expenditures on Transportation Modes by Key Sector and by Supply Chain Direction, 2012

The table depicts relative expenditure in various transportation modes by identified sectors that are key to Nevada by direction of commodity flow based on national input-output accounts data. There is a linkage between industry sectors and their preferred transportation modes, so investments in different transportation modes may benefit supply chains of key sectors in Nevada differently (Source: U.S. Department of Commerce, Bureau of Economic Analysis, National Input-Output Accounts - 2012 Use of Commodities by Industry valued at Producers and Purchasers Prices and 2007 Production of Commodities by Industry – 71 Industries Level; Cambridge Systematics' Analysis).

Transportation Mode	1st Rank Key Sector	2nd Rank Key Sector	3rd Rank Key Sector
	Relative Expenditure for Input Commodities		
Truck	Food and Allied Mfg.	Advanced Mfg.	Mining
Rail	Mining	Food and Allied Mfg.	Advanced Mfg.
Air	Advanced Mfg.	Food and Allied Mfg.	Mining
	Relative Expenditure for Output Commodities		
Truck	Advanced Mfg.	Food and Allied Mfg.	Mining
Rail	Mining	Food and Allied Mfg.	Advanced Mfg.
Air	Advanced Mfg.	Food and Allied Mfg.	Mining

Key:
- High Level (higher >= 50% mode share)
- Moderate Level (>= 10% and < 50% mode share)
- Low Level (>= 5% and < 10% mode share)
- Very Low Level (< 5% mode share)

State-Level Analysis – Highway

Las Vegas's close proximity to the nation's largest seaport complex of the Ports of Long Beach/Los Angeles, as well as Mexico, and Reno-Carson City's short distance to the Port of Oakland enable global supply lines at a competitive pricing.

Interviewed companies across all key sectors used third-party logistics (3PL) or trucking firms for transporting goods. The shipment sizes vary by source and market, there is no one truck size that fits all cargo. So, the interviewed companies used both full load (FL) and less-than-truckload (LTL) trucking services.

Some advanced manufacturing firms operate in both Las Vegas and Reno, where one typically acts as manufacturing center and the other as a specialized supplier or a sales market. The industry representatives cited safety and the travel time via US 95 as two primary concerns. Improving this linkage to interstate standards and providing high-speed freight rail connectivity would greatly increase the safety and efficiency of the movement of production inputs and outputs.

One of the mining firms indicated that I-80 highway carries heavy trucks between the mines and transloading facilities, experiencing inclement winter weather, which requires constant repair and maintenance. In addition, the lack of truck climbing lanes along Emigrant and Golconda Passes hampers traffic flow and reduces safety even during good weather conditions.

State-Level Analysis – Rail

Mining uses a significant amount of rail (particularly, railcar-load service) to transport inputs to production. More rail would be used for mining if rail spurs connecting to the rail along I-80 were in place or if additional bulk transloading[4] facilities existed at Dunphy in Nevada, in addition to the facility at Carlin. For example, diesel is transloaded and trucked from either Sparks or Salt Lake City, Utah, and Cyanide is transloaded and trucked from Winnemucca. This could be avoided if transloading facilities were constructed in Dunphy.

Interviewed companies in other key sectors have a low usage of rail. This is due to limited intermodal rail service options to nationwide distribution centers and ports, and limited loading/unloading locations within Nevada. One food manufacturing firm's split in the Reno area includes 65 percent moving through the Port of Oakland and 35 percent moving through Ports of Los Angeles/Long Beach. The industry representative stated that they would shift over to rail from Sparks to the Port of Oakland if rail availability were to increase.

State-Level Analysis – Air

Air cargo is used more often by the advanced manufacturing sector than the other key sectors for receiving high-valued and global inputs, and delivering high-tech products to overseas destinations. McCarran International Airport (LAS) and Los Angeles International Airport (LAX) are traditionally used for Nevada manufacturers requiring air cargo service. However, there is an onset of rapid growth in air cargo services at Reno-Tahoe International Airport (RNO) (Harrell, 2016), which may increase their use of this airport.

[4] Transloading is transferring a shipment from one mode of transportation to another. Transloading in the United States can mean either of the following: 1) bulk cargo transfer from railcar to truck; or 2) intermodal cargo transfer from import container to domestic container.

Section 3: Context and Competitive Market Analysis

Understanding the changing patterns of Nevada's urbanization and economy within the context of equally changing patterns of global trade and economic activity are important to understanding future demands that will emerge for the state's freight logistics system. Once an economy of primarily tourism, resource extraction, and agriculture, Nevada is beginning to increase its manufacturing and technology industry bases, adding important economic components that continue to alter the demands on its freight logistics system. The freight logistics network of Nevada is itself changing as the economy of the state is beginning an important new stage in its evolution as manufacturing continues to develop in the state's major metropolitan centers.

Developing an effective freight transportation system requires an understanding of the state's economic regions and their characteristics, including activities associated with the manufacture, distribution, and consumption of goods. It also requires a description and analysis of Nevada's relationships with trading partners along a multimodal freight service network with important local, regional, and global elements.

3.1 Nevada in the National and Global Context

3.1.1 Population and Urbanization

Nevada's Population and Urbanization Pattern

Nevada's metros are part of the widely spaced network of urban areas in the western United States. The largest urban center is located in the southern part of the state: the Las Vegas metropolitan area composed of four cities that have grown together to become one continuous urbanized area within Clark County. Las Vegas-Henderson-Paradise was the only metro in Nevada to make the top 100 in terms of population, ranking 30th with 2,069,681 residents (Figure 3-1).

The second largest concentration of population is in northern Nevada, however, the pattern of urbanization is significantly different: more a network of cities than a single large cluster. The cities of Reno and Sparks have grown together to form one continuous urban area. While this core area is the largest concentration in the north, it is part of a larger network that extends to Carson City to the south, Incline Village at Lake Tahoe and East towards Fernley. Reno ranks 116th, with 443,990 residents and Carson City is the smallest classified metro area ranked 381st with 54,522 people. Just 9 miles east of Reno-Sparks along I-80 is the Tahoe-Reno Industrial Center (TRIC), which is emerging as the world's largest industrial park and a growing employment center.

Of the total state population, these three metro areas make up more than 90 percent; Las Vegas contributing the vast majority at 73 percent and Reno-Sparks-Carson City contributing 18 percent. The eastern part of the state is characterized as a set of smaller urban areas clustered along the state's two primary corridors, I-80 and I-15, with a number of small cities and towns serving the mining and agricultural businesses located throughout the area.

Population and Urbanization Across the United States

It is clear that metro and micro areas are unequally distributed across the nation. The geographic pattern, the spacing between them, and the relative sizes are significantly different in the eastern United States than in the West, as divided by the Mississippi River. East of the Mississippi, metro and micro areas are more evenly spaced in a denser pattern with closer proximity to each other. The largest and densest clusters are in the Northeast and Upper Midwest. The area west of the Mississippi can be divided into two basic divisions: 1) between the Mississippi River and a line formed by I-35 starting in San Antonio and continuing northward through Dallas to Kansas City and Minneapolis; and 2) west of I-35 to the Pacific Ocean where the metro and micro areas are widely scattered between vast areas of low density, with the exception of two dense clusters around and between the Los Angeles and San Francisco metro areas. Within this zone, there is a high degree of isolation between metro areas, where largely rural areas surround single large metros or urbanized corridors, resulting in a very dispersed and fragmented market. This wide spacing translates to higher transportation and freight operation costs for businesses as compared to the East Coast.

By 2007, more than 50 percent of the world's population was living in urban areas and that number is projected to surpass 70 percent by 2050 (Site Selection Magazine and IBM Global Business Services, 2013). Census maps showing historical population distribution of the United States demonstrate the westward expansion and increasing urbanization of the nation. In fact, approximately 80 percent of U.S. residents live in urban areas that are increasingly larger and denser, with the total expected to reach nearly 90 percent by 2050 (UN Department of Economic and Social Affairs, 2014). With such a vast majority of individuals and families living in urban areas, cities are viewed as the drivers of economic growth and their competitiveness increasingly important (Site Selection Magazine and IBM, 2013).

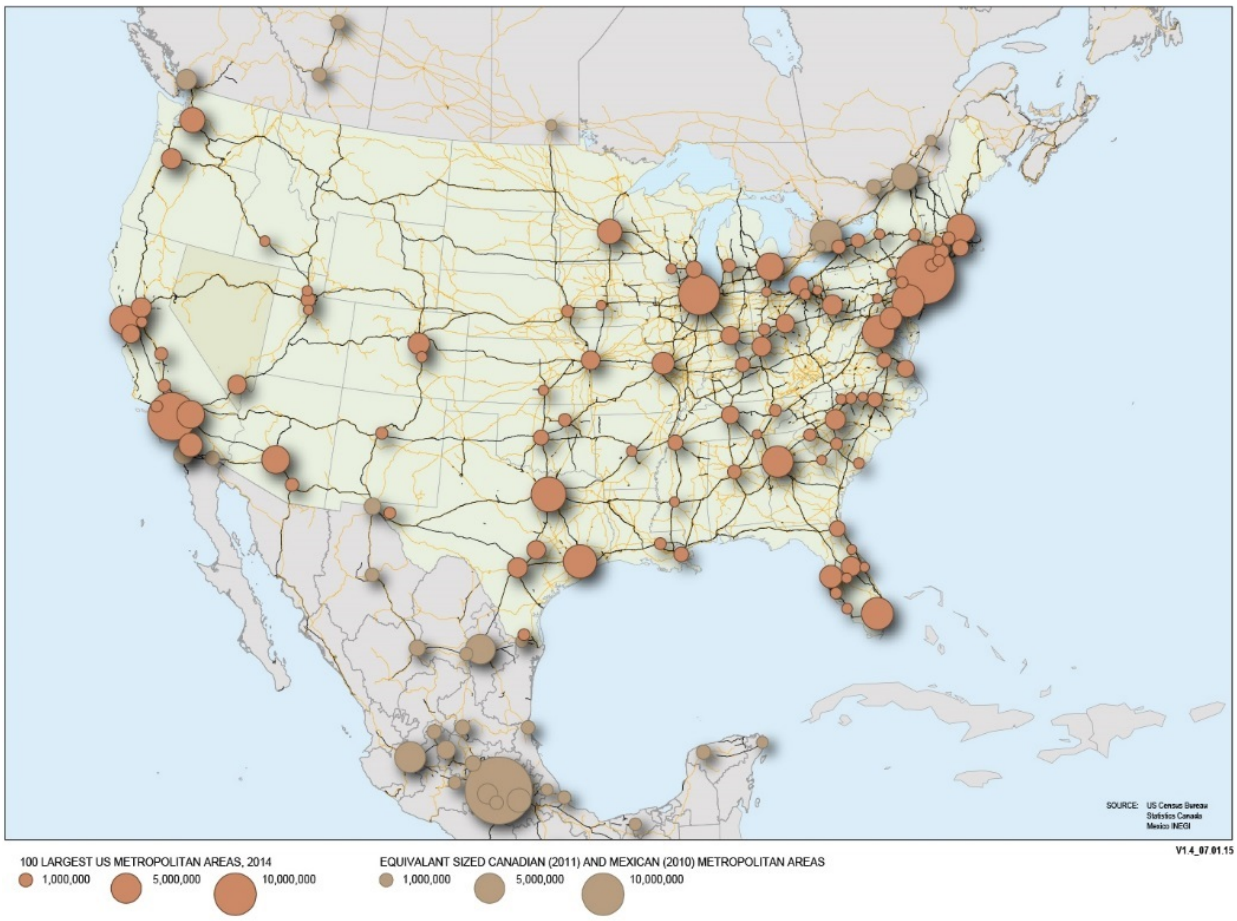


Figure 3-1. 100 Largest Urban Areas, 2014

The top 10 largest MSAs are: New York, Los Angeles, Chicago, Dallas, Houston, Philadelphia, Washington, Miami, Atlanta, and Boston. The Northeast is the most populous U.S. region, with the New York-Newark-Jersey City metro having the greatest population. California is the most populous state, with the 2nd and 11th largest metros: Los Angeles-Long Beach-Anaheim at 13,262,220 and San Francisco-Oakland-Hayward at 4,594,060 (Source: MG&A, 2015 based on U.S. Census, Statistics Canada and Mexico INEGI data).

Population Growth

The pattern of growth across the United States has significantly changed since the Great Recession began in 2007. Since the economy started to recover from the recession in 2009, a new pattern of growth has emerged. Prior to the recession, the western United States was one of the fastest-growing areas in the United States and the metropolitan areas of Las Vegas and Phoenix were among the top 10 metros (over 1 million) in growth. While growth in Nevada and Arizona has slowed compared to the pre-recession rates, it is still robust in these states' metropolitan areas.

Between 2000 and 2009, the Southwest and Intermountain West metros were among the fastest growing large metros (over 1 million) in the United States. However, since 2010, the pattern of population growth has shifted, revealing that the Lower Midwest and Southeast are again the fastest growing. Las Vegas has fallen from the fastest growing large metro to the 16th in terms of percentage growth and 22nd in terms of absolute growth, while Reno is yet slower at 88th and 99th, respectively.

The Freight Connection

Freight transportation as a derived demand is driven by the base of consumers and the inputs and outputs of manufacturing and distribution resources. Nevada as a state, and even its metro hubs, are comparatively lower in population and industrial/distribution output than the larger metro markets in

California, Utah, and Arizona. In this context, larger metro centers tend to provide the base for manufacturing and distribution that is consumed by the smaller region. This is indicated by the large spread of inbound with respect to outbound freight in Nevada. Freight service times are the limiting factor for Nevada's metro areas to serve the larger market area in the western United States. Thus, to bolster a competitive advantage for the delivery of goods that Nevada produces or may distribute beyond its borders, it must provide lower cost and more efficient services. A competitive advantage the state now enjoys is that its current infrastructure is largely uncongested and has future capacity. As congestion builds in major nearby hubs and as population and business move further inland to escape this congestion, Nevada's reach as a distribution point increases. Nevada has comparatively good access to West Coast port facilities and its tourism industry attracts airport services, which provide a basis for an expanded air distribution role.

3.1.2 Economic Activity and Freight Networks

Large metropolitan areas and smaller cities and towns are concentrations of production and consumption that form the basic market areas served by the transportation network. Growing the export component of Nevada's economy is one of the important drivers of the future freight system, as all economic activity requires getting products to market. Building the strength of Nevada's metros within the global supply chain network is an important factor in establishing a competitive advantage. Without greater export functions, Nevada's freight logistics infrastructure will remain a service in support of industry and not a foundation for the attraction of new industry.

The World Bank's *Connecting to Compete* report (2014) states "supply chains are the backbone of international trade and commerce." The report clearly establishes that improving logistics performance is fundamental to economic growth and competitiveness. Moving products efficiently and reliably to market requires nations, states, and metro areas to reduce costs and adopt policies that support trade. In fact, countries that want their firms to move up in global and regional value chains must provide the conditions for predictable and reliable supply chains (Ibid). This same concept can be applied to states and metropolitan areas, as they must also develop reliable and cost-efficient systems. The networked structure of global and regional trade means that small disruptions at one point spreads to others. Though cities do not move, trade patterns do, and they move towards the points of greatest efficiency. In this context, it is important for Nevada to strengthen its position through connections to the global freight network. Countries, regions, and metropolitan areas that do not provide reliable and cost-efficient systems will become increasingly disconnected from world markets (Ibid).

Growth and Change in the World Economy

The state of Nevada has the potential to greatly benefit from the major shifts taking place in the world economy. Understanding the new trade patterns is fundamental to understanding Nevada's fit within the national and continental economies. The major trade corridors linking the United States to the world economy have shifted from the Atlantic to the Pacific, resulting in the growth of trade across the western United States and the state of Nevada. Since the collapse of communism in 1991, the shift of manufacturing from the U.S. Midwest to overseas locations especially in Asia has reignited the Pacific trade lanes. As the growth rate of the Asian Pacific economies continue to lead the world, an increasing amount of trade between Asia and the United States is arriving on the West Coast (Figure 3-2). Total trade through the West Coast ports has surpassed the once dominant ports of the East Coast. This has led to the vast expansion of trade flows from the West Coast to the larger consumer markets on the East Coast via the primary corridors extending from the three major port concentrations at Los Angeles, San Francisco, and the Pacific Northwest.

As the world marketplace integrated after 1991, the competitive advantage that the United States enjoyed by having the largest economy of scale among the Free World nations disappeared as now

China and India had a far greater economy of scale. This drove the creation of trading blocs among the smaller nations of the world in Europe, North America, and the former Soviet Union.

Driven by changes in the global economy, the three nations of North America formed the North American trading bloc. For the first time in history, this has resulted in new north-south trade flows between Mexico, the United States, and Canada. The largest flow of goods is in the eastern United States, with the primary NAFTA corridor extending from Mexico City through Monterrey, Mexico, into Texas and the Upper Midwest and north into Toronto, Canada. This corridor serves the largest population and economic centers in all three nations. A western NAFTA corridor has also emerged, although the western infrastructure was never developed to connect the three nations and, therefore, it suffers from a set of discontinuities in the interstate and rail grid that are not as efficient as those found in the eastern United States.

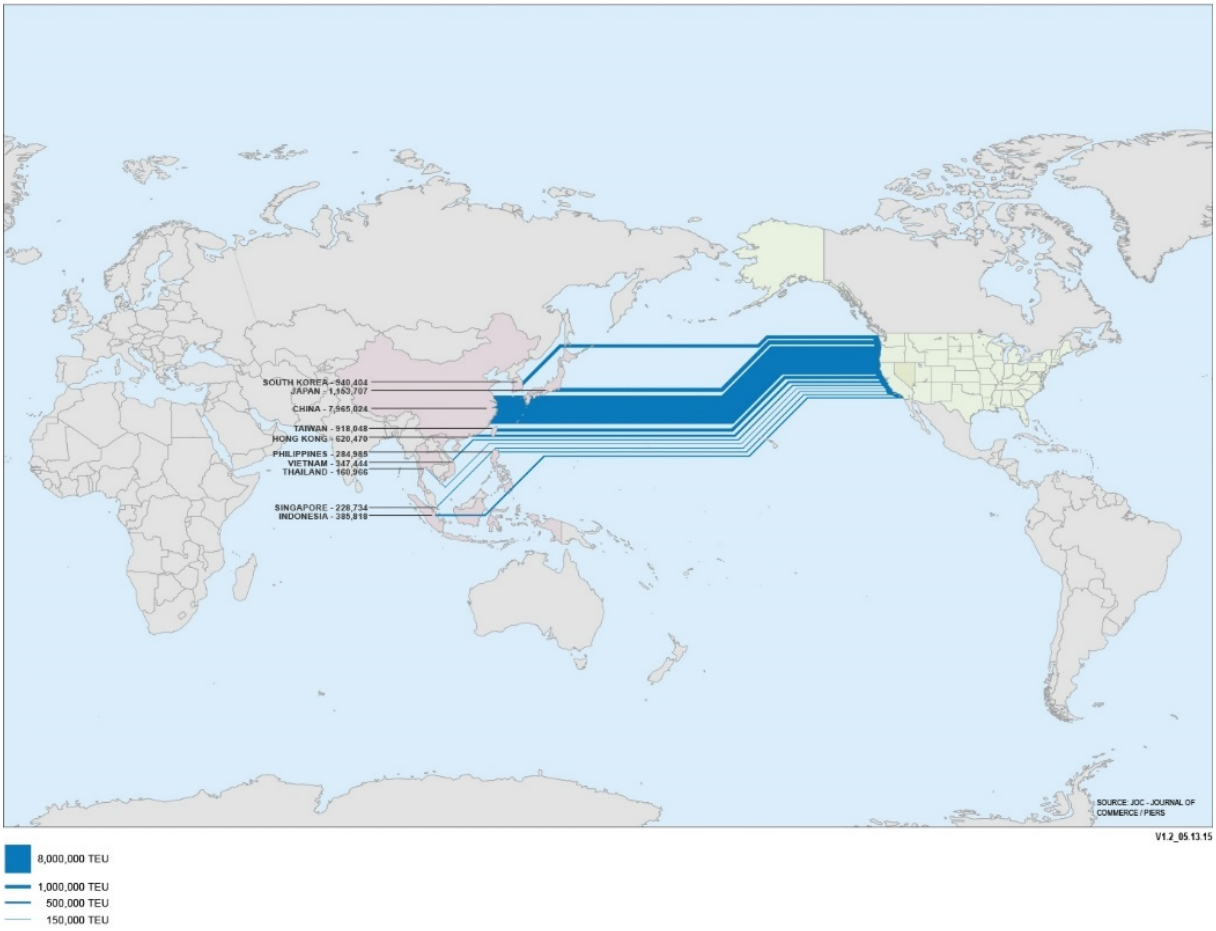


Figure 3-2. U.S. West Coast Containerized Ocean Trade via Asian Ports, 2014
The West Coast is intricately tied to Asia, especially China, through container trade flows arriving at the ports (Source: MG&A, 2015, based on Journal of Commerce/Piers data).

The initial period in the redistribution of global economic activity favored Asia and became known as outsourcing of U.S. manufacturing to other parts of the world. Recently, a counter move has begun, referred to as insourcing whereby companies have chosen to return their manufacturing plants to North America. Many companies have not returned their manufacturing to the United States, but rather to locations in Mexico along the U.S. border to take advantage of Mexican labor rates while serving American consumers. This has increased the importance of the NAFTA corridors, as the north-south movement of goods is increasing. However, Nevada does not have a north-south corridor that can serve as a conduit for the distribution of goods moving between the United States, Mexico, and Canada.

GDP by Metropolitan Area

Metropolitan areas in the eastern United States are more closely spaced and have a higher degree of economic interaction that allows each to benefit from the synergies that develop through those interactions (Figure 3-3). The pattern of metros in the western United States is marked by a more widely spaced pattern; Western metros function as islands of economic activity and not as interactive components of a larger marketplace (Western Regional Alliance, 2012).

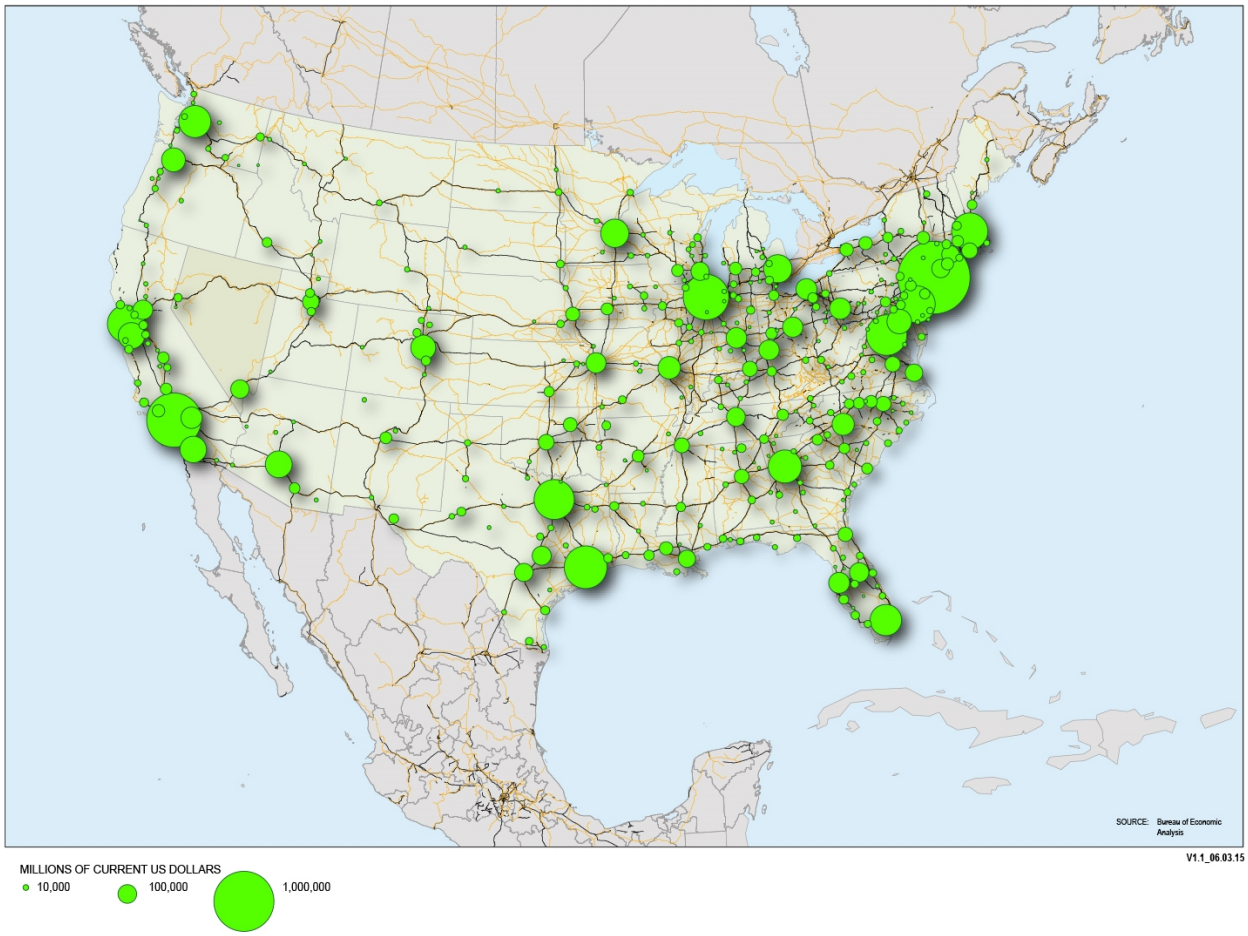


Figure 3-3. Gross Metropolitan Product, 2013

The distribution of metropolitan economies in the United States is not even. The eastern United States has a more densely packed pattern that provides greater synergy to each metropolitan economy, while the Western metros operate as economic islands. Nevada benefits from its close proximity to the massive economic concentrations in California (Source: MG&A, 2015, based on BEA 2013 GMP data).

Nevada's primary economy is concentrated in its metropolitan areas, with important contributions from its mining, resource extraction, and agricultural components found in the rural areas of the state. The growing importance of Nevada's metro areas is that they represent concentrated centers of economic activity and serve as incubators for development and innovation. Nevada has a specific advantage over many of the metro areas in the western United States because it is located in close proximity to the massive economic centers in Northern and Southern California. Between the Nevada metros and the dense pattern found in the eastern United States are a set of metros that are much more isolated and function as more independent economic units. Capitalizing on Nevada's proximity to California will create a greater economic synergy between the two states that will be of significant benefit to both as synergy increases the potential of both components.

Fortune 500 Headquarters and Freight Patterns

As the pattern of economic activity shifts, so does the geography of global corporations. The distribution of Fortune Global 500 companies has radically changed since the collapse of the Soviet Union (Figure 3-4). Asia has established a significant lead, with Europe and North America falling further behind. The United States, once the dominant center of corporate headquarters, is now being challenged by China, the nation with the single largest gain since 1990. Southeast Asia, Latin America, Russia, and the former Soviet Bloc nations have also experienced increases. While some European nations have added Fortune 500 headquarters, most have experienced significant losses, as has Japan, the United States, and to a lesser degree, Canada. As regions connect and develop to become larger and more competitive, companies move and merge together in ways that increase their competitive advantage and allow for more cost-effective operations. Nations, regions, and metros that have world 500 headquarters have a competitive advantage as these companies play a vital role as partners at the local, state, and national level in competing for global economic activity. In the western United States, only four states are home to Fortune Global 500 headquarters: California with 14, Washington with three, and Arizona and Oregon with one each (Fortune, 2015).

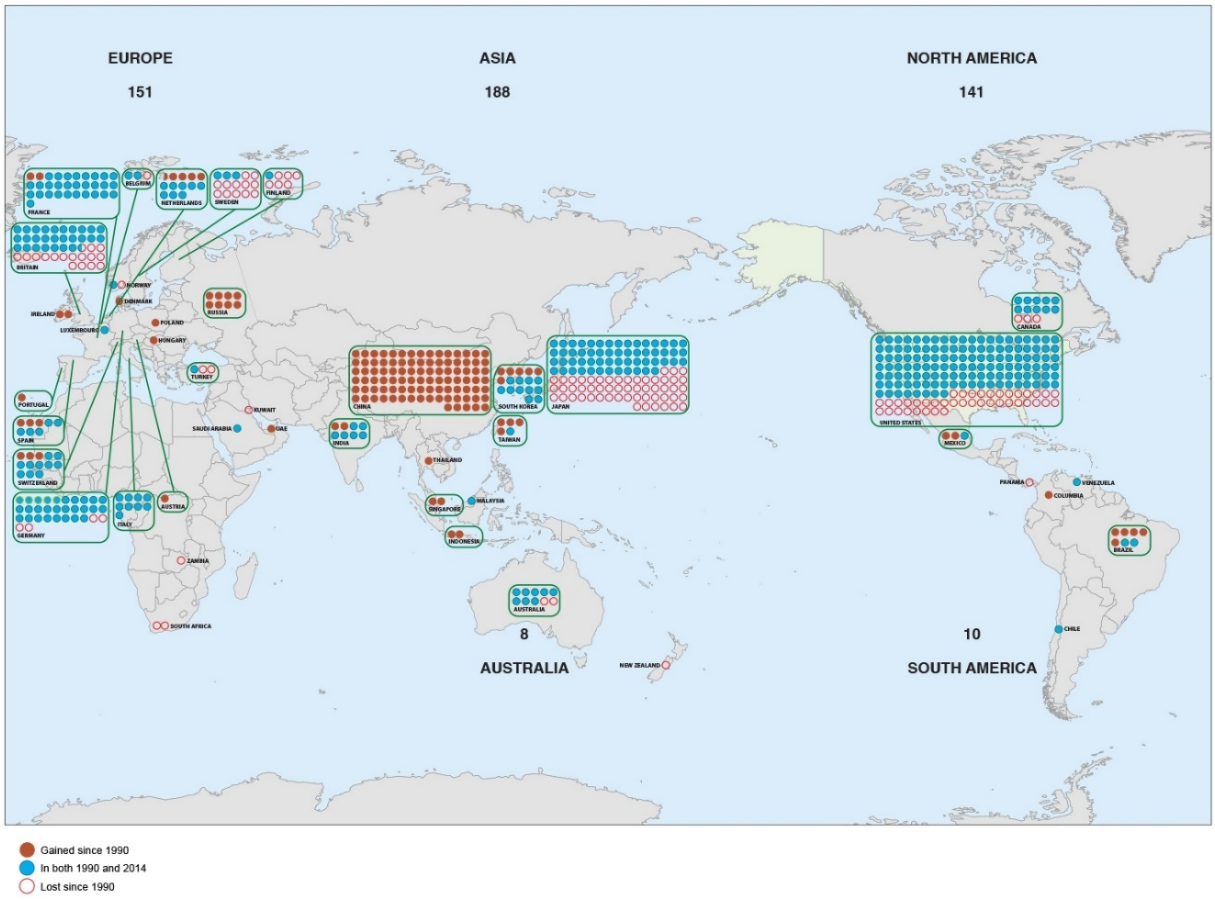


Figure 3-4. Distribution of Fortune Global 500 Companies

Blue Circles represent the number of Fortune Global 500 companies that existed in 1990 and remain by 2014, while red circles represent the number of Fortune Global 500 companies gained since 1990, and empty red circles represent the number of companies lost since 1990 (Source: MG&A, 2015, based on Fortune Magazine data).

While there are limited numbers of the Fortune Global 500 in the western United States, there are a significant number of the Fortune U.S. 500 companies. The distribution of U.S. Fortune 500 companies across the western United States in 2015 reveals an uneven pattern in both the number and types of companies located in the different states and metropolitan areas. California has the most Fortune 500 companies with a total of 53, 31 of which are located in Northern California and 22 in Southern

California (Fortune, 2015). Washington ranks second in the western United States with 10 Fortune 500 companies, followed by Colorado with nine, Arizona with five, Nevada with four, Oregon with three, and Idaho and Utah with one each (Ibid). There are no U.S. Fortune 500 companies in Wyoming, Montana, or New Mexico (Ibid).

The presence of Fortune Global and U.S. 500 company headquarters is one measure indicating the strength of a metro area in the national or global marketplace. The shift of companies to Asia is a sign of their increasing economic strength in the world economy. Headquarters are the location of high-end jobs, have significant influence on public policy and investment, partner with governments in creating jobs, and are typically innovators in new product development to reach world marketplaces. The type of headquarters in Northern California indicates the regions' strength in high tech. Nevada's proximity to these headquarter concentrations allows it to build stronger relationships that can attract new business, as illustrated by the symbiotic relationship between Tesla's battery factory in Reno as a manufacturing center and the Tesla headquarters in the Bay Area. Las Vegas-based Fortune 500 companies are all in the hospitality and accommodations industry; they do not produce any products for export, but rather support the economy of consumption. However, with the recent announcement of a financial company moving to the region, Nevada may continue the trend of economic diversification and attract yet more headquarters.

3.2 A Freight System for Economic Development

Economic Implications of Hub Status

Each tier of hubs (global, inland port, and local) has a very different effect on the local economy. Local hubs affect existing industries found within the area, but have little power to attract other industry to the area. Inland ports and global hubs are a major attraction for industry and have a positive effect on growing and diversifying metro economies. The reason that global hubs and inland ports attract industry is that high-cost freight transfers to inland points are overcome by such factors as the lower net line haul costs and the superior fit of hub services with a shippers' overall distribution network, bolstered by value-added processing, such as final product assembly and brand labeling at sites where the goods are being transferred. While improving the freight infrastructure in local hubs has a beneficial effect on the local economy, it may not serve to attract additional industry, as does the diversity and volume of goods flow and infrastructure additions that can result in the development of an inland port or global hub.

The Missing Major Corridor

The I-11 and Intermountain West Corridor provides a means to fulfill the congressionally designated CANAMEX Corridor, which was originally intended to connect Mexico, the United States, and Canada via the US 93 corridor to I-15. Rather than connecting from Las Vegas to Salt Lake City via I-15, a recent I-11 study found it more advantageous to connect major Intermountain West activity centers, including Reno, thereby creating the vision of a new corridor between I-5 and I-15. This new corridor would create economic synergies between the two largest metros in Nevada and facilitate greater production sharing between Las Vegas, Phoenix, and Mexico (Figure 3-5).

Importantly, the proposed I-11 and Intermountain West Corridor would provide both Las Vegas and Reno with a strong northwest-southeast connection that could be the foundation for greater NAFTA trade and an eastward expansion of West Coast economic activity that is currently hindered by the highly congested transportation network, relative scarcity of developable industrial land, and complex regulatory requirements. This would allow Nevada's population centers to become crossroads serving distribution functions.

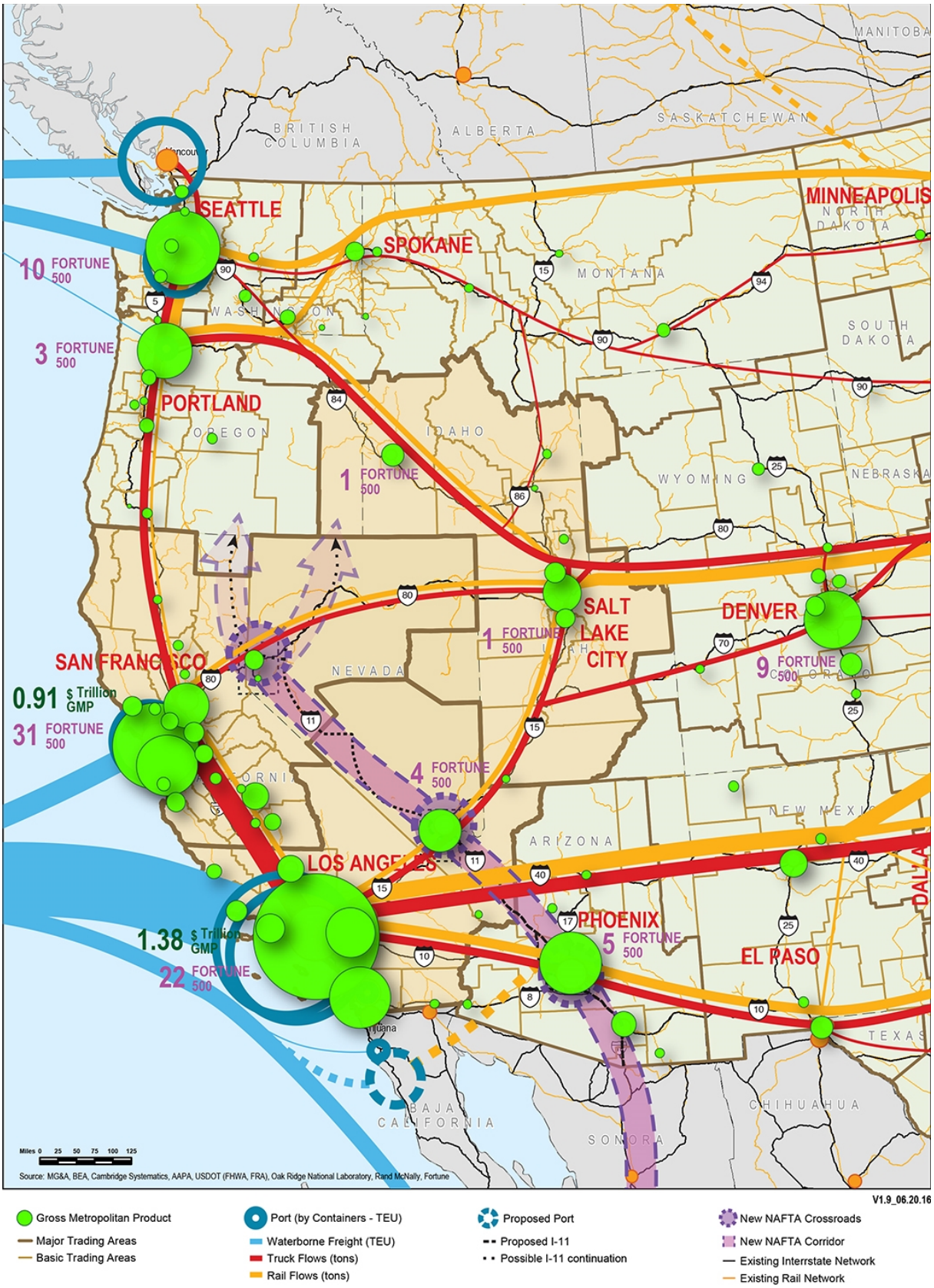


Figure 3-5. The Potential Future Freight System Serving Nevada

This figure highlights the major road and rail corridors that currently serve the state and the western United States, highlighting the possible future I-11 corridor that could serve the region (Source: MG&A, 2015, based on Cambridge Systematics, AAPA, USDOT (FHWA, FRA), Oak Ridge National Laboratory, BEA, Fortune, Rand McNally).

The West Coast Corridor that extends from Southern California to Vancouver is a short corridor that does not extend far into Mexico or Canada at either end. At the south end, it connects to Mexico in Tijuana and Ensenada, but not to Baja California because it is a peninsula with very little settlement. At the north end, it is blocked just past Vancouver because of the mountainous terrain. The I-11 corridor could extend from Mexico City, the central hub of the Mexican economy, and further to reach a greater portion of the western Canadian economy by connecting to Edmonton and Calgary. Because of the greater access to the Mexican and Canadian economies, I-11 has the potential to become a continental trade corridor feeding metropolitan areas in the western United States.

Conclusion: Increasing Export Functions and North-South Connectivity

Nevada is an import economy with a significant imbalance between inbound and outbound flows at a ratio of two to one. In order to build a stronger freight infrastructure, the state must build its export functions. Nevada is well situated in the western United States with freight delivery distances of 2 days or less by truck to several major metros despite the widely spaced urban networks. However, with only east-west corridors that do not interact, Nevada has limited access to the western region and serves mainly O&D functions. I-80 serves the northern and eastern regions of the state, while I-15 serves the state's southern region. Most truck and rail freight passes through the state along these corridors. Nevada's hubs and freight facilities are essentially stops along corridors.

Without a north-south corridor creating crossroads through the two major hubs, Nevada's ability to become an integral part of the NAFTA and Western regional markets, and attract new industries from the highly constrained West Coast economic zone will be severely limited. The state's economic development strategy should aim to strengthen its multimodal and multidirectional services to improve its links to Western ports and Eastern markets. Among other things, this involves integrating new intermodal rail terminals with highway and airport assets to capture more value-added distribution functions

3.3 Nevada's Economic and Freight Relationships

Economic Regions

States are political units and their boundaries do not reflect economic regions. The economic regions of the western United States do not follow political jurisdictional lines, but rather are defined by the MTAs. The state of Nevada is divided between three MTAs: San Francisco, Los Angeles, and Salt Lake City (Figure 3-6). The economy of the San Francisco region includes Reno, Los Angeles that includes Las Vegas, and Salt Lake City that includes parts of eastern Nevada are each very different in their economic function and role in the economy of the western United States. As a result, Nevada's relationship to each is very different as the Nevada components of the three economic regions are themselves very different. Therefore, the type of infrastructure that will evolve in each of the three regions will be different.

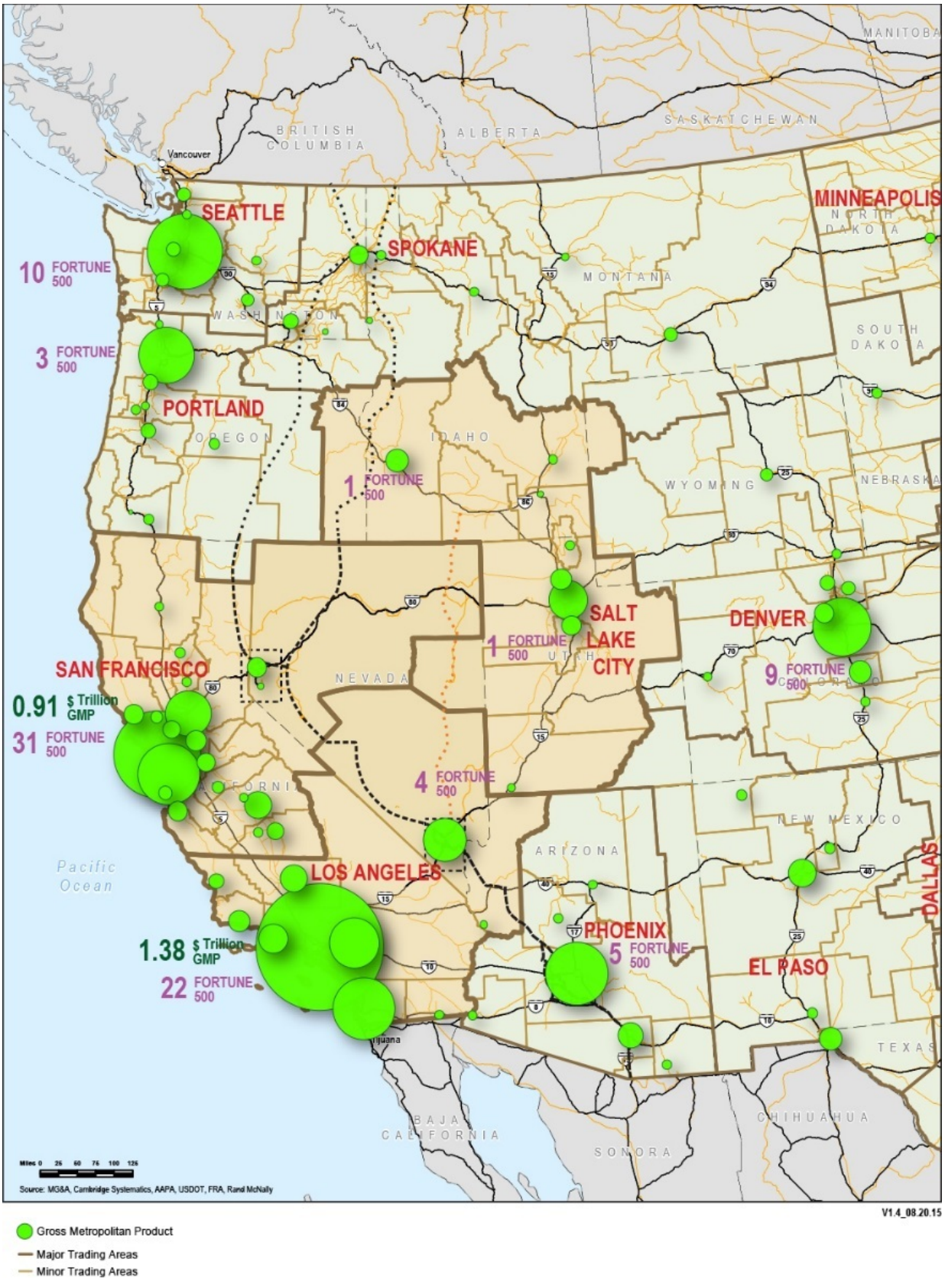


Figure 3-6. Major and Minor Trade Areas

The economic geography of the state of Nevada is divided between three major trade areas. Northern Nevada is part of the San Francisco MTA, southern Nevada is part of the Los Angeles MTA, and the East-Central section of Nevada is part of the Salt Lake City MTA (Source: MG&A, 2015 based on Rand McNally 2010 data; Fortune 2015; BEA 2013).

Because Nevada does not have its own MTA, understanding the economies of northern, southern, and eastern Nevada must be understood in the context of the greater economic trade area in which they are located. This relationship can be understood by analyzing their freight logistics and trade functions as expressed in commodity flows and logistics infrastructure, the economic structure of Nevada's regional economies and their relationships to the MTAs, and the industrial real estate that is the primary indicator of development activity and dependent on logistics infrastructure. Each of these has an influence on the relationship and defines Nevada's hub functions and its role in the western U.S. regional economy.

Economic Activity and The Freight Network

Economic activity and the freight and logistics network are closely related, as freight networks have developed to serve the economy. In the global economy, economic activity is increasingly attracted to efficient supply chain hubs and networks as they provide the highest level of access and greatest efficiency in the distribution of products. As a result, economic growth is increasingly centered in the urban areas where freight logistics infrastructure, including airports, rail yards, and truck terminals concentrate, as evidenced by the increasing proportion of people and jobs located in urban centers. Within the United States, the top 100 Metro areas produce more than 80 percent the value of all goods traded, 75 percent of U.S. GDP, and contain 66 percent of the national population (Brookings, 2013).

The current freight logistics network serving the three Nevada regions has evolved to fit the size of their populations and the type and structure of economic activity. Currently in Nevada, more than 90.4 percent of the state's population and over 87.8 percent of its gross state product (GSP) are located in the Las Vegas and Reno-Sparks-Carson City metro areas (U.S. Census Bureau, 2014; U.S. Bureau of Economic Analysis [BEA], 2013). Las Vegas is the largest concentration with just over 2 million people, 72.9 percent of the state total, and economic activity at $92.9 billion, or 70.4 percent of GSP (U.S. Census Bureau, 2014; BEA, 2013). The Reno-Sparks-Carson City area is the second largest concentration with 498,512 people, 17.6 percent of the state's population, and economic activity representing a proportional $23 billion or 17.4 percent of the state total (U.S. Census Bureau, 2014; BEA, 2013). The remainder of the state's population, 270,906 people or 9.5 percent, and economic activity, $16.1 billion or 12.2 percent, are dispersed in larger and smaller towns, mining centers, and agricultural areas across the state (U.S. Census Bureau, 2014; BEA, 2013).

Las Vegas' freight infrastructure has largely evolved to serve its tourism economy, heavily dependent on imports and producing few exports. Machinery and mixed freight, which are heavily represented by consumer goods, is its largest value-traded commodity. Reno traditionally had evolved the same way as Las Vegas, but has begun an evolution towards a more diverse manufacturing and service economy. Electronics and mixed freight's consumer products are its highest value-traded commodities. The rural areas in north-central Nevada remain primarily mining and agriculture, and are home to the nation's largest gold reserve and a variety of non-metallic mineral mines. Thus, the natural resources and mining industry sector is very important from a real GDP contribution perspective. The ores, minerals, and their products, mainly produced in the state's metro areas, have national and global markets.

Each region of Nevada has to attract industry based on either a cost advantage in land, labor, and buildings, or on a compatibility basis, based on similar industries that share similar labor and management skills. With California's tax rates and regulations changing, Nevada is becoming a popular alternative for distribution centers (Bauman, 2013). However, crossroad cities that become distribution centers are able to attract industry because they have a structural advantage in that as more goods are handled for distribution to larger markets, it provides a very different infrastructure that supports a wider range of business activity. Thus, the growth of Nevada's logistics functions will be a function of its growth as a more diversified economy with stronger export functions and volumes and major investments in its surface grid of highway interstates and rail to transform the northern and southern Nevada regions into crossroads.

3.3.1 Major Trade Area Overviews: Logistics Infrastructure, Economy, and Industrial Real Estate

3.3.1.1 Northern Nevada/California

The Northern Nevada/California economic region represents the second largest economic concentration in the western United States. Traditionally, the Reno-Sparks market area operated as a market relatively independent market of the Northern California market, although it was long a tourist destination for residents of the Northern California area. However, recent developments in this market area indicate that Northern California companies are increasingly seeing Reno as an extended submarket that has competitive advantages over the markets in the San Francisco Bay Area and Central Valley. As a result, the Reno-Sparks-Carson City area is moving toward greater economic integration and becoming a more diverse and integral subcomponent of the Northern California market.

The $5 billion investment made by Tesla for its Gigafactory in the 100,000-square-foot (ft^2) TRIC represents an example of this trend. The growing and diversifying export economy of Reno and the northern Nevada region is creating significant potential to develop a much stronger infrastructure platform that can attract a much wider range of freight-related economic activity. Some of the infrastructure development will involve internal improvements to the northern Nevada regional infrastructure, higher levels of modal integration, and increased capacity and performance. A second set of improvements will have to address external conditions focused on northern Nevada's access to the Mexican and Canadian markets via the proposed I-11 corridor. Due to the issues of crossing the Sierra Nevada Mountains, a deeper partnership with California will be required to resolve reliability and safety issues in the trans-Sierra freight movements.

Logistics Infrastructure Overview

Currently, Reno is only a stop along the I-80 corridor and not a crossroads that could evolve into a transshipment or transloading point that could reach other markets. As a result, the only intermodal service that could be provided in Reno would be relative to the Northern California market. To start, development agencies in northern Nevada could work with the region's shippers, UPRR and BNSF, to determine what volume of freight is needed to build unit trains at Reno and at what cost point this service would become viable to justify the establishment of a major intermodal rail yard. It may be possible for the Reno rail yard to develop an exchange relationship with Lathrop that favors Reno intermodal consolidation for east-west moves and Lathrop for north-south rail connections. Such a relationship over an immediate and interim period would improve freight connectivity for Reno as its direct north-south capabilities while an I-11 multimodal corridor can be designed and completed. A strong NAFTA corridor connection is needed to allow Reno shippers to efficiently distribute north into the Northwest and Canada, and south into Southern California, Arizona, and Mexico.

Economic Overview

The San Francisco Bay Area within Northern California is the high-tech center of the world and one of the greatest wealth-producing regions on the planet. The population of Northern California and northern Nevada combined is approximately 14,611,069 as of 2014 (U.S. Census Bureau, 2014). The

addition of micro areas brings that total to 15,215,336 (U.S. Census Bureau, 2014). The total GDP of these metros as of 2013 was nearly a $1 trillion economy, at $910.4 billion (BEA, 2013). Within the San Francisco MTA, the northern Nevada subarea holds 2.5 percent of the total good manufacturing practice (GMP) and 4 percent of the employment; a smaller GMP than employment percentage, meaning the jobs are lower-wage in northern Nevada than they are in the San Francisco region.

The rapid growth in size and value of the San Francisco Bay Area economy has resulted in a large shift of industrial activity out of the Bay Area and into the Central Valley. The Central Valley was traditionally a rural agricultural area with small towns and cities that provided services to the farming areas surrounding them. With the growth in the San Francisco Bay Area, these cities along the I-99 corridor from Sacramento to the north, and especially south towards Fresno and Modesto, are being transformed into industrial and manufacturing areas.

More recently, Northern California companies have come to realize that Reno-Sparks area has cost and logistics advantages that can better serve the growth in the Northern California economy. No longer is Reno considered a separate location on the other side of the Sierra Nevada Mountains, but is in the process of becoming more integrated into the San Francisco Bay Area economy.

Industrial Real Estate Overview

Of the western U.S. markets analyzed, the San Francisco Economic region is the second largest market at 617,019,989 ft^2, of which 197,023,051 ft^2 are in Oakland, 170,035,673 ft^2 in Sacramento, 101,888,757 ft^2 in Silicon Valley, 77,082,219 ft^2 in Reno, and 70,990,289 ft^2 in the Peninsula (Figure 3-7) (CBRE, 2015). Thus, the Reno area contains 12.5 percent of the MTA's industrial space, a number that will increase as TRIC builds out.

From 2005 to 2015, the San Francisco Peninsula, Silicon Valley, and Sacramento grew slowly with a range of 2.9 million to 4.9 million ft^2 in growth, while Reno's industrial market grew by 14.6 million ft^2 (CBRE, 2015). Net absorption in the Reno market exceeded Las Vegas by approximately 2.5 million ft^2 in the period from 2009 through 2014, and has been positive every year since 2010 (CBRE, 2015). This is indicative of Reno's efforts to capitalize on its proximity to Northern California markets. However, vacancy rates have fluctuated dramatically over the past decade during the economic downturn and recovery.

At 38 cents, Reno has a competitive lease rate advantage over any of the four Northern California markets, including the San Francisco Peninsula at 90 cents, Silicon Valley at 61 cents, Oakland at 56 cents, and Sacramento at 44 cents (GOED, 2015). Reno has remained low and fairly stable over the decade, with a range of only 11 cents between its maximum of 38 cents per ft^2/month and its minimum of 27 cents ft^2/month (CBRE, 2015). This makes it very competitive for capturing potential spillover. However, once the Tesla plant is complete and in operation, it is expected that there may be a significant increase in at least short-term rates as suppliers and others react to the growing demands of the Tesla plant.

Recent Developments Indicating Future Trends

Powdered Milk Processing Plant in Fallon

Nearby in Fallon, Perazzo Brother's dairy company has added a new milking barn and is capitalizing on a new market overseas using a new powdered milk processing plant that opened a short 5 miles from its dairy farm in 2014 (Breen, 2015). Alan Perazzo has stated that he now has the opportunity to increase production with a stable market that does not require shipping to California anymore (Ibid).

Figure 3-7. Western United States - CBRE Industrial Real Estate Markets

This figure shows the geographic location and size of each industrial real estate market included in this study of the western United States, as defined by CBRE (Source: MG&A, 2015).

The Tesla Example: World's Largest Industrial Park Located near Reno

Northern Nevada has captured widespread attention as Tesla Motors, Inc. has decided to build a $5 billion lithium battery factory, which is currently under construction in TRIC (Hull, 2015). Tesla chose this location not only because of the $1.25 billion in subsidies, but because Nevada's high unemployment rate meant an available workforce, not only to work in the plant, but also to build it (Cohn, 2015). The deal was also made because of land availability and the active lithium mining operation in Nevada (Business Facilities, 2015). As a technology and manufacturing company, Tesla has diverse needs, hiring high-tech workers with doctorates as well as employees for the assembly line (Ibid).

Tesla's Gigafactory in Reno will be the largest lithium battery production plant in the world located in the world's largest industrial park, TRIC, at 110,000 acres (Business Facilities, 2015; CalSTA, 2014). This highlights Reno's projected major rise as a manufacturing and distribution location. The project has already increased commercial and residential real estate values, added a direct flight from Reno to New York, and spurred the movement of Bay Area and other future employees to relocate (Hull, 2015).

This investment represents an incredible opportunity for transformation, with long-term benefits including economic diversification and attracting more manufacturing to the region. An economic impact analysis completed through the Governor's Office of Economic Development (GOED) stated that Tesla will support transportation and utility infrastructure improvements to "greatly enhance the region's competitiveness for future manufacturing and logistics projects," while the state has committed to "$100 million in infrastructure improvements to support the Gigafactory" (Applied Economics, 2014; Business Facilities, 2015). This investment will include the state purchasing the right of way needed to link I-80 and US 50 to the TRIC site in Storey County with the proposed USA Parkway Project (Business Facilities, 2015; NDOT). The 20-year forecast is that Tesla will generate $97 billion in economic activity and boost regional GDP by 26 percent (Hull, 2015).

A key requirement built into the deal is the guarantee that half of the factory workers must be residents of Nevada (Hull, 2015). It is projected that the company will create 6,500 jobs in the next 4 years at an average wage of $27.35 per hour, thereby increasing the metro area's manufacturing employment by more than 50 percent (Applied Economics, 2014). Construction of the facility will create 9,000 direct jobs and 4,700 indirect jobs (Ibid). Overall, this represents a tremendous gain: state employment will rise 2 percent and regional employment will increase by 10 percent (Business Facilities, 2015).

Additionally, large technology companies have relocated some of their operations to Reno, including an Apple data center, an Amazon distribution center, and a Microsoft licensing unit (Business Facilities, 2015). Reno is capitalizing on its proximity to Silicon Valley and emphasizing the lack of corporate and inventory taxes (Business Facilities, 2015). In order to truly capitalize on the job growth potential associated with these developments, the region will need to ensure, create, and attract a technically skilled workforce.

3.3.1.2 Southern Nevada/California

The Southern Nevada/California economic region represents the largest population, logistics, and economic concentration in the western United States. While the Las Vegas regional economy is becoming a more diverse, it remains a primarily tourism market based on accommodations, entertainment, retail, and gaming. As it has traditionally, it continues to attract a large percentage of its tourists from the Southern California area. Unlike Reno-Sparks, Southern California companies do not view Las Vegas as an extended submarket that has competitive advantages over the traditional California markets centered in the Los Angeles Area or the Inland Empire. The Las Vegas area announced a $4 billion investment in a new resort on the Strip along with the recent completion of the City of Rock and the new Las Vegas Arena. All of these investments reinforce the continued focus on tourism as the primary sector of the southern Nevada economy. However, recent announcements by Switch indicate a

billion-dollar investment in Las Vegas, a distribution center announced by Amazon, and Zappos' focus on developing an innovation economy in downtown Las Vegas point toward a long-term interest in economic diversification. Additionally, UNLV has published its Tier One Initiative: its vision to become Nevada's first top 100 American Public Research University by 2025 (UNLV, 2015).

Despite the trend towards greater diversity, it remains a small fraction of the larger and dominant tourism economy that remains a consumption- rather than export-oriented economy. Under the present freight model, Las Vegas' economy will grow in increments related to population increases and general freight activity, but not in its relationship to attracting spillover from the Los Angeles economy. As a result, freight will continue to be import dominated. Both Phoenix and Las Vegas are essentially freight satellites of the Los Angeles logistics concentration and do not function as freight centers on their own as neither forms a crossroads in the western U.S. distribution network.

Logistics Infrastructure Overview

Las Vegas sits atop one of three primary corridors (I-15, I-40, and I-10) connecting Southern California to the East Coast markets; it is only a stop along the I-15 corridor and not a crossroad. Its rail services, especially intermodal connections, are limited. UPRR serves southern Utah on a line that runs northeast-southwest through Clark County and has access to several industrial sites. Its intermodal facility at Valley yard offers inbound service from Chicago to Las Vegas and outbound service from Las Vegas to Los Angeles; however, there is no outbound service from Las Vegas to Chicago or any other destination (Mesquite Regional Business, Inc., 2015). These limiting service factors make the crossroad strategy with improved direct intermodal connections more difficult to realize than it may be in northern Nevada. Nevertheless, Las Vegas does have a well-established logistics and operation base that employs more than 38,000 workers (which constitute the labor base of its logistics supply services) and that sector has increased the number of jobs in this category by nearly 4,000 between 2004 and 2014 (GOED, 2015).

One of the strongest beneficial connections between tourism and trade in greater Las Vegas is McCarran International Airport, which connects to nearly 140 different destinations, including points in Central America, Europe, and Asia (Las Vegas Global Economic Alliance [LVGEA]). Each day, the airport transports approximately 611,000 pounds of arriving/departing cargo (Mesquite Regional Business, Inc., 2015). It is the base for air cargo operations of several airlines including US Airways and Southwest, and also serves freight logistics specialist UPS and FedEx (LVGEA). Its 200,000-foot freight and distribution facility completed in 2010 is a transfer hub for approximately 611,000 pounds of cargo arriving/departing daily (LVGEA). Based on national statistics, Las Vegas may be served well with growth in international connectivity. Air freight between the United States and the rest of the world in December 2014 increased 10 percent from December 2013 to 867,093 tons (USDOT, 2014).

One of the major limiting factors for Las Vegas logistics development is the high inbound to outbound ratios: 42 million tons of freight arrive and only 8 million tons go out; and in terms of value, inbound moves generate $44 million while outbound movements yield less than $13 million. Likewise, the truckload shipping costs suffers from a similar imbalance: truckload rates from Los Angeles to Las Vegas are $875 while Las Vegas to Los Angeles is $450 (RCG Economics, LLC and Schlottmann, A., 2012).

Las Vegas may be able to serve intermediary distribution and value-added services, with consolidation and cross dock services on triangular traffic lane involving Los Angeles, which is only 270 miles from Las Vegas, Phoenix, which is 292 miles away, and Salt Lake City, at a distance of 518 miles (Figure 3-8). This puts Las Vegas in the range for one day out-and-back trucking operations between each of these points with an opportunity to limit some of the imbalance of flows for services between these points. As is the case with Reno, the growth in industrial output would strengthen its regional opportunities.

Figure 3-8. Approximate Truck Distances from Las Vegas and Reno

This figure indicates truck travel times from Reno and Las Vegas, showing their extensive reach for one- and two-day truck services within the western United States. Nevada's metros are well positioned with great potential to grow and evolve as crossroads to serve the entire western U.S. market (Source: MG&A 2015, based on NV Energy and Rand McNally data).

There is little doubt that growth in transportation logistics in Las Vegas would significantly benefit from the development of an I-11 interstate and rail corridor that could transform it into a crossroads to serve a larger market region. Growth in Mexican-related trade is likely as relative time distances between the Nevada and Mexican markets shorten. Las Vegas' best intermodal rail connections may lie just to the south in Arizona, where UPRR's major east-west intermodal route passes from California through to Texas and continues east. A combination of improved drayage from both Las Vegas and Phoenix to a new intermodal facility on this route may produce enough volume, increasing Las Vegas' logistic choices and accessibility to larger markets.

Economic Overview

The population of Southern California and southern Nevada combined is approximately 25,860,192 as of 2014 (U.S. Census Bureau, 2014). The total GDP of these combined metros as of 2013 is $1,375.7 billion (BEA, 2013). This economy has increased by 10.3 percent over the 3-year period between 2010 and 2013 (BEA, 2013). The southern Nevada subarea holds 7 percent of the total GMP and 8.3 percent of total employment within the Los Angeles MTA, a larger portion than northern Nevada, but a similar trajectory of lower-wage jobs, though GOED is currently pursuing efforts to attract higher wage jobs to Nevada.

Although Las Vegas is located in close proximity to Southern California, the companies that choose to locate in Las Vegas want to be there because of the resorts or to serve the population (Roberts in Baumer, 2013). The region is more focused on supplying the resort and entertainment industry than on exporting goods (Baumer, 2013). Las Vegas was the only metro in which accommodation and food services was a top industry, accounting for 27 percent of jobs in Clark County (GOED, 2015). Manufacturing accounted for only 3.3 percent of the Las Vegas GDP for 2013, the lowest percentage for any metro analyzed (BEA, 2013).

Industrial Real Estate Overview

The industrial markets in the western United States are dominated by the sheer size of the Greater Los Angeles market (Figure 3-9). This market is about 6.5 times larger than the other markets on average, ranging from about 2.25 the size of the Inland Empire market to 14 times larger than the San Francisco Peninsula and Reno markets. In the first quarter of 2015, the combined size of the Los Angeles MTA markets analyzed was 1,791,939,472 ft^2 of which 993,852,371 ft^2 is in the Greater Los Angeles market, 441,986,528 ft^2 in the Inland Empire, 253,661,243 ft^2 in Orange County, and 102,439,330 ft^2 in Las Vegas (CBRE, 2015).

Over the decade from 2005 to 2015, the Inland Empire exhibited the largest increase in industrial market size by 84.3 million ft^2, while Las Vegas increased by 19.5 million ft^2 (CBRE, 2015). With its close proximity to the Ports of Los Angeles and Long Beach, the Inland Empire has seen great increases in net absorption since 2008, reaching a level much higher than the other western U.S. markets (CBRE, 2015). The Las Vegas industrial lease rate of 56 cents per ft^2/month is 17 cents higher than the current average lease rate in the Inland Empire at 39 cents and, therefore, less competitive as an alternative to continued expansion in the Inland Empire (CBRE, 2015). Based on the lease rate, it is unlikely that these markets will capture excess demand generated in the Southern California region until rates in the Inland Empire significantly exceed those in Las Vegas and Phoenix.

Overall, there is great competition for Las Vegas in absorbing Southern California spillover with the nearby Inland Empire and Phoenix submarkets as well as the Stockton, Barstow, and Bakersfield locations, which are closer to the ports and within state lines.

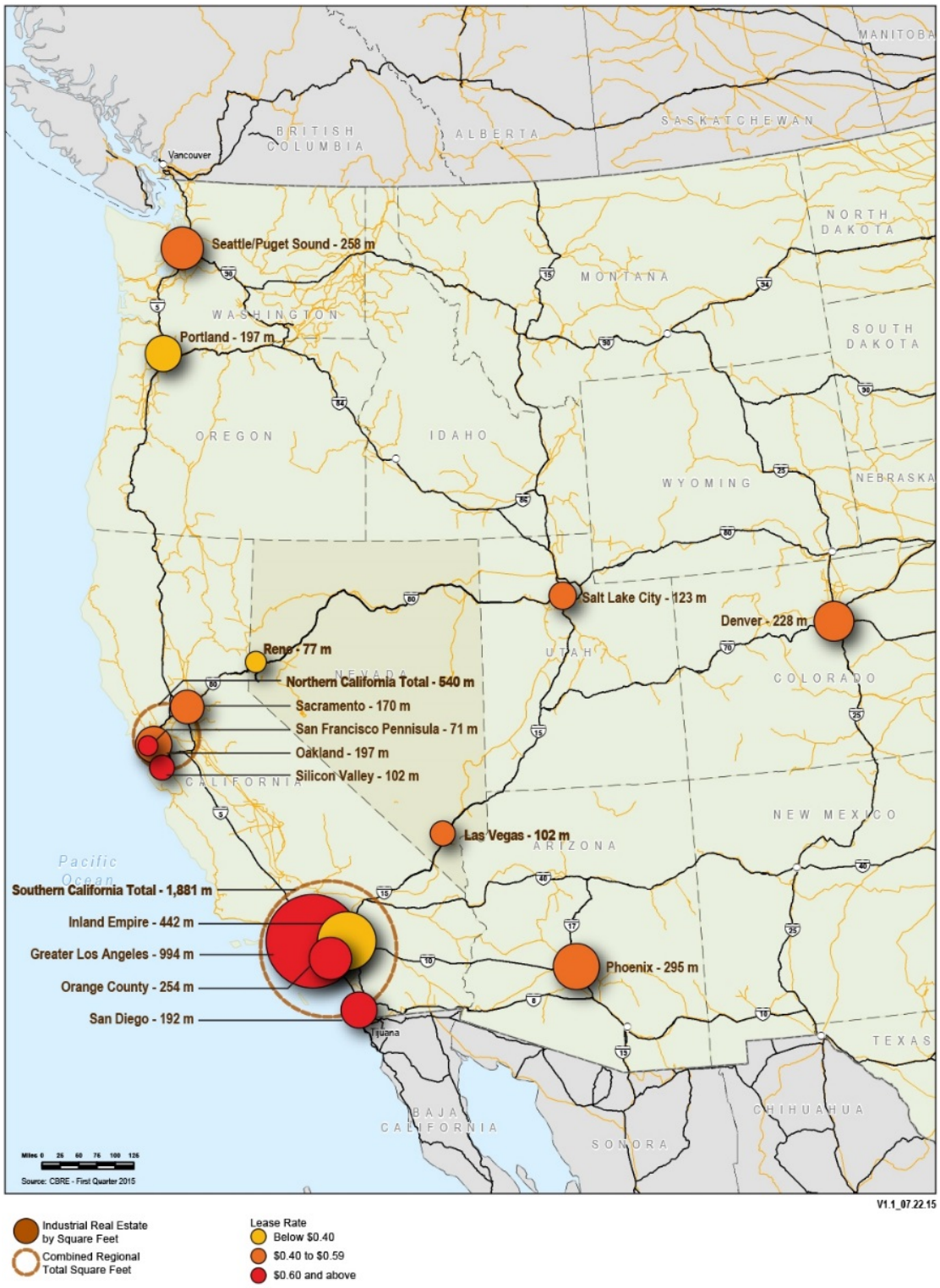


Figure 3-9. Industrial Real Estate Market Size in the Western United States

This map depicts the industrial real estate market size and lease rate in each of the western U.S. markets analyzed for this study: Las Vegas, Reno, Sacramento, San Francisco Peninsula, Oakland, Silicon Valley, Inland Empire, Greater Los Angeles, Orange County, San Diego, Seattle/Puget Sound, Portland, Salt Lake City, Phoenix, and Denver. It also shows the combined sizes of the Northern and Southern California markets, revealing the vast amount of industrial space in Southern California. The cost advantage that Reno has over markets in Northern California is clear, while Las Vegas and Phoenix are more expensive than the Inland Empire in Southern California (Source: MG&A, 2015 based on CBRE, Q1 2015 data).

Recent Developments Indicating Future Trends

Genting Resort Investment Indicating Continued Dominance of Tourism Industry

Southeast Asia's Genting Group is constructing a $4 billion gaming resort on the Las Vegas Strip (Stutz, 2014). This investment is similar in dollar amount to Tesla in Reno and will act to reinforce and grow the tourism economy and increase the import side of the freight logistics movements. Development will create several thousand short-term construction jobs in Las Vegas (Stutz, 2014) and produce long-term employment effects that will be concentrated in accommodations and food service.

Beyond the Rack Distribution Center in North Las Vegas

Since March 2012, North Las Vegas has been home to the West Coast Distribution Center of Beyond the Rack (BTR), one of the fastest growing e-commerce sites in North America. BTR is a private online shopping club for men and women seeking designer brand apparel, accessories, and home goods at up to 80 percent off. The factor that drove the decision to open a facility in this part of the country was to reduce shipping times to U.S. customers. The company originally considered locating its West Coast Distribution Center in Los Angeles, the source of many of the apparel items it sells, but upon closer examination, the executive team decided on southern Nevada. With its lower rents, larger work force, and greater support from state government leaders, Las Vegas was the smartest choice (LVGEA).

3.3.1.3 Eastern Nevada/Utah

Logistics Infrastructure Overview

Eastern Nevada is primarily a rural region with a mining, energy, and agricultural-based economy. The pattern of cities and towns grew up to serve the local economy and is generally located along the primary transportation corridors, I-80 and I-15, the major roads traversing the region, US 93, US 50, and US 6, and the resource extraction and agriculture communities. While the I-80 corridor is considered part of the San Francisco trade area, the more eastern section, including Elko and Wells, would appear to be equally oriented toward Utah and the Salt Lake City region. Due to the energy reserves in Utah, Eastern Nevada has opportunities to participate in the energy economy that originates in Utah. Unlike northern and southern Nevada, the eastern Nevada freight logistics infrastructure is not concentrated in a single location, but rather developed on a more site specific basis to serve the specific needs of the industry or combination of industries (mining, agriculture, or energy) that are located in that specific area. These improvements tend to be either capacity or performance enhancements rather than hub related strategies.

Economic Overview

The eastern Nevada economy is mainly focused on mining and subject to rather dramatic cycles based on the commodities market and the cycle of the general economy. Gold mining is especially significant, as 79 percent of all gold in the United Sates is mined in Nevada. Not surprisingly, it is Nevada's number one and most volatile value export, as export values fluctuate dramatically. Copper ores and concentrates export value follows a similar pattern, susceptible to major highs and lows in value from year to year.

Since the late 19th century, the boom-and-bust cycle in metals prices have had dramatic effects on population and economic activity. General economic cycles that affect the national economy also have significant impacts on the local economy due to the downturn in manufacturing and construction that reduces the demand for minerals and energy. Unlike northern and southern Nevada, the cities and towns in the eastern portion of the state tend to be smaller. Due to their size, they tend to be more industry-specific rather than diversified economic centers, making them more vulnerable to single industry trends. Economic diversification is also a major economic goal for this region as it is for the state as a whole and there are signs of diversity based on the value of its outbound production. For

example, mixed freight, pharmaceuticals, and electronics produce more than 25 percent of its $11.7 billion total (Freight Plan Existing Freight Flows Tech Memo, 2015).

Industrial Real Estate Overview

The eastern Nevada industrial market tends to be a single tenant market developed in response to the specific needs of the mining, energy, and agricultural sectors. Unlike northern and southern Nevada, there is not a significant multi-tenant market that results in speculative industrial construction. The major national real estate information services, including CBRE, the company used as the real estate data source for this report, do not track industrial real estate markets in eastern Nevada because they tend to serve only single tenant who builds on an as-needed basis to fulfill specific industry needs.

3.4 Employment and Earnings Analysis

The purpose of this chapter is to provide a deeper understanding of employment and personal earnings by two-digit NAICS codes, or industry sectors, in the San Francisco and Los Angeles MTAs. The analysis is intended to determine the industry focus and strengths of each MTA and the profile of northern and southern Nevada within them in order to define the potential impact that an improved freight system could have on each industry.

The economic geography of the western United States has little relationship to the political geography. Economic regions are defined as market areas with interactive economic activities and are not defined by political boundaries. Economic geography is defined MTAs, which are anchored by major urban areas that form the primary economic concentrations and transportation hubs of larger areas with many smaller cities and towns. MTAs are named according to their major urban areas or anchors. While Nevada is one state from political point of view, it is divided into three different regions from an economic point of view. Parts of Nevada are contained within three MTAs: San Francisco, Los Angeles, and Salt Lake City. The Salt Lake City MTA includes only one Nevada county, White Pine, located in eastern Nevada. Because this section is based on MSA data and as there are no MSAs in White Pine County, there is no ability to include comparison of eastern Nevada as defined within the economic geography.

The BEA was found to contain the most complete and geographically refined earnings and employment data that allows for comparison of economic activities by industry across the MTAs. All numbers outlined herein are directly from, or calculated from, BEA 2013 datasets (see Appendix 3B).

Of the 20 two-digit NAICS codes, eight are considered to be freight-dependent to different degrees; the remaining 12 are not considered freight-dependent because they use the freight system to a much lesser degree. The eight freight-dependent industries identified are: Agriculture, Forestry, Fishing and Hunting (11), Mining (21), Utilities (22), Construction (23), Manufacturing (31), Wholesale Trade (42), Transportation and Warehousing (48), and Accommodation and Food Services (72).

Companies classified under these industries depend on the freight system either to obtain raw materials from another region or to ship their final products to market. Produce from the Agriculture, Forestry, Fishing and Hunting, and Mining are bulk commodities; the companies in these industries depend on the freight transportation system to transport their goods to the next destination. Construction depends on the freight transportation system to obtain the raw materials needed for construction. Wholesale Trade depends on the freight transportation to coordinate and facilitate the movement of goods between manufacturers and distribution to retail outlets. In Accommodation and Food Services, the freight transportation system is especially important to the convention activity component as large scale

displays that are required to be delivered, set up, broken down, and removed in short amounts of time depend on efficient freight service.

3.4.1 The Economic Regions and Subareas

Despite Nevada being one state politically, it is divided into three different economic regions or MTAs within the national economy. Each MTA has a different type and structure of economic activity and contains multiple subareas, one of which is part of Nevada and others that are parts of an adjoining state or states. Each subarea has its own specific pattern and structure of economic activity. As a result, it is important to recognize the economic pattern and structure of the Nevada subareas in comparison to the other subareas within their MTAs as well as to the overall economy of their MTA. Understanding the uniqueness of economic activity within the MTAs and within each of Nevada's subareas provides the framework for understanding the type of infrastructure investments that have the greatest impact on growing Nevada's economy.

3.4.2 Employment Analysis

Basic Employment Characteristics

There are four basic employment characteristics that need to be understood as the foundation for infrastructure investments that can grow economic activity. The first is the share of employment and earnings that each of the Nevada subareas contain relative to the MTA in which they are located. The second and third are to understand the similarities and differences between the employment characteristics in northern and southern Nevada. The fourth is to compare the individual categories in the two subareas.

Nevada Subareas' Relative Shares of MTA Employment

Both the northern and southern Nevada subareas have a relatively small share of employment within their respective MTAs (Figure 3-10). The northern Nevada subarea holds only 4 percent of the employment within San Francisco MTA, while the southern Nevada subarea holds 8.3 percent of total employment within the Los Angeles MTA. Thus, the southern Nevada subarea contains more than double the share of employment within its MTA than northern Nevada.

Similarities and Differences in Nevada Subareas' Employment Profiles

The northern and southern Nevada subareas have many similarities in their employment characteristics among the 22-digit NAICS code categories and some notable exceptions. The top three employment categories in the northern Nevada subarea each contains over 10 percent of the region's total employment: Public Administration at 12.7 percent, Accommodation and Food Services at 11.7 percent, and Retail Trade at 10.4 percent. Six employment categories contain more than 5 percent: Health Care and Social Assistance, Professional, Scientific, and Technical Services, Administrative and Waste Management Services, Real Estate and Rental and Leasing, Manufacturing, and Finance and Insurance. The remaining 11 categories contain fewer than 5 percent of employment.

The top industries in the southern Nevada subarea are the same three as northern Nevada. However, in southern Nevada, Accommodation and Food Services account for nearly 22 percent, a much larger share than in northern Nevada where the industry ranks second at near half of the southern Nevada percentage. This reveals the high degree of specialization and lack of diversity within southern Nevada's economy. The other two of the top-three employment categories have relatively similar shares as northern Nevada with Retail Trade at 10.8 percent and Public Administration at 10 percent. Another five employment categories have over 5 percent of southern Nevada's total employment, while northern Nevada has six. However, these five are also over 5 percent in northern Nevada: Health Care and Social Assistance, Administrative and Waste Management Services, Real Estate and Rental and Leasing, Finance and Insurance and Professional, Scientific, and Technical Services. The missing category over 5 percent in southern Nevada is manufacturing, which has only 2.3 percent in the region, less than half of that found in northern Nevada.

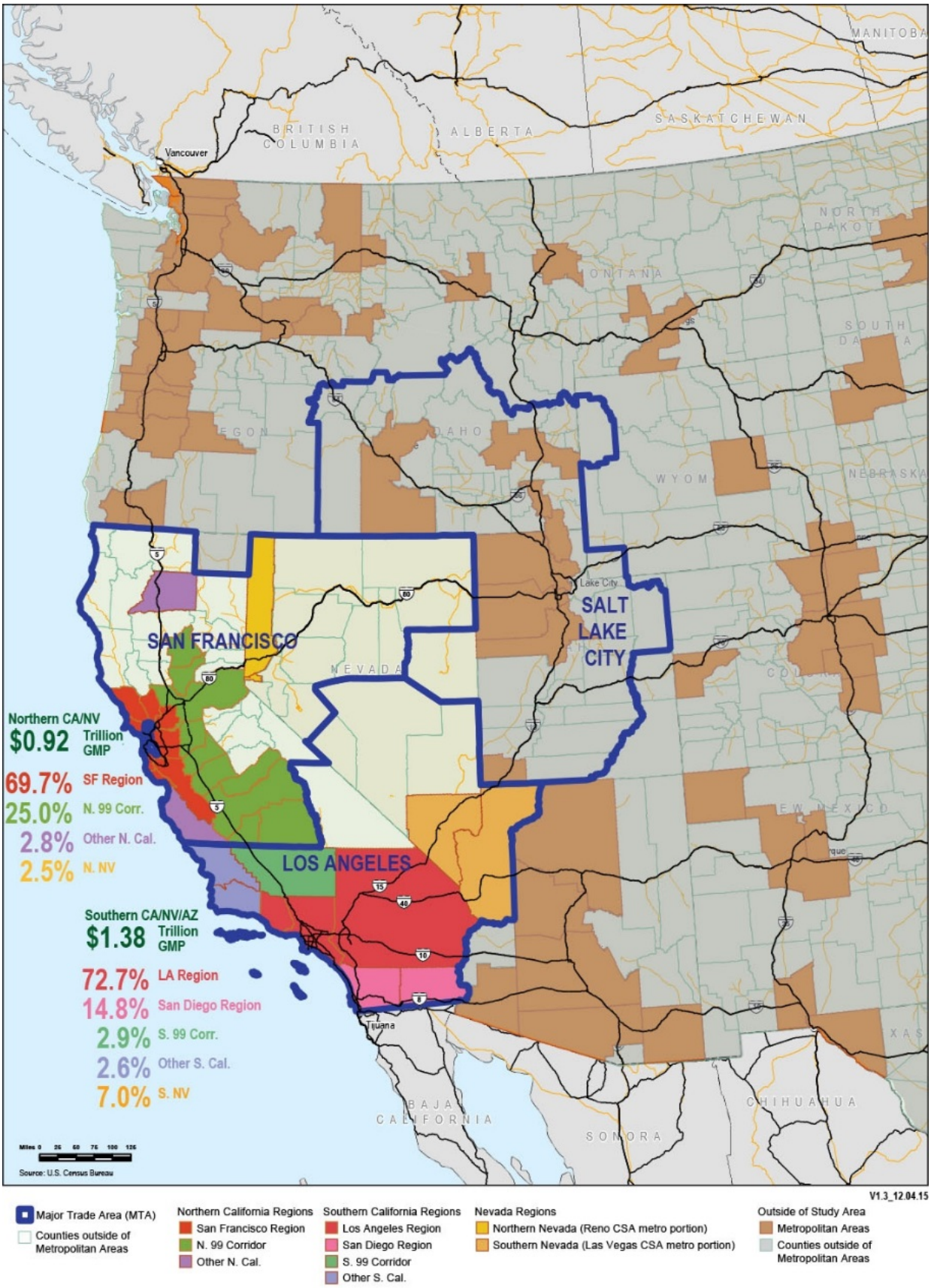


Figure 3-10. Major Trade Areas and Subareas

This map depicts outlines of Nevada's Major Trade areas and the MG&A-defined subareas with relative percentages of GMP.

Figure 3-10 caption continued:

The San Francisco MTA includes most of Northern California (one Northern California County is included in the Portland MTA) and all of northern Nevada. There are 13 BTAs within the San Francisco MTA, one of which contains all of northern Nevada and a portion of Northern California in the Lake Tahoe area. The San Francisco MTA was divided into four economic subareas by MG&A according to the interactions and geographic proximity of the basic trade areas. The four subareas are the San Francisco region, Northern 99 Corridor, Other Northern California peripheral, and northern Nevada.

The Los Angeles MTA contains seven Basic Trade Areas and includes all of Southern California, all of southern Nevada, and a county in northwest Arizona. All of southern Nevada and a portion of northwest Arizona comprise one BTA in the Los Angeles MTA. The Los Angeles MTA was divided into five subareas by MG&A: the Los Angeles region, San Diego region, Southern 99 Corridor, other Southern California peripheral, and southern Nevada (Source MG&A, 2015).

Thus, although northern and southern Nevada have very similar percentages in 18 of the 20 NAICS code categories; there are two important exceptions. Northern Nevada has more than double the percentage of employment in Manufacturing in comparison to southern Nevada. The southern Nevada subarea has nearly double the percentage of employment in Accommodation and Food Services in comparison to northern Nevada.

Comparison of Nevada Subareas' Employment Profiles

Comparing northern and southern Nevada subareas, northern Nevada has a higher percentage of employment in Agriculture, Forestry, Fishing and Hunting, Mining, Wholesale Trade, Transportation and Warehousing, and Public Administration, and a slightly higher percentage in Professional, Scientific, and Technical Services, Educational Services, Health Care and Social Assistance, and Arts, Entertainment, and Recreation.

Southern Nevada has a slightly higher percentage of employment in Information, Real Estate and Rental and Leasing and Administrative and Waste Management Services. Both the northern and southern Nevada subareas have nearly the same percentage of employment in Utilities, Construction, Retail Trade, Finance and Insurance, Management of Companies and Enterprises, and Other Services, Except Government.

As previously mentioned, the northern Nevada subarea doubles the percentage of employment in Manufacturing in comparison to the southern Nevada subarea, and southern Nevada doubles the percentage of employment in Accommodation and Food Services in comparison to northern Nevada.

3.4.3 Earnings Analysis

Nevada Subareas' Relative Shares of MTA Earnings

The northern and southern Nevada subareas have some similarities in their earnings characteristics, but their relationship to the MTAs they located in are very different. The average personal earnings in the northern and southern Nevada subareas are very similar, with a difference of only $569: $47,753 in northern Nevada and $48,322 in southern Nevada. However, because the average personal earnings are much higher in the San Francisco MTA than in the Los Angeles MTA, the Nevada comparisons to California differ greatly. The average personal earnings in northern Nevada are 30.9 percent lower than the San Francisco MTA average, while the average personal earnings in southern Nevada are only 15.7 percent lower than the Los Angeles MTA average. Thus, the gap between Nevada subareas and their respective MTA is larger for northern Nevada than for southern Nevada.

Similarities and Differences in Nevada Subareas' Earnings Profiles

In the northern Nevada subarea, the highest average personal earnings are in Utilities at $131,282, Management of Companies and Enterprises at $96,772, and Public Administration at $77,227. In the

southern Nevada subarea, the same three two-digit NAICS categories have the highest average personal earnings in the same ranking order but with different values: Utilities at $135,677, Management of Companies and Enterprises at $122,349, and Public Administration at $79,558. Thus, the average personal earnings of each of these categories are higher in southern than in northern Nevada.

Aside from these top three industries, average personal earnings in northern Nevada are 20 percent or more higher than the overall northern Nevada average in the following two-digit NAICS code categories: Wholesale Trade at $72,875, Manufacturing at $64,206, Mining at $58,790, Health Care and Social Assistance at $58,509, Construction at $57,330, and Professional, Scientific, and Technical Services at $57,201.

Aside from these top three industries, average personal earnings in southern Nevada are 20 percent or more higher than the overall southern Nevada average in the following industries: Wholesale Trade at $71,820, Professional, Scientific, and Technical Services at $68,150, Health Care and Social Assistance at $57,540, Construction at $65,581, Manufacturing at $61,853, and Information at $58,555.

These relatively high earning industry categories are similar in both northern and southern Nevada, except for in Mining and Information. Earnings in Mining are nearly 50 percent lower than overall average earnings in southern Nevada, while they are 23 percent higher in northern Nevada. Earnings in Information are more than 20 percent higher than the overall average in southern Nevada, while they are only 10 percent higher in northern Nevada.

Comparison of Nevada Subareas' Earnings Profiles

Comparing northern and southern Nevada, the northern Nevada subarea has higher (15 percent or more) average personal earnings than the southern Nevada subarea in Mining by 136 percent, Agriculture, Forestry, Fishing and Hunting by 52 percent, and Finance and Insurance by 19 percent. The southern Nevada subarea has higher (15 percent or more) average personal earnings than the northern Nevada subarea in Arts, Entertainment, and Recreation by 62 percent, Accommodation and Food Services by 40 percent, Management of Companies and Enterprises by 26 percent, Professional, Scientific, and Technical Services by 19 percent, and Real Estate and Rental and Leasing by 19 percent.

3.4.4 Freight Dependencies

Nevada has a high degree of economic dependency on freight-dependent industries as shown by the fact that both the northern Nevada and southern Nevada subareas have a high percentage of employment in freight-dependent industries then their MTA total percentages. Northern Nevada subarea has 32 percent of its employment and 33.2 percent of its personal earnings in freight-dependent industries. Southern Nevada subarea has 35.4 percent of its employment and 36.6 percent of its personal earnings in freight-dependent industries. Thus, the state has a high economic dependency on freight-dependent industries.

Employment to Earnings Relationships in Nevada

In contrast to the high percentage of employment in freight-dependent industries, average personal earnings in freight-dependent industries are low in northern and southern Nevada. Average personal earnings in freight-dependent industry categories are $49,355 in the northern Nevada subarea and $50,080 in the southern Nevada subarea. The gap between northern Nevada and the San Francisco MTA is much larger than that between southern Nevada and the Los Angeles MTA, at 30.1 and 14.1 percent lower, respectively.

Nevada's High Degree of Dependency

Both northern and southern Nevada have a high dependency on freight-dependent industries. As a result, an improved freight system with better connectivity between these two subareas and the dominant economy within their respective MTAs could be extremely beneficial for both northern and

southern Nevada. These two subareas can and should become more integrated parts of their respective MTAs in order to capture a larger share of economies and develop a competitive advantage in the global and western U.S. marketplace.

3.4.5 Nevada's Shares of Respective MTAs

The northern Nevada subarea is located in the same MTA as the San Francisco region, a well-developed and affluent subarea and a world leader in Technology. The San Francisco MTA, compared to Los Angeles MTA, is also leading in personal earnings. However, northern Nevada has a small share of the total economy of San Francisco MTA. In contrast, Los Angeles is a large employment region although not as affluent as San Francisco MTA, the southern Nevada subarea takes a larger share of the total economy of the Los Angeles MTA. It also indicates that the northern Nevada subarea has huge potential to grow and diversify to become a more competitive economic region if it can capture a larger share of employment and earnings within the San Francisco MTA.

3.5 Multimodal Freight Transportation Drivers, Critical Issues, Trends, and Implications for Nevada

3.5.1 A Changing Economic Order

End of Bi-Polar Political Divisions and Emergence of Trading Blocs

The emergence of a global economy after 1991 erased the division in the world's economy that resulted in a massive restructuring of the global trading network (Figure 3-11). Routes, hubs, industry, and businesses of all types began a process of rapid change that had powerful effects on established locations, routes, and businesses. These sweeping and dramatic changes are still in progress with industry consolidations, new capital investments in both established and new locations, and a shifting unstable world economy.

The massive restructuring led to a pattern of increased trade among nations; a dynamic pattern rooted in economic, geographic and/or cultural affinities. The creation of the European Union and the commercial rise of China and other nations in East and Southeast Asia are signs of ongoing changes in global economic relations. This restructuring is abetted by the lowering of tariff barriers and introduction of infrastructure and technology improvements that have linked production in low-cost labor markets with demand in developed economies. Population growth and increasing wealth in formerly underdeveloped countries has expanded both domestic and global commercial opportunities throughout much of the world. The West Coast has only three major points of entry, while the East and Gulf Coasts have many. The rise of Asia has made the West Coast the primary point of access to Asian economies. This has fueled the growth of trade flows through the West Coast seaports, with the dominant location being Los Angeles.

International commerce is evolving into patterns of regional and continental trading blocs, such as the European Union (EU), NAFTA, and Association of Southeast Asian Nations (ASEAN). Economic downturns among any one major trading partner can impact the prosperity of others well beyond their borders. Moreover, unstable political conditions create ongoing threats to global supply chains. These and other factors, such as advances in technology and demographic changes, are feeding greater inter-bloc trade.

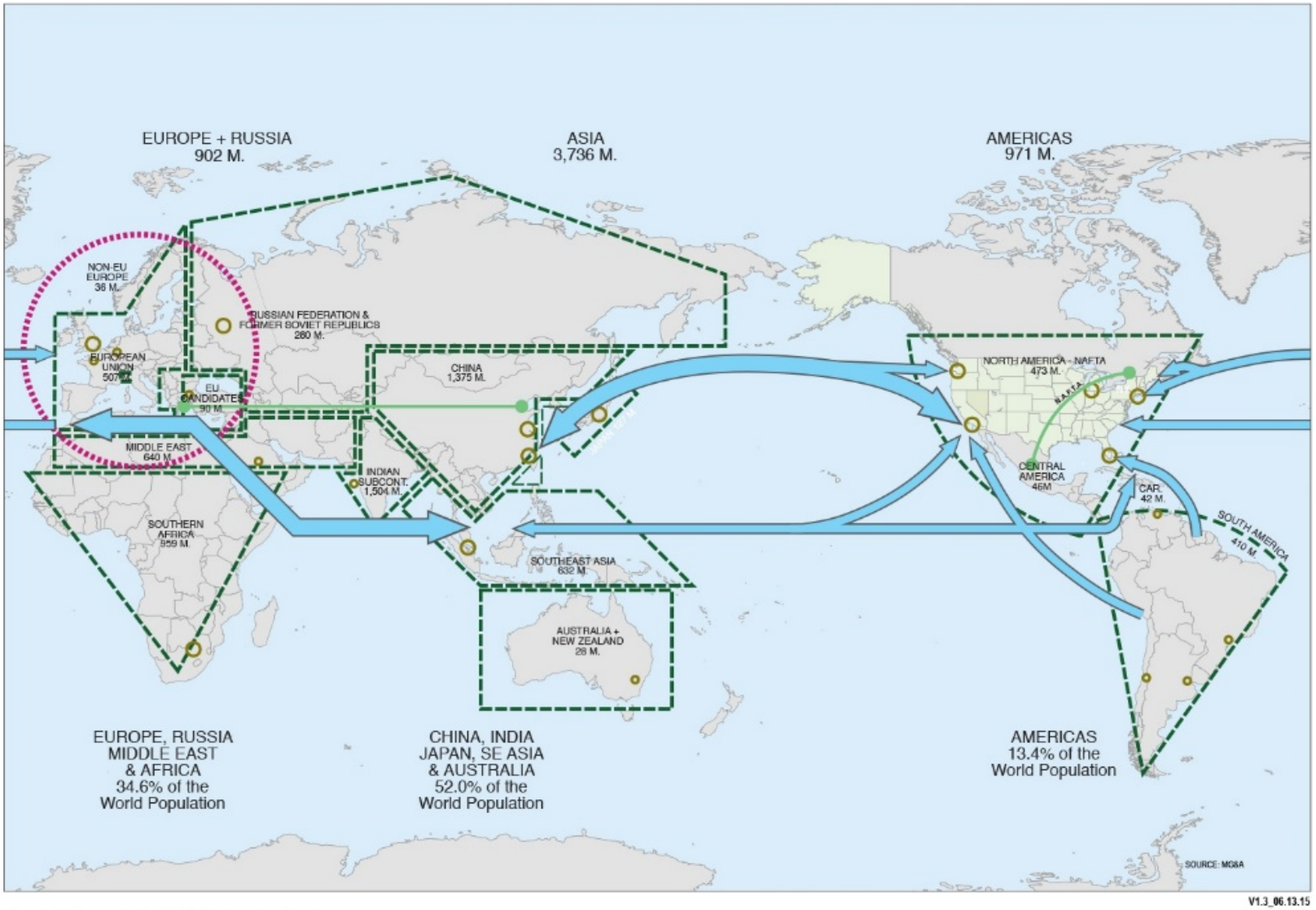


Figure 3-11. Global Trading Blocs

The emergence of large nations with populations over 1 billion, China and India, have provided them with the competitive advantage of economies of scale. This resulted in the need for smaller nations in Europe and North America to develop into trading blocs that compete more effectively in the integrated global marketplace. Massive investments in infrastructure provide greater reliability and cost effectiveness to move people and products to market (Source: MG&A, 2015).

Advent of Urban Mega-Regions

The Regional Plan Association (RPA) and Brookings Institute note that U.S. demographic growth and shifts are resulting in mega-regional economic relationships where urbanized areas increasingly converge into larger networks. These metro-centric networks result in inter-urban trade flows as the foundation of the domestic economy and international trade. It is forecast that by 2050, 75 percent of the nation's inhabitants will live in 10 mega-regions (or megapolitan clusters) and 80 percent of the nation's population growth will occur there (FRA, 2010). Many goods consumed by these densely populated areas will be supplied by surrounding rural regions and ports. Traffic congestion, lost productivity, and their effects will diminish quality of life in and around the mega-regions.

Two mega-regions are especially germane to Nevada's freight plan: Northern California and Southern California. (Figure 3-12) The Sierra Pacific mega-region's principal cities include Oakland, Reno, Sacramento, San Jose, and San Francisco (RPA, 2005). The megapolitan areas in the greater southwestern United States—Southern California, Las Vegas, and the Sun Corridor—have expanded and are interlinked, forming the Southwest Triangle. The Sierra Pacific mega-region accounted for 5 percent of the U.S. 2005 Gross Domestic Product, and the Southern California and Las Vegas mega-regions accounted for 7 percent (America 2050, 2015).

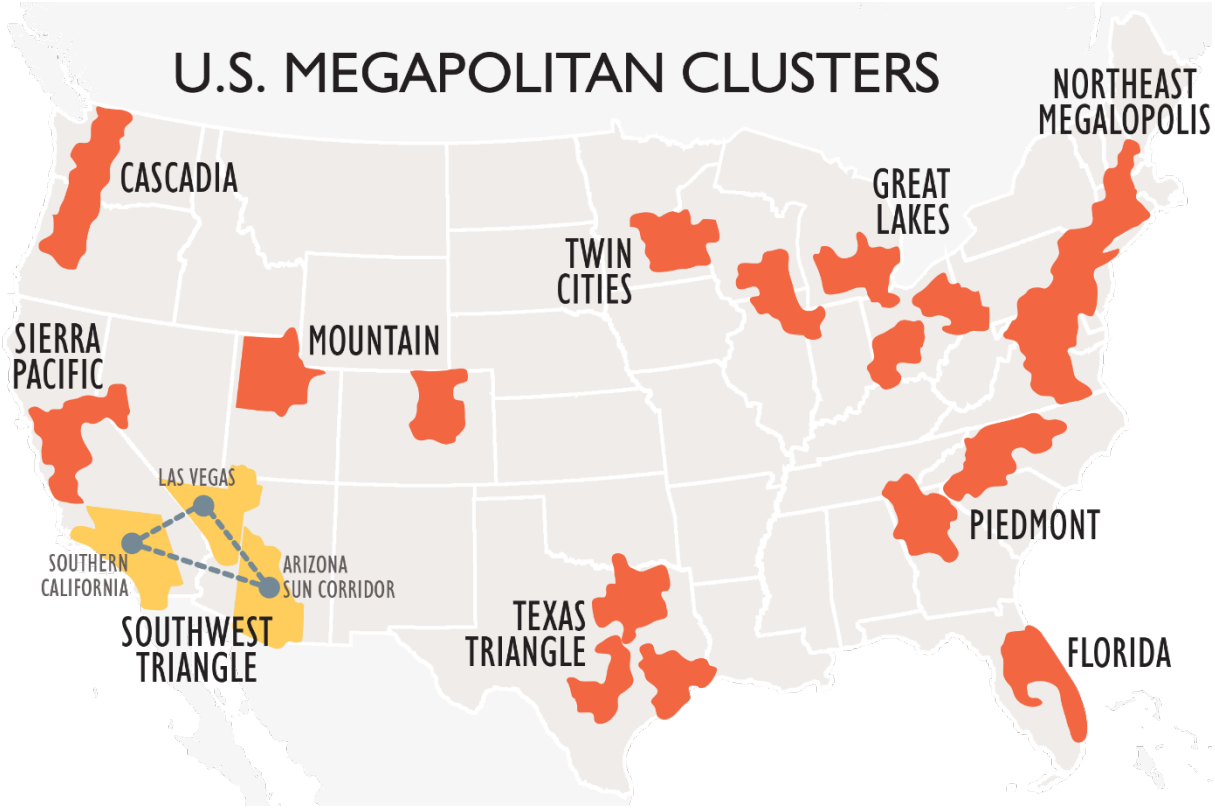


Figure 3-12. U.S. Megapolitan Clusters
Image Source: Metropolitan Research Center, University of Utah, Brookings Mountain West, 2010.

Economic Implications for Nevada

The macro scale economic trends noted above are setting the framework for Nevada's participation in commerce on a global, national, regional, and local scale. This structure is geared toward increasing trade among nations and regions and requires strong multimodal links at key urban hubs for full state participation. The breadth and quality of Nevada's multimodal and intermodal freight network is and will continue to be a major determinant in the state's ability to trade and receive goods.

Nevada's current truck, rail, and air links demonstrate both strengths and weaknesses. Strengths include strong west-to-east highway connectivity, particularly to California as its dominant trading partner and gateway to overseas trade. Weaknesses include a lack of strong north-south connections and connectivity to intermodal rail services. Nevada lacks direct north-south highway and rail systems to efficiently move goods to its U.S., Mexican, and Canadian neighbors. Nevada gets little relief from its railroad services as freight trains mostly pass through the state. The state needs stronger intermodal rail connections to relieve highway congestion, especially for trade with California. Nevada needs to develop an outbound traffic base and requisite intermodal terminal facilities to create point-to-point shuttle services from rail yards at or near California port facilities. This would ensure economic-scale match-ups within a logistics supply chain that includes huge ocean carriers and large intermodal rail transfers emanating from the ports. Nevada's airports have the capacity to expand freight services to international markets if their direct air passenger service to those markets continues to grow.

Congestion outside the state border is limiting the efficiency of the highway system. Nevada is below the national average in its manufacturing output and participation in overseas and NAFTA trade. A major part of the remedy may rest with the success of the state's current efforts to diversify its economy; creating more output through manufacturing and distribution services and simultaneously improving multimodal and intermodal links. If Nevada is to have an attractive and balanced transportation system, it needs to produce more goods for export to other states and nations. Future success enjoyed by Nevada will have much to do with its relationship to the large California economy. With an increased output of goods or performance of value-added distribution functions, the freight system will become more balanced to Nevada's advantage.

3.5.2 A Changing Logistics Order

The global network is defined by a series of hubs and corridors. The hubs are points where the air, water, rail, and road freight handling facilities, such as ports, terminals, and yards, are found together with the ancillary services and massive industrial real estate that serves these points. Air and sea routes, major highways, and rail lines define corridors. Within the global network, there is a hierarchy of hubs and corridors from the largest global gateways connected to the largest freight corridors to the smallest rural towns connected to small rural highways. Two of the nation's major corridors traverse Nevada, but its hubs are only local service points. Being on a major corridor does not necessarily mean that a city is a major hub. Major hubs are defined by: their level of connectivity to major corridors, the market area they serve, and the value added functions they perform.

Freight Hubs: Global, Inland Port, and Local

Every city and town connected to the global transportation network is a hub in the network. There are three tiers of freight hubs: global, inland port, and local. Global hubs, the largest of the three tiers, are where international goods arrive by air and sea and where goods produced within the country are exported. Inland Ports, the second tier, are defined as those hubs within a nation that perform internal distribution or transloading functions (Figure 3-13). Local hubs, the third tier, only provide services for the communities where they are located.

All three tiers of hubs serve local distribution functions. In other words, every city and metro performs local distribution and consolidation functions, as each consumes and produces products and must have the facilities necessary to serve its local market.

Although not every city or metro region is an inland port or global hub, every inland port and global hub is also a local hub. Therefore, in addition to the infrastructure needed to serve the local market, the global hubs and inland ports have developed infrastructure to serve the transshipment or global shipping functions. This may take the form of expanding the existing rail, truck, air, or seaport facilities or adding other facilities that provide the services needed to handle larger volumes of freight. Global

hubs and Inland ports serve as junction points where freight bound for destinations other than the local metro area is transferred either within a mode or between modes.

Local hubs, such as Las Vegas and Reno-Sparks-Carson City, are considered O&D points of freight serving local demand created by its population, institutions, businesses, and industries. While the freight infrastructure in local hubs must serve the needs of that area, the only goods arriving and departing are those destined for that location or produced at that location. With the global population and economic growth, more freight is moving through expanding global networks. Some metropolitan areas are realizing the opportunity to grow their freight functions; taking the initiative to expand, add, or modify key components to their freight infrastructure in order to provide additional value-added services. Typically, these additions are inland port functions whereby they can attract a more diversified freight stream.

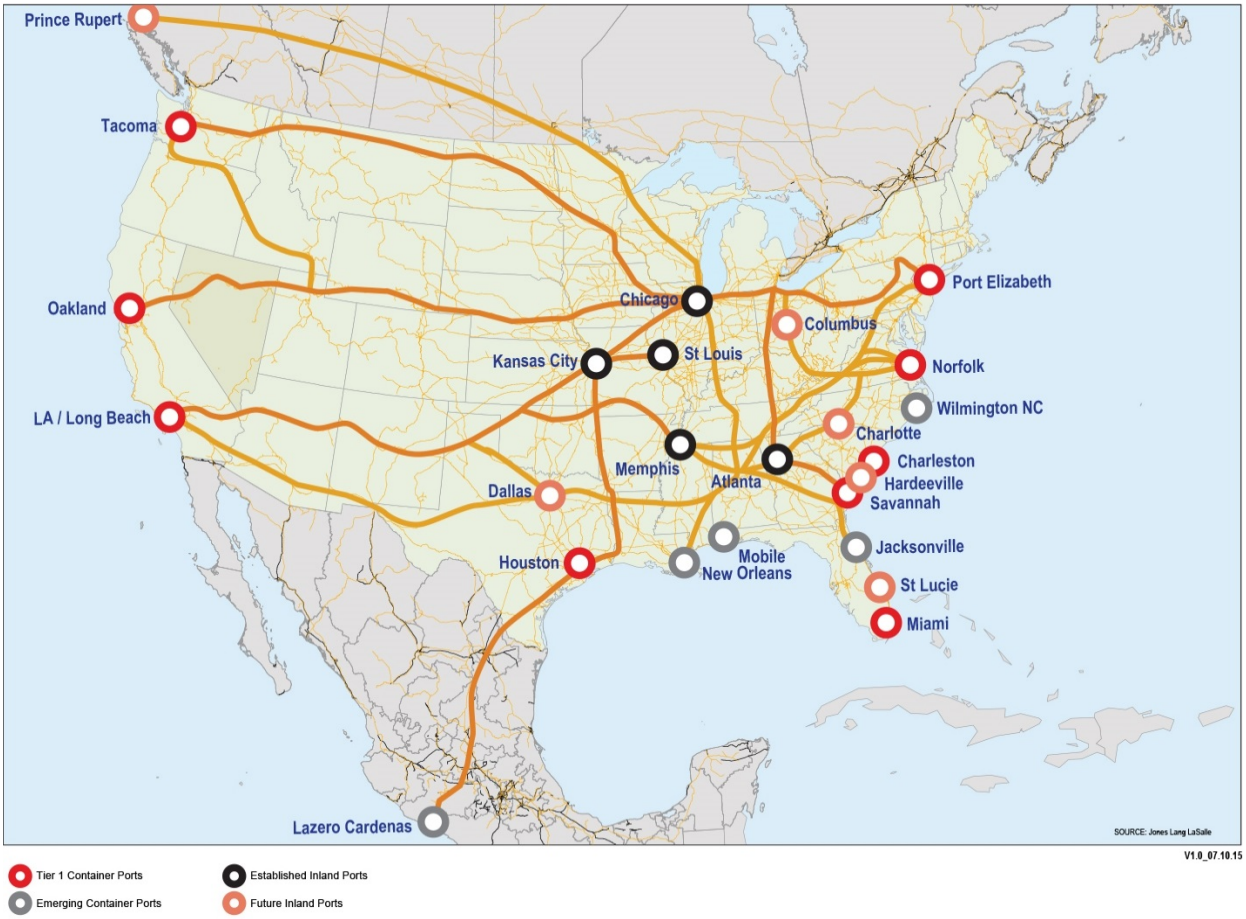


Figure 3-13. Inland Port Connections

This is a re-creation of national developer Jones Long LaSalle's 2011 Midwest and Eastern Centric view of inland port connections. It highlights the numerous container, emerging container, established, and future inland ports in the eastern United States, while in the western United states, there are only the West Coast tier 1 ports and corridors for movement eastward. Salt Lake City is shown as an intersection, but not a hub (Source: MG&A, 2015 recreated from Jones Long LaSalle, 2011).

Nearshoring and Reshoring

The return of production to the United states or to those countries near our borders is growing. The concept of moving operations back to its country of origin is referred to as "reshoring," while relocating manufacturing to a nearby country rather than far overseas is known as "nearshoring" (see Figure 3-14). A 2013 Boston Consulting Group survey found that 54 percent of executives at U.S. companies with sales in excess of $1 billion are planning to return production to the United States, a sharp increase from

the 37 percent who said they were considering reshoring just 1 year earlier (Purolator International, 2015). This movement is primarily away from Asian production towards returning at least some of their manufacturing to North America recognizes that Asia is no longer the low-cost option it once was and that keeping manufacturing closer to home makes good logistical and financial sense.

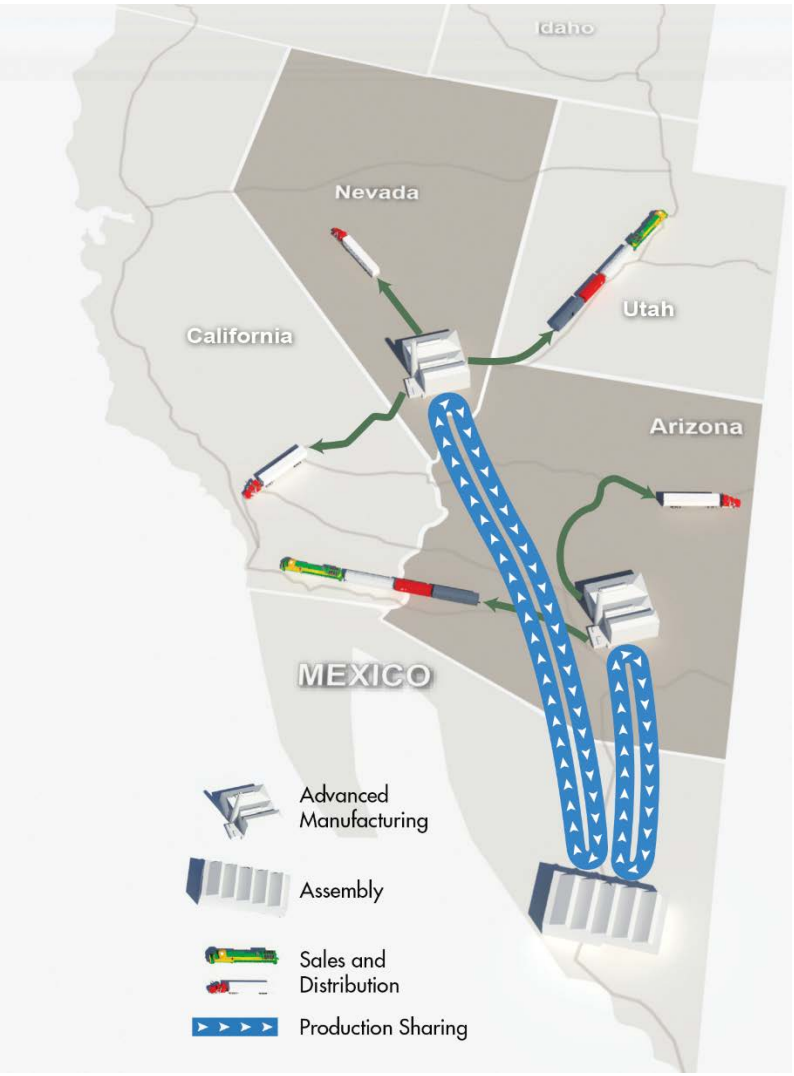


Figure 3-14. Nearshoring Conceptual Illustration
Image Source: NDOT, I-11 and Intermountain West Corridor Concept Report, 2014.

The partial reshoring of manufacturing may create opportunities to increase Nevada's industrial base as a cost-efficient business location offering lower-cost land, labor, and efficient permitting processes, especially within the Northern California market. For Nevada to maximize opportunities associated with nearshoring shifts to Mexico or Canada may require the development of a north-south intercontinental route through a proposed I-11 highway and rail corridor extending from Mexico to Canada.

Carrier Industry Consolidation and Collaboration

A major ongoing trend affecting carriers across the modes and freight forwarders or 3PL is the pursuit of growth and market dominance. This trend manifests itself in the form of alliances among former competitors (e.g., ocean carriers) and mergers and acquisitions (M&A) among motor carriers and freight forwarders. The hope is that shared use of common assets such as oceangoing vessels in trucking equipment by motor carriers will increase productivity and efficiency. For motor carriers, M&A are a means to gain entry into new markets and have access to equipment and drivers that would otherwise be in short supply. Non-asset service providers look for synergistic service match-ups, for example, between companies efficient at filling empty backhauls with firms that have large customer bases. Ports including Los Angeles and Long Beach, and Seattle and Tacoma sought and received Federal Maritime Commission permission to work cooperatively to increase operational productivity at their contiguous terminals.

Freight carriers and forwarders are increasingly consolidating their operations to apply assets more efficiently and increase their bottom line and their transparency in relation to shippers. The public sector, as represented by the ports, is looking to establish more cooperative rather than competitive relationships. State and local governments can also foster initiatives for closer cooperation in planning and financing through their MPOs and public-private partnerships (P3's) as showcased in the Tesla deal. Nevada's leadership in building a Western States Freight Coalition (WSFC) among the Freight Program Leads at respective DOTs is a positive step in this direction. Nevertheless, states have to be alert to the negative possibilities of mergers among large freight companies that may harm small shippers, increasing the prospects that the state may lose essential services.

Regulatory Change

Transportation systems and modes are among the nation's most heavily regulated industries. This is due to their important role in the economy and major impact on safety and the environment. There is an ongoing debate regarding the cost-effectiveness of regulations in achieving their intended goals. During the 1980s, there was a major shift in national transportation policy away from expensive economic regulation of aviation, railroading, and motor carriage, a shift that has had profound effects on the structure and economic health of these industries. Most economists agree that the major relaxation of economic regulation has produced positive consumer benefits and was an important factor in the railroads' return to general economic health.

Safety is always a paramount goal of carriers and the public sector responsible for much of the nation's transportation infrastructure and vehicular regulations. Likewise, rules mandating improvements in vehicle miles per gallon and emission reductions are generally credited with positive energy use and environmental results. Nevertheless, controversy continues over the cost of the technological improvements required to advance environmental and safety goals and their economic impacts on the modes. These controversies constitute a major part of the political dialogue between the railroads (e.g., Positive Train Control implementation, competitive trackage access) and the motor carrier industry (e.g., driver hours of service, permissible truck sizes and weight) with federal agencies and Congress. Conflicts occasionally develop among governmental agencies over whether state and local regulations targeted to local conditions are constitutionally permissible given Commerce Clause restrictions prohibiting restraints on interstate trade.

Like all other states, Nevada is challenged to use its regulatory authority prudently and effectively where matters of safety, security, and the environment are involved. Greater economic freedom tends to support the growth of free enterprise. Nevertheless, the state must use its public interest powers to

ensure that M&A subject to regulatory review serve the state's best interest. Environmental, safety, security, and economic regulations are important to the general welfare of Nevada's citizenry. State policies in these areas are colored with a heavy federal interest and do not stop at state borders, as evidenced by the impacts of California's clean air rules on the types of trucking and rail equipment used nationwide. As a state where the development of both drones and driverless trucks is underway, Nevada has an opportunity to work with the federal government to provide effective rules for safe operation. Moreover, key regulations are often best advanced when done in concert with neighboring states and localities. Projects such as site selection for truck stops and the regulation of heavy and oversized tractor-trailers are well advanced through interstate compacts and cooperative multistate initiatives.

Systems Capacity Constraints and Underinvestment

Systems capacity constraints have been well documented on a national and regional basis, indicating that critical elements of freight infrastructure are getting worse. In its 2013 report card for America's infrastructure, the American Society of Civil Engineers (ASCE) graded America's overall physical assets a "D+," with roads and aviation facilities receiving a "D" (ASCE, 2013). USDOT reports also indicate a worsening pattern of congestion along vital highway links, particularly between the country's largest metropolitan areas, with projections based on growths in population and related economic activity that suggest an even more constrained future. Deficiencies in America's surface transportation system currently costs households and businesses nearly $130 billion, including approximately $97 billion in vehicle operating costs, $32 billion in travel time delays, $1.2 billion in safety costs, and $590 million in environmental costs (ASCE, 2013). If present trends continue, the annual costs imposed on the U.S. economy by deteriorating infrastructure will increase by 82 percent to $210 billion by 2020, and by 2040 the costs will have increased by 351 percent to $520 billion (ASCE, 2013). Cumulative costs could amount to $912 billion by 2020 and $2.9 trillion by 2040 (Ibid).

3.5.3 Demographic Change

Steady population and economic growth is taking place both within and beyond U.S. borders. The U.S. economy is expected to double in size over the next 30 years. By 2045, the nation's population is projected to increase to 389 million, compared to 321 million in 2015. Americans will increasingly live in congested urban and suburban areas, with fewer than 10 percent living in rural areas by 2040 (USDOT, 2015).

A 2010 FRA report estimated that that on average, Americans require the freight system to move 40 tons of freight per person annually; a figure that includes bulk commodities such as coal for power, grains for food, and high-value consumer goods (FRA, 2010). These demographic realities mean 2.8 billion more tons of freight in the next 25 years for 70 million more people, and 4 billion more tons of freight in the next 40 years to sustain an additional 100 million Americans (FRA, 2010). Worldwide population growth is even more dramatic, as demographers predicted that just nine overseas countries (India, China, Ethiopia, Nigeria, Pakistan, Congo, Indonesia, Bangladesh, and Brazil) would add over 390 million people between 2012 and 2020 (Vickerman, 2013).

Nevada's population is expected to grow by about 17.9 percent, or 0.8 percent annually, between 2013 and 2033. The growth rate in population of Nevada's major urban areas is expected to be higher than other counties. Additionally, the growth in population between 2013 and 2033 in Reno-Sparks-Carson City combined statistical area is about 25.6 percent, or 1.15 percent annually, without the Tesla plant and about 31.3 percent, or 1.37 percent, annually with it. Moreover, neighboring states are expected to grow much faster than Nevada, particularly Arizona and Utah (USDOT, 2015). This will create new market opportunities for the freight industry in Nevada, such as becoming a manufacturing or value-added activity center for consumer goods or a Western hub for distribution of all types of goods.

Part of Nevada's long-term freight planning challenges will be to meet the demands of a growing, local, statewide, and regional population. Moreover, Nevada's economic growth will be increasingly dependent on its regional freight corridor connections and on reaching overseas markets. Improved connectivity to national and international multimodal, highway, and rail corridors, and aviation and port networks as well as increased local output is essential to accelerate Nevada's long-term economic growth.

3.5.4 Environmental Issues and Trends

Climate Change

Between 2013 and 2015, parts of America experienced their two worst winters in 30 years. Additionally, drought and severe weather in the West slowed goods movement and hindered the nation's economic recovery. Rail operators, intermodal drayage and trucking companies, airlines, and marine operators all faced service failures and bottlenecks due to highway washouts and extreme weather conditions. Climatologists are predicting the return of El Niño winds and torrential rains to the West Coast. In addition, predictions for the rise in sea level along the East Coast are challenging storm preparedness of major cities such as New York. Thus, climate change or major weather volatility has entered the consciousness of freight planners and can have significant impacts on supply chain planning. Nevada's response requires systems resiliency and emergency preparedness elements, including plans that outline transportation alternatives for the supply of critical goods when normal supply chains are disrupted as a result of extreme weather condition.

Source: NDOT, 2015.

New Efficient and Green Truck and Train Technology

Growing concern for climate change has affected public policy at the national and especially the state level, with California instituting some of the most restrictive emissions regulations in the United States. This has led to the need for cleaner and more efficient means of moving freight. The trucking and railroad industries have introduced new equipment to make their operations more energy efficient and environmentally sustainable. Trucking technologies in development aim to increase large truck gas mileage per gallon from six and less to nearly 10 miles per gallon with cleaner engines (DOE, 2014). The railroad industry has added energy efficient hybrid locomotives to their yards and fleets to reduce harmful pollutants.

The West Coast states, strongly led by California, are likely to be among the nations' first adapters for the use of low-to-zero-emissions technology to power motor vehicles, yard tractors, and locomotives. Since the passage of Assembly Bill (AB) 32, the California Global Warming Solutions Act of 2006, the state has established critical path plans to reduce greenhouse gas (GHG) emissions to 80 percent below 1990 levels by 2050 (Brown et.al., 2014). Moreover, in July 2015, Gov. Edmund G. Brown called on state leaders to develop a plan to transition to zero-emission technologies in the entire freight industry by July 2016 (Phillips, 2015). To achieve the vision of cutting GHG emissions, state plans call for a 50 percent reduction in petroleum use in vehicles by 2030, including heavy-duty commercial trucks (CARB, 2016). As a result, zero-emission EVs, including those used to haul containers from the ports are being tested by trucking firms at the Ports of Los Angeles and Long Beach with support from the South Coast Air Quality Management District (Lopez, 2016). Ultimately, these vehicles will serve customers throughout the Pacific Coast and their neighboring states.

Figure 3-15. Nevada's Electric Highway
NV Energy is working with GOED and NDOT to implement electric charging stations on US 95 between Reno and Las Vegas.

A necessary requirement for eventual use of these vehicles for both domestic and import-related drayage will be the establishment of strategically placed charging stations along major passenger and freight Highway corridors. This task is being advanced by an I-5 focused "West Coast Green Highway" partnership that includes the states of Washington, Oregon, and California, among others (West Coast Green Highway, 2014). Expanding this concept, the Nevada Electric Highway is an effort jointly initiated by NV Energy and the state of Nevada to electrify Nevada's highways between Las Vegas and Reno along US 95 (NV Energy, 2016) (Figure 3-15). It was first announced in June 2015, with NV Energy and the Governor's Office of Energy soliciting interest from business and government entities to host stations and support this infrastructure development in communities such as Fallon, Hawthorne, Tonopah, Beatty, and Indian Springs (NGOE, 2015). This initiative adds five EV charging stations to the 150 already installed around the state, but they are crucial because of their locations in connecting northern and southern Nevada (Hidalgo, 2015). Not only does this contribute to environmental sustainability, but it also furthers diversification of the economy in advancing the energy sector (Ibid).

Changes in Energy Supply and Demand: Fuel Cost, Availability, and Consumption

In the first decade of the new millennium, the price of oil and natural gas fluctuated sharply and the high cost of fuel had a negative effect on the bottom line of all modes. Fuel prices have stabilized over the last few years and long-term forecasts suggest that comparatively low energy costs will become the norm. This developing trend is mainly because of large U.S. petroleum and natural gas reserves made available through the application of fracking. The United States is making a transition from being a large importer of energy to a major exporter, even as the internal and international demand for coal is falling.

The cost and availability of fuel is very important in the transport sector. Heavy-duty trucks use one-fifth of the fuel consumed in the United States, and fuel is a major operating cost for both trucks (37 percent) and railroads (25 percent) (Goodwill, 2013; AAR, 2008; AAR, 2009). Coal has historically been the single most profitable bulk commodity for railroads, but it is being supplanted by natural gas in the creation of electricity for environmental and cost reasons. The fact that coal volumes are likely in permanent decline is troublesome for the railroads.

Governmental policies aimed at reducing fuel use and mitigating environmentally harmful elements of fossil fuels by technological and operational refinements will continue. Nevada is a national leader in terms of the amount of energy it derives from zero-emission solar and wind power. Nevertheless, the world's freight transportation requirements are expected to consume 70 percent more energy in 2040 than they did in 2010 (Goodwill, 2013).

The cost and availability of fuel is a major concern to both the freight community and the general public in Nevada and elsewhere. When fuel prices are low, as they are currently, the operating costs for carriers decline and the spending power of the general public increases. Lower energy costs lead to higher personal consumption rates, more goods being transported, and carrier operations becoming more profitable. Because Nevada is a truck-reliant state, a combination of plentiful supply and lower fossil fuel costs are positive developments. Over the long term, clean air and climate change concerns will require a greater commitment to alternative energy sources and the development of a service network the make their use possible for motorists as commercial carriers.

3.5.5 The Effects of Technology on Freight and Economic Systems

Autonomous Vehicles

In describing the major events impacting the trucking industry in 2015, the American Trucking Associations' news journal noted "history was made through the continued expansion in rapid maturity of technology" (Transport Topics, 2015). The summary highlighted the debut of Mercedes-Benz's Daimler autonomous driving Inspiration truck at the Hoover Dam in early May 2015 (Figure 3-16), as well as progress made by other companies. Techniques such as platooning and automatic braking seem closer to reality than to science fiction compared just 1 year prior (Ibid). In fact, Nevada is a demonstration state for truck platooning, helping to further efforts to reduce fuel consumption (TT, 2014).

Figure 3-16. Daimler's Driverless Truck Being Tested in Nevada
(Source: Daimler AG).

Transport Topics, other technology and trade publications, and the popular press are stating that the phased introduction of driverless vehicles for passengers and freight is now a question of when, rather than if (Roberts, 2015). The National Traffic Safety Administration (NHTSA) has developed a classification system which uses four levels to define automation in motor vehicles; these levels reflect the degree that technology will assist vehicle operations (NHTSA, 2013). Major tipping points towards autonomous operations will occur at Level 3 where significant self-driving is possible with in-cab driver assistance on to Level 4 where full self-driving automation is achieved (NHTSA, 2013).

As the May 2015 Mercedes-Benz Daimler test in Nevada and a subsequent on-the-road demonstration use in Germany indicates, commercial over-the-road vehicles, under test conditions, can meet NHTSA's Level 3 criteria where:

> "Automation enables the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time" (NHTSA, 2013).

At Level 3 autonomy, automobiles or trucks are anticipated to provide numerous advantages in terms of safety, convenience, mobility, and environmental protection over vehicles requiring full engagement. By freeing up a driver for other in-route tasks, these vehicles will also increase productivity. The enhanced awareness and reaction capabilities of these vehicles eventually should result in thousands of saved lives

and other injuries and inconveniences as a result of avoided vehicle crashes. Intelligently coordinating the movements of driverless vehicles should mitigate or eliminate traffic congestion, air pollution, and human frustrations linked to everyday driving (Glacy et al., 2015).

There are several reasons specific to commercial trucking that make the eventual introduction of driverless vehicles a likely outcome. It provides a solution to industry driver shortage concerns. Even as the technology is phased in, it will make the driver more productive. With semi-autonomous operations, drivers can become the equivalent of "captains of their ship," monitoring operations and communicating across the supply chain to ensure seamless connectivity as well as perform additional tasks in route. Importantly, these vehicles would relieve much of the driver fatigue involved in truck operations and likely allow for the extension of driver hours of service to increase the range and efficiency of truck services. Truck platooning, where one driver is controlling the operations of two or more trucks in convoy, would create additional efficiencies (Roberts, 2015).

However, there are major practical limitations to the rapid introduction of such vehicles, including high additional capital costs and major changes in truck O&M that will slow down their introduction. Perhaps, the greatest challenges will come from the necessity to establish new federal, state, and local safety standards, as well as a new commercial law framework to govern the operation of these vehicles in a mixed driver and driverless environment. As of 2015, only Nevada, California, Florida, Michigan, and the District of Columbia have enacted legislation authorizing the testing of driverless vehicles. The federal government remains in a research mode (Glacy et al., 2015).

Nevada is a leader in the industry and became the first state to grant a license for an autonomous commercial truck to operate on an open public highway (Daimler, 2015). The Nevada Legislature and Department of Motor Vehicles enacted legislation in 2011 and 2013 regulating the testing and operation of autonomous vehicles in the state: 2011 Legislature Assembly Bill 511, 2013 Legislature Senate Bill 313, Nevada Revised Statutes Chapter 482A – Autonomous Vehicles, and Nevada Administrative Code Chapter 482A – Autonomous Vehicles (DMV, 2016).

Taking a leadership role in implementing favorable policies regarding this innovative technology puts Nevada ahead of the curve and gives the state a competitive edge, while helping to facilitate the trajectory of these technologies on a national scale. Daimler's experimentation in Nevada is the "beginning of a new era of automation" (Dorrier, 2015). Gov. Sandoval has further announced that by the beginning of February 2016, a center for autonomous vehicles will be created within GOED (Velotta, 2016).

Aviation Drones

Drones or unmanned aerial vehicles (UAVs) have been the subjects of much discussion over the last several years as either instruments of war or as a tool for professional and hobbyist video photography. However, companies like Amazon, Sony, and Matternet are busy at work with prototype models that would use drones to facilitate e-commerce delivery (Woods, 2015). Like autonomous ground surface vehicles, drone manufacturers have demonstrated that the technology is well on its way to practicable development. Both real and potential air cargo uses include the delivery of medicine and other key supplies to rural areas, providing parts and supplies to oil rigs, and moving inventory across large warehouse complexes (Ball, 2015). Matternet, which recently established development agreements with Swiss Post and Swiss World Cargo, has a bold vision in mind to establish a service network to serve the 1 billion people that have no access to all-season roads and to provide air deliveries that would relieve congestion on urban highway networks (Air Cargo World, 2014).

Nevertheless, there are significant challenges to realizing U.S. drone cargo systems in the near term, including reliability, safety, and airspace management concerns (Ibid).

The FAA, which regulates air safety, is in the early stages of developing rules for the use of both commercial non-commercial UAVs. The agency is proceeding cautiously in light of rapidly proliferating incidents where unmanned vehicles fly too close to traditional aircrafts. For example, there were 780 such incidents reported in 2015 through the first week of August, as compared to 238 for all of 2014 (FAA, 2015).

In December 2015, the FAA issued rules asserting the primacy of a federal framework, and governing matters such as permissible hours of flight, line-of-sight observation, altitude, operator certification, optional use of visual observers, aircraft registration and marking, and operational limits (FAA, 2015) The FAA has established a specific set of rules for the use of UAVs for business purposes that include:

- Special airworthiness certificates for research and development;
- An airworthiness certificate in a restricted category and for special purposes; and
- A petition for exemption that allows the performance of commercial operations in low-risk controlled environments (FAA, 2015).

These user rules, and the development of regulatory coordination with states and localities, can be expected to slow the development of commercial cargo uses (e.g., Amazon Prime drones). Moreover, the commercial motivation for the development of these systems is not as great as it is for autonomous surface vehicles. Meanwhile, research and development on UAVs concerning their safe integration into the nation's airspace is taking place at six research centers, including one within Nevada (FAA, 2013).

High-Tech Ultra-Large Ships

Perhaps the best example of "economies of scale" advances in freight transportation technology is the widespread construction and continued addition of post Panamax or Chinamax megaships to the world's fleet inventory. The size of ocean-going container ships accessing world ports has expanded more than three times from approximately 5,300 TEUs to over 18,600 TEUs in the last 10 years (Mongelluzzo, 2015). When the Panama Canal expansion was planned, it was designed to handle up to 13,000-TEU megaships (up from its current 5,000-TEU limits). Ships are now being introduced that are beyond this size and design limit at over 21,000 TEUs. These huge vessels will operate primarily in the Asia-to-Europe trade as well as between East Asia and the U.S. West, and to the East Coast via the Suez Canal. There is also a cascading effect, as the formerly largest vessels begin to replace smaller ships for other trade. When operating at full or near full capacity, these mega-vessels have dramatically lower per slot operating costs than their smaller predecessors, in part because they utilize much less fuel per unit. For example, Maersk's largest "Triple E" ships need only 0.902 tons of bunker fuel to move a 40-foot container today while its 2007 fleet used 1.791 tons of fuel (Dupin, 2015b).

These large vessels have major impacts on the depths of channels needed to receive them as well as on landside terminals and supply networks. Ultra-large vessels require larger cranes that can extend over 22 rows of containers. These new high-volume cargo drops and pickups resulting from even a single ship visit stress current terminal operations, even at ports with the large-scale facilities, such as the San Pedro Bay Ports and the Port of New York and New Jersey. This new massive transfer delivery pattern is out of sync with current more constant but lower volume loading and unloading practices. As a result, port terminal capacity is challenged. Surges from 4,000 to 5,000 containers discharged over the 2 to 3 days the ships are in port can choke a terminal's yard, gate operations, and rail transfers, as well as generate long lines of truckers waiting and idling at the gates. Industry experts state that a high degree

of terminal automation will be required to provide efficient loading and discharge. The cost of cascading technology demands to accommodate mega-vessels are estimated in the range of $200 million to $500 million and require massive amounts of terminal space (Mongelluzzo, 2015).

Currently, only the large West Coast ports, the Virginia ports, and the Port of New York and New Jersey have the channel depths needed for megaship access, although several East Coast ports may complete access projects within the next decade. One major consequence of the increased accessibility of these ships to the East Coast via the Suez Canal or within the newly expanded Panama Canal limits is that more trade from Asia, particularly Southeast Asia, will move from the West Coast to East Coast gateways which are closer to large inland consumer markets in the East and Midwest.

Ultra large vessel use and the consolidation of business among a few large ocean carriers is a worldwide trend to achieve economies of scale efficiencies in ocean trade. The changes taking place within the port industry will cascade through the international and domestic supply chains and have an impact on the modal services and networks serving Nevada and other inland points. Inland logistics chains, such as those in Nevada, will need to be readjusted to bring new supply and demand patterns into equilibrium as cargo arrives and departs ports in larger and less frequent bunches. The major adjustments and economic costs to the system largely will be felt at the ports and on the first and last miles of access.

New Manufacturing Processes

Several new computer-based manufacturing processes are revolutionizing the manufacturing industry. Through their machine-based efficiencies, these processes are helping to reduce the costs of production and distribution, and in doing so, are spurring a return of manufacturing to the United States. An especially revolutionary representative of such processes is additive manufacturing or three-dimensional (3D) printing: where a printer reads a digital blueprint and methodically drops building material according to a set of instructions, creating a final product that is built up tiny layer by tiny layer. This direct transfer from blueprint to finished products may revolutionize manufacturing and its supply chain. In effect, it allows individuals, small businesses, and corporate departments to make parts, appliances, tools, and a wide variety of materials right from the workplace or home (Intrieri, 2014). Farewell to traditional tooling, assembly lines, or supply chains (Figure 3-17).

Three-dimensional printing and other computer-based inundations have a way to go before they can revolutionize major manufacturing techniques, but they are on their way. A recent survey of high-tech executives conducted by UPS found 4 percent reported their companies actively use the technology and 12 percent are experimenting with 3D printing (Dupin, 2015a). Early adopters of the technology include aerospace, automotive, medical, and consumer products (Dupin, 2015a). The 3D printing development firm *Underwriting Laboratories* estimates that the overall growth of $5 billion additive printing industry will be between 30 and 40 percent over the next few years, reaching $80 billion by 2023 (Dupin, 2015a).

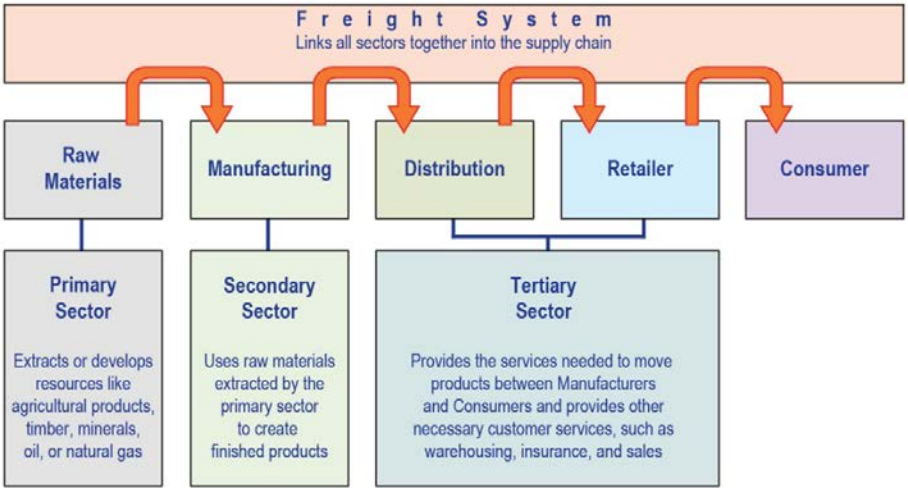


Figure 3-17. Traditional Supply Chain Overview

All finished goods follow a similar path from raw material collection to consumer ownership as illustrated by this supply chain diagram (Source: MG&A, 2015 recreated from Business Case Studies, Lafarge Case Study).

Additive manufacturing is illustrative of the types of changes that can truly revolutionize the production and distribution supply chain worldwide. Current networks for subassembly processes, such as those that support automobile manufacturing, would require much less worker labor and goods transfer. Additionally, ingredients for manufacture would be transmitted for product completion rather than sub-parts themselves. Manufacturing by online transmissions of templates as opposed to the transfer of parts through the freight system could reduce motor carrier and rail trips as well as the related congestion and wear and tear on highway and rail infrastructure. In doing so, template transmission could reduce much of the need for new systems capacity. The changes above may constitute a major future advantage for Nevada as a production hub, because manufacturing in Nevada will often enjoy lower land, facility construction, and operations costs than in California and elsewhere. As a potentially rich source of rare minerals that often constitute key ingredients for 3D printing material, Nevada could enjoy an advantage in becoming a major additive manufacturing materials provider (Table 3-1).

Table 3-1. The Long-Term Impact of 3D Printing on Supply Chains

The Current State or Traditional Supply Chain Before Mass 3D Printing Adoption	What 3D Printing and the Supply Chain Will Look Like Once Mass Adopted and Applied
Products are mass produced (e.g., in China)	Customized production
Manufactured goods are "pushed out" and distributed through warehouse network to customers	"Pulled" by end customer demand; Locally printed and distributed
Long lead time	Short lead time
High transport costs	Low transport costs
Large carbon footprint	Low carbon footprint

This table describes the projected impact on supply chains as a result of 3D printing (Source: Directly reproduced from *Robinson, A. 2014. INFOGRAPHIC: 3D Printing and the Supply Chain to Drastically Alter Manufacturing. Cerasis).*

3.5.6 Rise of Computer-Based, Internet, and Wireless Technologies

A revolution is occurring in how goods are assembled, tracked, and delivered to consumers. Retailers can now flexibly tailor their warehousing and distribution systems to speed their products to customers through sophisticated new goods inventory and tracking technologies as well as smartphone apps that simplify purchase and delivery. Entire production and delivery networks are being reconfigured to shorten delivery time.

> "Prior to the rise of the Internet, consumers had no option for obtaining products beyond retail stores and catalogs. Supply chain entities were focused on providing the right product at the right place and time. Today, supply chain entities need to have any product available at any place at any time. This may seem impossible, yet more supply chain entities have learned to leverage consumer demand against supply chain efficiency" (Robinson, 2015).

In doing so, they are changing the language of supply chain management to "clicks-and-bricks" retailing and the use of omni-channel distribution platforms that can serve warehouses, stores, and e-commerce customers directly.

Prototypes and Other Concepts

New concepts that may have major impacts on the movement of both passengers and freight are under development in the state of Nevada. They extend beyond autonomous truck and drone testing to include Elon Musk's proposed Hyperloop system that would offer travel speeds that challenge current aviation and ground transportation technologies, as well as a proposed congestion-busting multimodal Land Ferry system being developed with strong NDOT interest at UNLV.

The Hyperloop involves an enclosed surface vacuum to right-of-way (ROW) that would enable the pods inside it to move at ground speeds up to 745 miles an hour in a way that would minimize energy use and drastically reduce travel time between city pairs within its system. The project developer, Hyperloop

Technologies, Inc., proposes to have a commercially viable system in operation by 2020 despite the skepticism of many in the scientific community (Deutchmann, 2015). Hyperloop began testing in Nevada in early 2016 at a 50-acre site in North Las Vegas and successfully conducted its highly anticipated Propulsion Open Air Test on May 11, 2016 (Thompson, 2016).

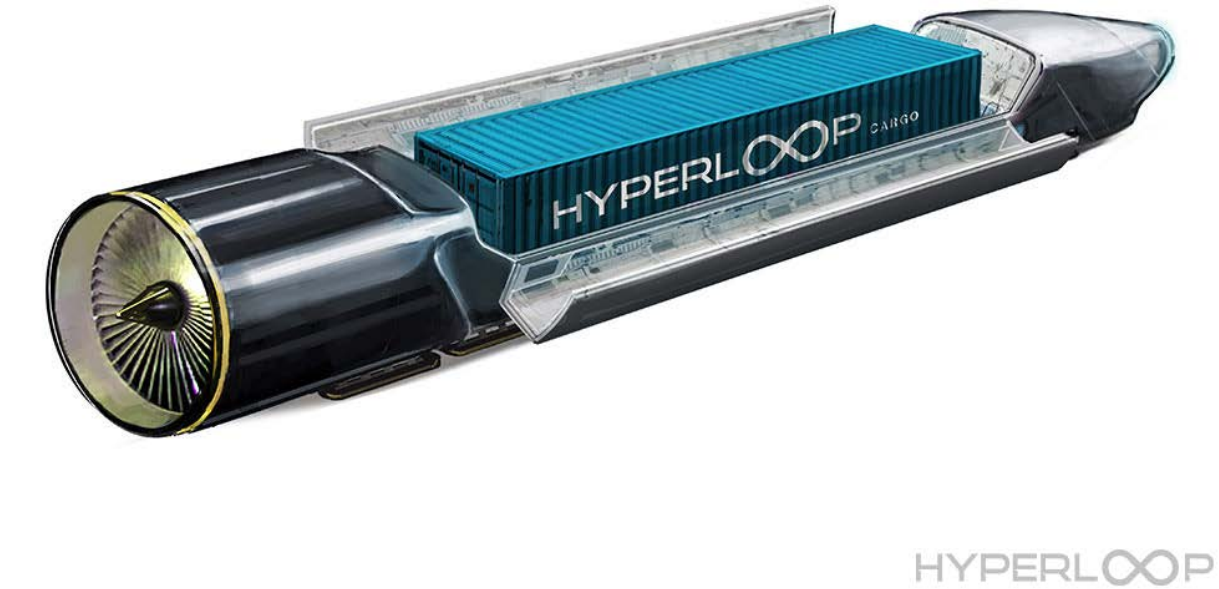


Figure 3-18. Hyperloop

Hyperloop, a technology that would enable cargo pods to move at ground speeds up to 745 miles an hour, began testing in Nevada in early 2016. (Photo source: https://hyperloop-one.com/image-library).

The Land Ferry is a locomotive-powered, multimodal platform that can be assembled at various lengths to simultaneously move a combination of trucks, automobiles, and passenger railcars in a single consist over intermediate distances along its own ROW, and includes efficient pickup and delivery terminals at each end (Figure 3-19). Proponents at UNLV and NDOT cite safety, congestion relief, travel improvements, environmental benefits, and jobs creation as elements favoring its development and operation (UNLV, 2015). Proponents believe that the Land Ferry would be especially effective at the distances between the inland Nevada points and the California ports.

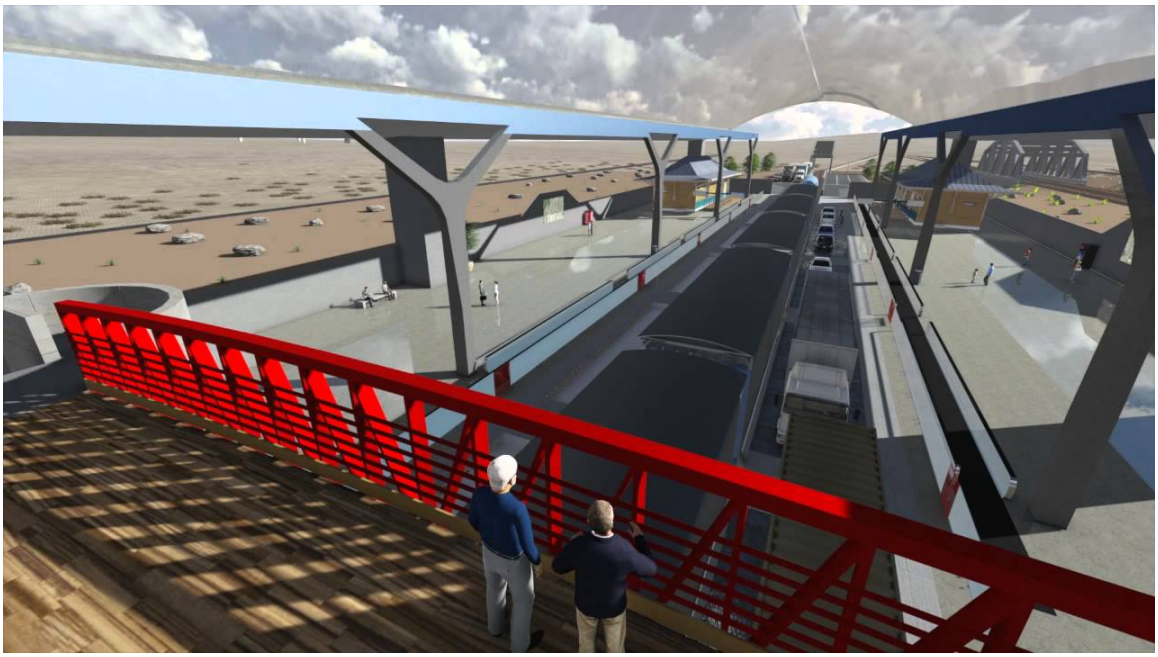


Figure 3-19. Land Ferry Station

This graphic illustration depicts what a station would look like if the Land Ferry was in operation. Trucks, containers, automobiles, and passengers could be transported (Source: NDOT, 2015).

Nevada has made it a matter of state policy to favor development and testing leading-edge technology, such autonomous motor vehicles, commercial drones, and the Hyperloop. This cooperation between the public and private sector places the state in a position to become an early beneficiary of these systems. For example, drone deliveries could be especially useful in both emergency and mundane freight needs of rural areas. It may be possible to create even greater synergy between these efforts through a Governor's Cabinet Coordinating Group advancing a concerted effort to link supportive initiatives: transportation, economic development, and education. University research and development of new transportation alternatives such as the Land Ferry may lead to applied results that will attract a skilled technical workforce to Nevada; one that is attuned to its future transportation needs and also provides new in-state resources to support public and private sector project development.

New Terminal Management Technologies

Port and rail terminal operators are in the process of introducing sophisticated new data-driven terminal management systems (e.g., NAVIS) to better coordinate and manage ship clearance, yard, and gate operations. Following European and Asian examples, these systems are seen as a prelude to greater seaport automation and are an ongoing source of labor management contention, as recently evidenced at the West Coast ports. The implementation of automated systems has not been smooth at ports such as San Pedro Bay, New York and New Jersey, and elsewhere, but it is critical to the long-term management of the handling and transfer of goods from post-Panamax megaships at U.S. ports.

3.5.7 Mode-Specific Trends and Drivers

Trucking's Essential Role

The motor carrier industry is the most essential mode in U.S. freight transportation (Figure 3-20). In 2014, the trucking industry hauled 9.96 billion tons of freight, or 68.8 percent of total U.S. freight tonnage, garnering $700.4 billion in revenue, which represents 80.3 percent of the nation's freight bill (ATA, 2015). The flexible nature of trucking services makes it ideal for both long and short hauls, as well as a key intermodal partner with seaports and rails for moving freight from their terminals to the final consignee. Motor carrier profitability is closely tied to the success of the economy and is viewed by

economists as a leading indicator of economic conditions. There is a certain fragility to the industry as a large number of small operators heavily populate the industry; 97.3 percent of the nearly 500,000 for-hire carriers and over 700,000 private carriers in the United States have fewer than 20 trucks and 90.6 percent are operating six trucks or less (ATA, 2015).

From an industry-wide perspective, trucking is not without its problems. The industry faces a chronic and growing driver shortage problem as it seeks to maintain a labor force that currently includes 3.4 million truck drivers and 7.1 million total industry employees; one out of every 16 people working in the United States (ATA, 2015). Moreover, the average age of truck drivers is currently 49, compared to an average age of 42 for the labor force as a whole (Morris, 2015). An essential driver availability question is whether the driver shortage is driven by demographics or a market shortage created by comparatively low pay in unsatisfactory working conditions (Cassidy, 2015). Factors contributing to the capacity shortage are many. They include regulatory changes such as: the Federal Motor Carrier Safety Administration's (FMCSA) Compliance, Safety, Accountability Program (CSA), which strengthens the reporting standards and tools available for safety rule enforcement; hours of service (HOS) rule changes which reduce driver service times to include greater overnight rest; a mandate for electronic driver log devices; and new health requirements for drivers, drug and alcohol testing databases and new driver training and minimum insurance requirements (Larkin & Beach, 2015).

There are policy and technological factors that may mitigate the capacity crunch: immigration reform; allowing longer combination vehicles; expanding U.S. operations for Mexican trucks; and driverless truck innovations. Efficient packaging can allow as much as 30 percent more freight units per trailer, while network optimization technologies and increasing allowable gross vehicle weights are also available to bolster service capacity (Beach, 2015).

Figure 3-20. Western U.S. Highway Freight Flows, 2010

This map depicts the volume of freight flows on interstate and non-interstate highways. The highway freight flows in California are much larger than those across the rest of the western United States, while flows along I-40 and I-10, as well as I-15 from Salt Lake City, are also significant. Flows in Nevada are relatively much smaller in tonnage along I-80 and I-15 (Source: MG&A, 2015 based on USDOT, FHWA data).

The driver shortage and related capacity pressures are not entirely negative for the industry. Many shippers are working more closely with the truckers to ensure more efficient pick-up and deliveries within their facilities. As supply of trucking exceeds shipper demand, truckers are able to consistently command higher rates for their services; However, to do so requires truckers to deal with labor shortages and pressures from increased environmental and safety regulations, and generally rising costs. These factors will drive many small carriers out of business and encourage large carriers to consolidate and merge.

The two major drivers of trucking costs are the price of fuel and labor. Currently, trucking is enjoying the recent reduction in fuel costs. These costs, which are historically volatile, are expected to remain on the low side for some time. Truckers enjoy generally good operating conditions on Nevada's major highways; bottlenecks are limited to a few urban locations. However, trucking services to key markets in major California metropolitan areas are constrained by heavy congestion.

At the moment, the effectiveness of trucking as an essential contributor to Nevada's economic growth is less a matter of the current level of service Nevada's highways and more an issue of the quality and abundance of motor carrier services available to Nevada businesses and their partners in other markets. Issues involving driver shortage and the imbalance in the flows of goods moving in and out of the state, and the ability to address congestion issues on a regional basis, take on a high degree of importance alongside the state's ability to maintain and improve its highway infrastructure.

Railroad Policy & Service Level Challenges

There is an inextricable link between the railroad sector and the broader economy (Figure 3-21). Railroads account for approximately 40 percent of U.S. ton-mile freight volume, more than any other mode of transportation, and they earn approximately 20 percent of freight revenues (AAR, 2015). Railroads excel at handling bulk and other heavy commodities, including coal, chemicals, agricultural and food products, paper and lumber, petroleum, metallic ores, and non-metallic minerals, among others. They also play an important role moving general consumer goods in intermodal containers in partnership with seaports, domestic distribution transfer centers, and trucking firms.

Railroads have a competitive and cooperative relationship with trucking in major intermodal traffic lanes. Rail has the upper hand in longer-distance moves, at about 1,000 miles or longer. With few exceptions, railroads are not competitive with trucking at distances under 500 miles, the point over which trucking requires a stop and more than one driver to deliver goods (AAR, 2015). Given the large mix of raw materials in the railroads' commodity portfolio, railroad revenues are subject to volatility based on factors beyond their control, including weather and global price and currency fluctuations.

Three of the most distinguishing features of North American railroading are:

1. It is a private sector endeavor and thus is responsible for funding its infrastructure and operations.
2. It is dominated by a small number of large North American railroads i.e., BNSF Railway, CSX Transportation, Kansas City Southern Railway, Norfolk Southern, and UPRR.
3. It is subject to greatly diminished, but substantial economic regulation, as well as numerous safety and environmental rules.

These factors give shape to the critical issues facing the railroads. Class I carriers generate nearly a half billion dollars in annual operating revenue, yet their need for constant cash flow is considerable given the large sums that need to be set aside for capital investment.

In light of their constant need to make large infrastructure investments, the railroads are concerned over policies that limit their ability to control pricing and set operational improvement priorities. Likewise, rail shippers are concerned about the availability and quality of their services in an industry historically prone to monopolistic practices.

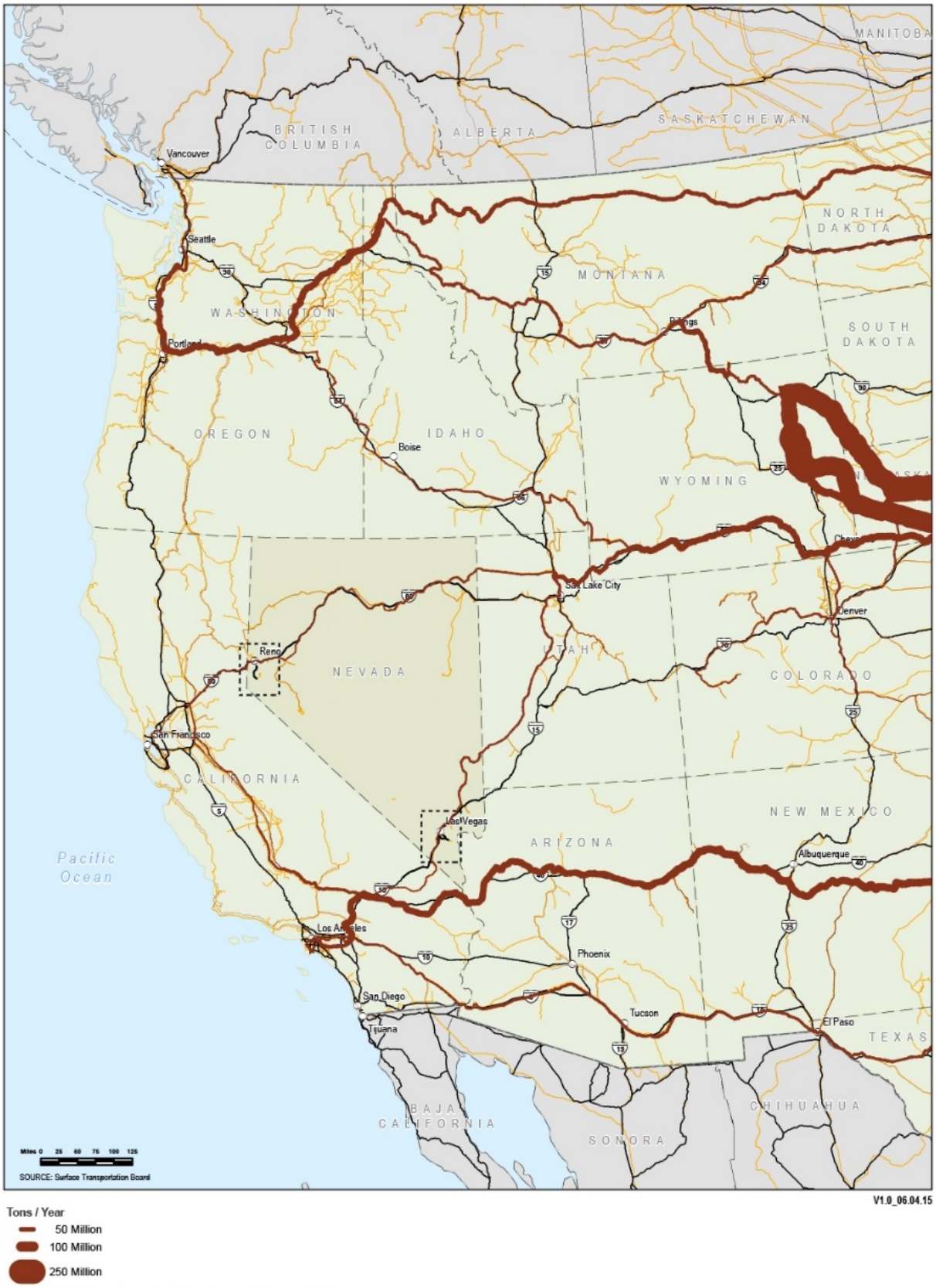


Figure 3-21. Western U.S. Railroad Freight Flows, 2010

This map depicts the volume of freight flows on railroads in the western United States. It is significant that much of the railroad freight flow from Southern California travels along I-40 just south of Nevada (Source: MG&A, 2015 based on Surface Transportation Board data).

Among the industry's ongoing policy concerns is the mandated implementation Positive Train Control (PTC), a technology that will automatically stop or slow a train before certain accidents occur (AAR, 2015). The federal mandate for railroads to install this train crash-prevention safety system on rail lines that include passenger and toxic inhalation hazardous materials has been a focus of the industry since Congress passed the PTC requirement in 2008 (AAR, 2015). Railroads were faced with a deadline to complete PTC implementation by December 31, 2015, a deadline that, despite diligent efforts, the railroads were not ready to meet nationwide (AAR, 2015). The FRA acknowledged this and so Congress granted a 3-year extension to 2018.

BNSF Train in Nevada
Source: NDOT, 2015.

At present, Nevada's railroad service is a secondary matter to both the state and the railroads that serve it. BNSF Railway has limited trackage rights within the state providing service to a small base of long-standing customers. UPRR is the state's primary carrier, but its focus is primarily in providing through service. However, for Nevada railroad customers who generate and receive energy bulk commodities, including mining and agricultural products, the scope and quality of railroad service are of primary importance.

Railroading may be a sleeping giant with respect to Nevada's long-term multimodal-based business development plans. The prospective development of intermodal shuttle services is an important means to increase access for Nevada's shippers to gateway ports in California and elsewhere. Nevada-based intermodal services may prove to be an efficient means to serve future distribution and manufacturing firms. If sufficient volumes warrant, the railroads could be excellent partners in public-private sector development projects.

The amount of railroad trackage in Nevada is among the lowest among all the states. Future railroad volume expansion either along current east-west routes, or involving the potential creation of north-south services will require the acquisition of ROW. Historical records indicate the mid-20th century presence of railroad ROWs that have since been abandoned, but may be a good path for future use. An inventory of such properties would be useful to future freight planning.

Air Cargo

There are several technology trends in the air cargo industry, including but not limited to:

- New wide-body aircraft types (B787, A350) that can serve "thinner" long-haul international passenger routes but have substantial belly cargo capacity. These planes can serve medium-sized markets rather than just the very large hubs and allow them to ship directly rather than through the large hub.
- Global positioning system (GPS), radio frequency identification (RFID) technology ensuring higher visibility/transparency of shipments: location/time tracking, temperature control, vibration recordings etc. This trend also increases reliability and is a value-add.
- High-tech air freight containers with built-in temperature controls etc. which expands the market for air freight.
- New Security/Screening technologies, as mentioned in the above section.
- Electronic air waybills: paperless initiative to increase air cargo processing efficiency.
- Future trend: drone delivery systems and other automated cargo handling technologies could vastly expand the air cargo market.

The globalization of trade has led to more goods flowing between world regions and over long distances. Air carries 0.5 percent of global trade in terms of weight, but 35 percent in terms of value, as determined by the types of commodities suited for air cargo and time/cost factors (Air Transport Action Group). Modal shifts in intercontinental air cargo are increasingly impacted by competition from ocean container shipping while domestic and regional air cargo is impacted by a modal shift to trucking. Both ocean container shipping and trucking are lower-cost alternatives and albeit slower, their production schedules can be controlled to ensure reliability on certain set delivery dates. The high cost of jet fuel has also made these modes more attractive than air.

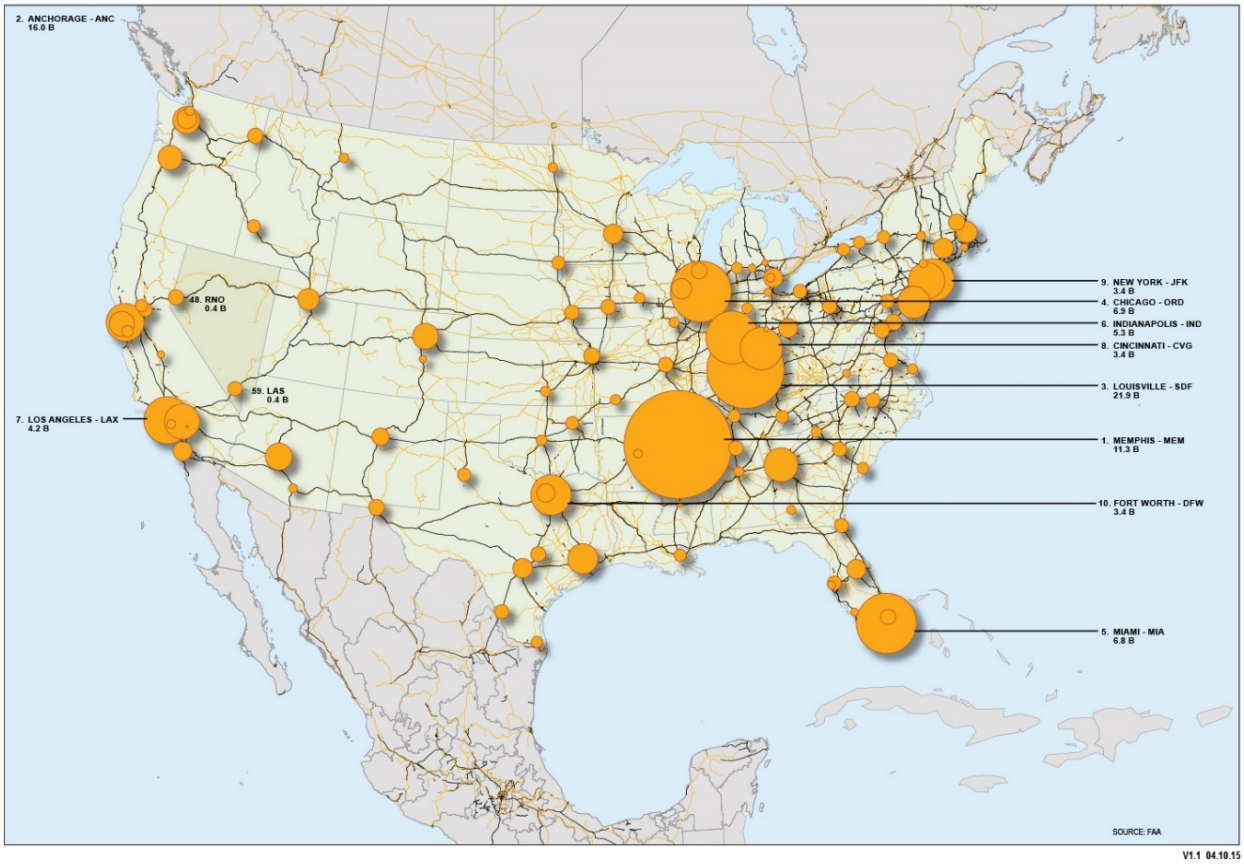


Figure 3-22. Airports by Total Landed Weight of All-Cargo Aircrafts, 2013

This figure depicts the relative size of cargo functions at U.S. airports, ranking the airports by total landed weight of all-cargo aircrafts. The size of the dot is relative to the number of pounds (Source: MG&A, 2015 based on FAA data).

Near shoring, or a shift in the location of production and manufacturing, also leads to a modal shift and facilitates reliable delivery often at a lower cost. For example, mode choices are different if production occurs in Asia than if it occurs in Mexico. Belly capacity from wide-body, long-haul passenger aircraft is offsetting the demand for all-cargo freighter capacity. These aircraft have been configured to maximize belly space, allowing medium-sized markets to ship directly rather than through very large hubs, and more people travelling by air has led to an induced increase in capacity for airlines to carry freight. Thus, there is a trend toward medium-sized hubs putting larger emphasis on more efficient cargo operations to capture the increased opportunities in air freight.

Since 9/11, security and screening requirements have increased significantly. Thus, to be part of the air cargo industry, airports need to have the new technology, equipment, and certified personnel required

for tight security and screening, which involves an expensive fixed-cost investment. In an effort to control investments in these security-related resources, freight forwarders are motivated to consolidate and ship freight at large-hub airports, thereby limiting air cargo activity at the medium-sized hubs.

The U.S. air cargo industry is mature and growing slowly, at approximately 3.0 percent per year (Boeing). FedEx and UPS dominate the U.S. domestic market, with market shares of 47 and 27 percent, respectively (Figure 3-22). The mature and slow growth market is attributed to consolidation over the past 15 years as well as more sophisticated and dependable trucking services. Growth in international air cargo to/from the United States exceeds U.S. domestic air cargo growth, at 5.1 percent year-over-year (YOY) and 3.1 percent YOY, respectively, with Asia being the primary market driving volume and growth rates (U.S. Census Bureau, Foreign Trade Statistics, and A4A).

Moreover, as aircraft technology advances and more wide-body aircraft fly direct to more U.S. airports, the trend may see more cargo diversifying to non-traditional U.S. gateways as large hub functions become less important. Additionally, routing structures have changed, with more international flights from non-traditional hubs. For example, the British Airways B787 flight added from Austin, Texas, to London's Heathrow Airport provides nonstop inter-continental service to a mid-sized U.S. passenger market. This flight is only viable due to having the right-sized aircraft and its ability to carry large amounts of air cargo. High traffic congestion in and around global gateway airports is affecting reliability and driving producers to seek alternate departure points. This may become important for Las Vegas and Reno located in close proximity to the highly congested San Francisco and Los Angeles.

Airports on the West Coast are particularly strong with air cargo related to trade between the United States and Asia, as well as serving the western United States, where distances between major markets are greater than in the eastern United States. The infrastructure and scale of operations at Los Angeles International Airport (LAX) encourages the utilization of LAX for import/export shipments facilitated by extensive trucking networks. With respect to Nevada, FedEx and UPS together account for 74 percent of the total air cargo in the state (USDOT; U.S. Census Bureau Foreign Trade Statistics). Nevada's international air exports are largely handled by LAX, at 28 percent of the state total (USDOT; U.S. Census Bureau, Foreign Trade Statistics). According to 2013 statistics, McCarran International Airport (LAS) ranked 38th in North American air-cargo tonnage, likely a result of the fact that it is a service-oriented economy that does not drive the density of air cargo as manufacturing economies do (ACI-NA). Outside of integrated carriers, Reno-Tahoe International Airport (RNO) is dominated by narrow-body air services that have limited carrying capabilities and ranks 60th among North American airports (ACI-NA, 2013).

Nevada's major airports at Las Vegas and Reno have the capacity to increase their intermodal air freight business. This will depend on increasing connections to major foreign markets and higher volumes of Nevada generated products. However, Nevada's economy does not produce a lot of commodities that use air cargo. The state is more of an import economy and is within trucking distance of the LAX and San Francisco International Airport (SFO) facilities. Low-back haul truck rates could support increased air exports for Nevada air cargo commodities through these facilities. The attitude of the airports toward air freight is also important, and both Las Vegas and Reno airports place a high priority in attracting increased passenger service from international markets. A joint marketing effort to attract belly freight to these routes may accelerate the attractiveness of expanding international service at these airports.

Seaports

These are uncertain times for marine supply chain stakeholders; the economic conditions that determine national economic growth levels of international commerce are highly volatile. Major technological changes are taking place within the industry and centers of production and consumption are shifting among nations. Nevertheless, the volumes of goods produced and traded between the United States and the rest of the world is certain to grow. At this time, it is not clear which markets will lead growth and/or whether there will be major shifts in cargo volumes among the major U.S. gateway ports (Figure 3-23).

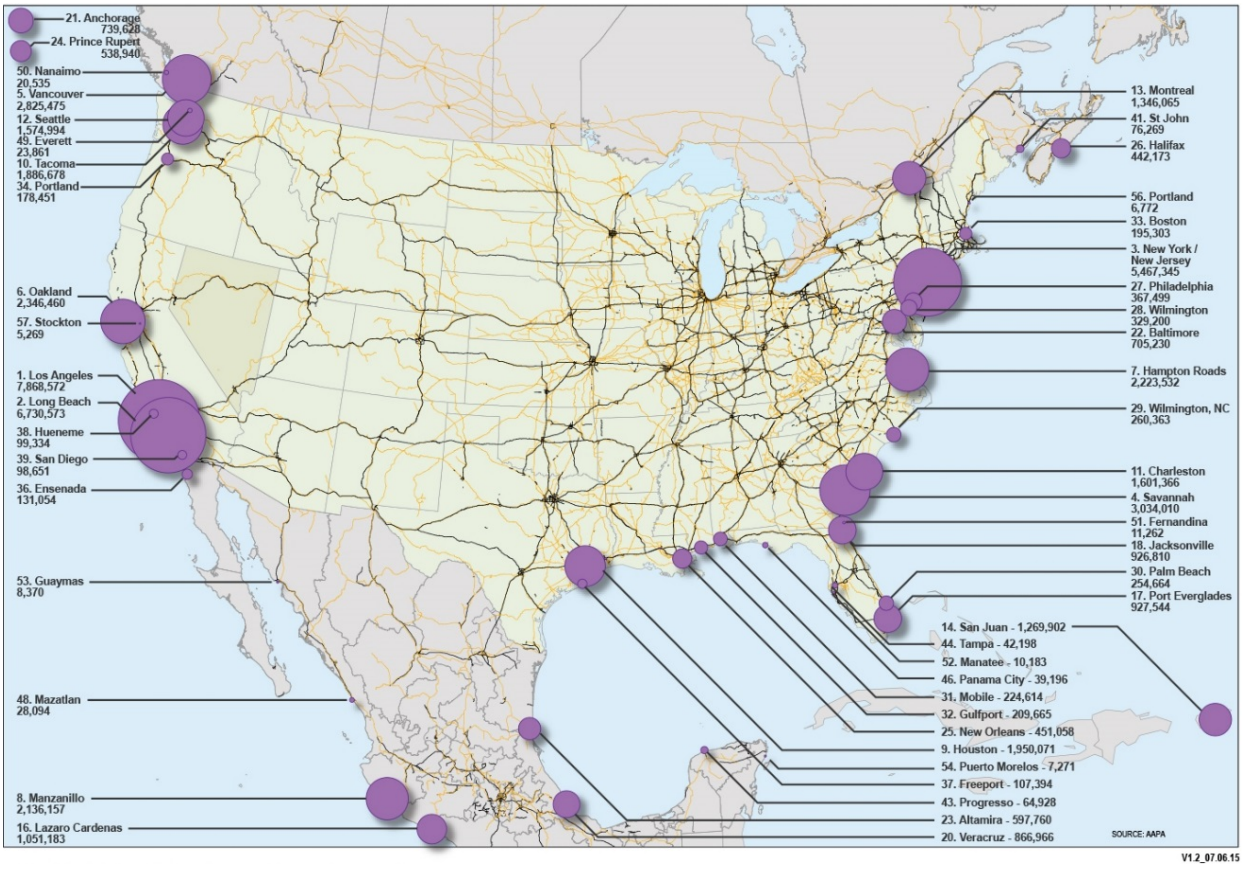


Figure 3-23. North American Ports by Container Traffic, 2013 (TEU)

This figure ranks and depicts the relative size of North American ports by their 2013 container traffic in TEUs (Source: MG&A, 2015 based on AAPA data).

Two recent studies raise questions as to whether the West Coast ports will continue their dominance as the leading gateway for Asian import cargo. An *American Shipper* survey conducted in early 2015 (when acrimonious labor negotiations were taking place and not yet concluded) revealed that there is serious concern that congestion wrought by labor and operational difficulties that began in 2014 will be an ongoing problem (Johnson and Kasper, 2015). Both large and medium/small shipper respondents indicate active plans to migrate on average 20 percent of their volume from west to east (Johnson and Kasper, 2015).

Another report concluded that up to 10 percent of the container traffic to the United States from East Asia could shift from the West Coast ports to the East Coast ports by 2020 (BCG and Robinson, 2015). This shift is anticipated as a result of the expanded Panama Canal and current growth trends favoring East Coast ports. In 2014, about 35 percent of container traffic from East Asia to the United States arrived at East Coast ports, but based on import shifts, that share would rise to about 40 percent by 2020 without the canals expansion (BCG and Robinson, 2015). With expansion, the East Coast share could rise to 50 percent and a 10 percent net increase in market share (BCG and Robinson, 2015). As the size of ships able to get through the Panama Canal increases by two or three times, the East Coast will gain cost advantages that bring cargo closer to their large local and hinterland markets (Ibid).

The West Coast ports will retain their transit time advantage in delivering northern Asia and Chinese exports to the battleground Midwest/Mississippi Valley markets, which produce 15 percent of the nation's GDP (Ibid). The long-standing trade-off between time and cost may tilt in favor of East Coast destinations if operating conditions and reliability prove superior to West Coast services. Nevertheless, the potential losses to the market share of the West Coast ports are likely marginal as they have the

infrastructure in place to handle ultra large ships and the Western railroads have the capability to align their intermodal rates to retain market share. The export of goods required by a growing East Asian middle class may sustain West Coast port growth. An ongoing challenge to all U.S. ports may come from improved port systems in Canadian and Mexican ports improving their intermodal connections into the U.S. Southwest and Midwest.

Any long-term plan for economic growth must consider Nevada's access to overseas and intercontinental markets as a priority, simply because the majority of future customers and trading partners will reside there. Therefore, issues of access to major gateway ports in California raise important matters in long-term freight planning. Related sub-issues will involve improving intermodal rail access to the ports and the potential creation of an I-11 corridor for Western states and NAFTA trade as well as a means to create freight hubs at Reno and Las Vegas, which are now merely stopping points. Potential shifts in freight flows may increase the level of commercial activity between Nevada and eastward regions, particularly the growing Southeast. Therefore, Nevada's freight and industrial development planning must be sensitive to potential shifts and the changes they may bring to Nevada's logistics role in the broader network (e.g., as a backdoor supplier to California).

Intermodal Systems

The rapid emergence of intermodal freight transportation systems has been one of the most significant developments in logistics over the past half-century (Figure 3-24). Intermodalism involves an exchange of freight between two or more transportation modes including air, road, sea, rail, and pipelines. The modes use a common unit of transport, such as a container or a truck trailer, which means that the cargo does not need to be handled, rather only the unit of transfer is involved. Intermodal freight logistics include first-mile collection and last-mile delivery at transfer terminals and connecting line haul movements in between. Intermodalism enhances the economic performance of supply chains by using each mode in the most productive manner. For example, the use of rail, air, and water modes provide operational economies over long and intermediate distances, while trucking offers efficient and flexible pickups and deliveries. The pricing and movement of goods occur under a single bill of lading, and goods must be tracked through each modal segment and transfer.

Container-based intermodal systems provided the foundation for the rapid growth of overseas trade. International movement of containers began in the early 1960s, and the ocean and rail freight terminals essential to efficient transfer developed in the 1970s and 1980s. Refinements such as the standardization of containers into 20-, 40-, and 53-foot boxes, and the use of the TEUs for effective volume comparison soon followed. The U.S. domestic intermodal rail systems did not blossom until the 1980s with the advent of double-stacked rail technology. Technological advances also include economies of scale based development of efficient large ships, well railcar technology that allows containers to be double stacked in single railcar wells, electronic data information systems (EDI) to advance billing and tracking, and computer-based terminal management systems.

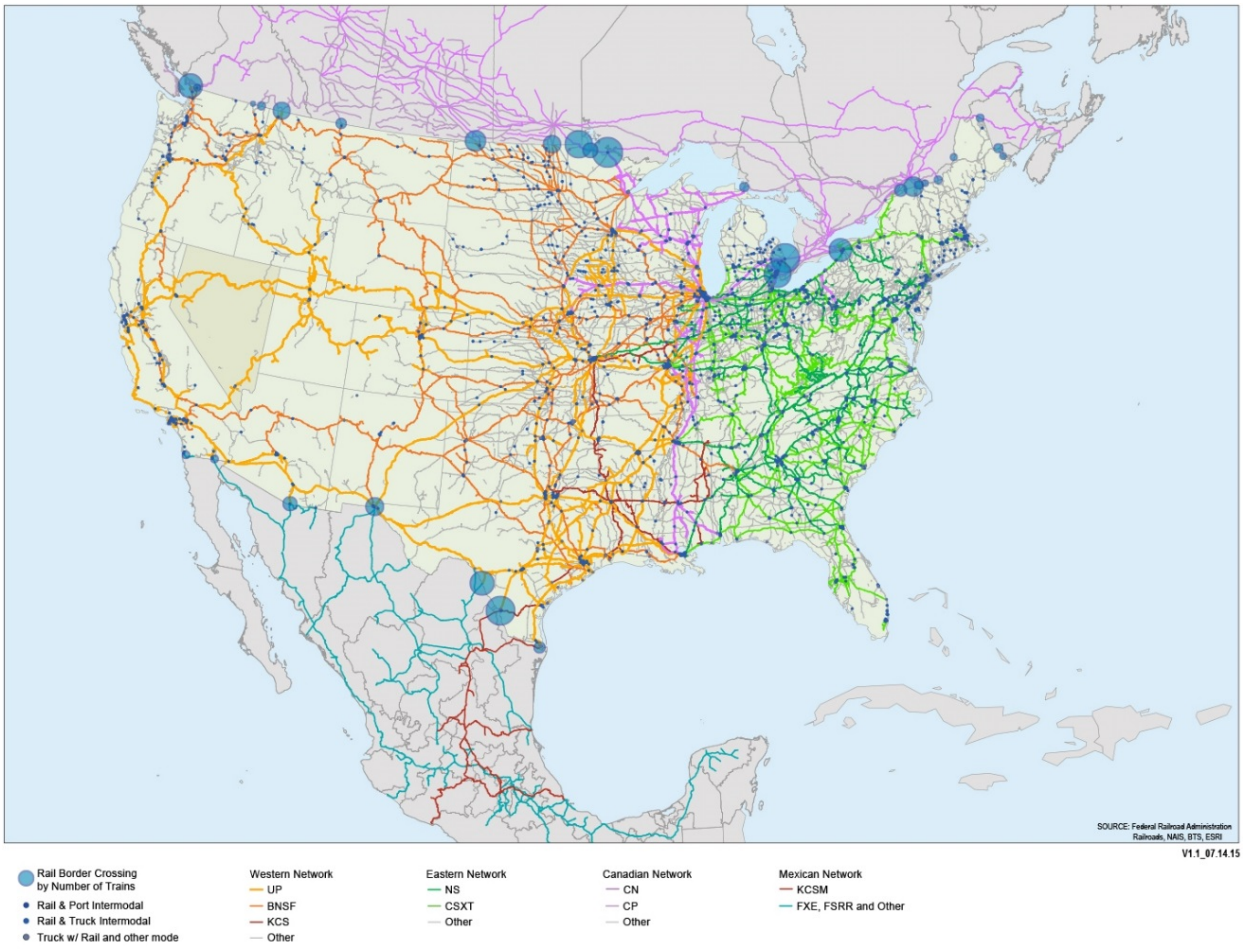


Figure 3-24. The North American Intermodal Rail System

The map below highlights the conductivity between the North American intermodal rail system and major seaports and border crossings. It also depicts the ownership of rail lines across the continent, with the Canadian National Railroad purchasing lines in the United States to Chicago and New Orleans, giving it port access to the Caribbean, and Kansas City Southern purchasing lines in Mexico to Mexico City and to Pacific and Caribbean ports. The U.S. intermodal pattern below emphasizes the large gap between the northern and southern Nevada logistics hubs (Source: MG&A, 2015, based on FRA, NAIS, BTS, ESRI data).

Without the development of the container-based intermodal systems, railroads would be bereft of one of its high-volume profitable lines of service. According to Intermodal Association of North America Statistics (IANA), U.S. intermodal rail use has grown steadily and totaled 14 million loadings in 2014 (Hatch, 2014) (Figure 3-25). Moreover, industry experts estimate that over the next few years, annual intermodal growth will be in the 5-7 percent range based on positive GDP growth in international business and two to three times GDP growth in domestic intermodal transportation (Hatch, 2014).

The U.S. intermodal market has two components that allow for this steady growth. One is the transfer of intermodal containers from East Coast and West Coast ports to national distribution hubs at the center of the country. The other is domestic intermodal service, which uses lighter domestic containers to meet shipper needs (LaGore, 2013). The two lines of business intersect with transloading, which involves the transfer of largely imported goods into domestic containers for more efficient shipping. Transloading constitutes approximately one-third of cargo moving east from the Southern California ports.

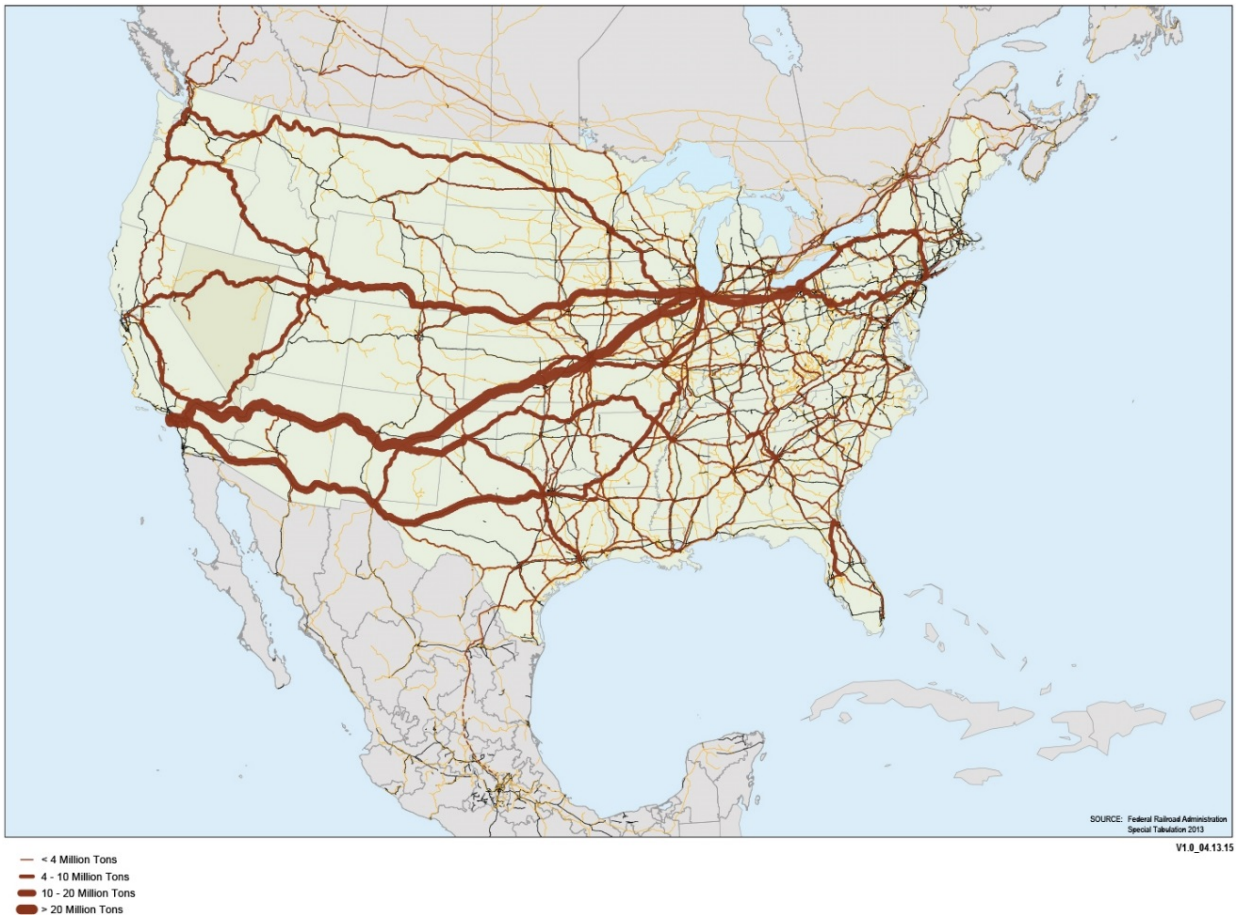


Figure 3-25. North American Rail Intermodal Freight Flows, 2011 (Tons)

This figure depicts 2011 trailer-on-flatcar and container-on-flatcar rail intermodal movements across North America by tons. It is evident that the largest flows come from the Southern California region to Chicago and the Northeast as well as a smaller but still significant flow to Dallas along I-10. Flows from Nevada and the Northwest merge in Salt Lake for distribution or to head east to Chicago (Source: MG&A, 2015 based on FRA Special Tabulation, 2013 data).

The next frontier for rail intermodal development is to penetrate the less-than-500-mile market. Both the federal government and the states are taking a more active interest in promoting intermodal transportation because the system helps take trucks off crowded highways and provides environmental and safety benefits, relieving overall systems congestion and cleaning the air. The ability to consolidate local truck pickups and deliveries at terminal for transfer to rail is an essential tool for transforming Nevada's hubs into attractive distribution and manufacturing hubs. Rail/truck intermodal systems require high volumes of freight at collection and distribution points along major traffic lanes, particularly when the distances are less than 500 miles.

There are major congestion, safety, and environmental issues in California together with continued economic growth that favor concerted efforts to develop intermodal service for Reno and Las Vegas shippers. However, there is a chicken-or-egg problem to overcome. On one hand, these Nevada hubs need to generate much higher volumes of outbound freight to attract railroad investment services and intermodal terminal operations. At the same time, the availability of intermodal services is needed to attract manufacturing and distribution center investments. Growing Nevada's intermodal freight activities may be developed in two different ways. The first is to grow incrementally with regional freight consolidation services organizing bundles of freight for railroad "hook-and-haul" services in major intermodal traffic lanes. Once initiated, these facilities can grow to support expanded point-to-point services. The second way is to change the configuration of the freight system to transform Reno and Las

Vegas into crossroads, thereby accessing a much larger market area and increasing the importance of these hubs in the distribution pattern of the western United States.

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